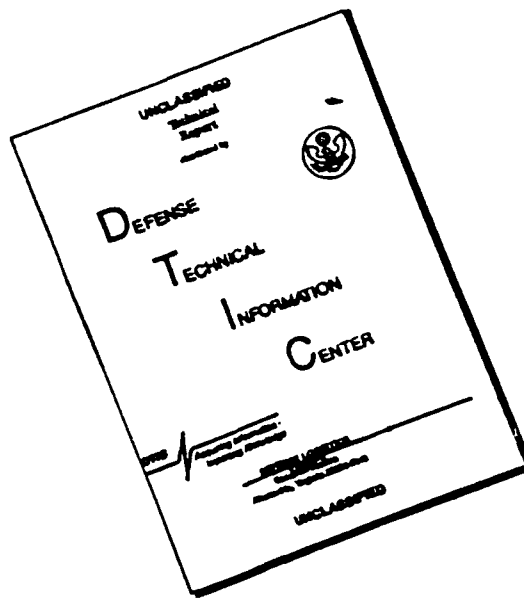




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**TECHNOLOGY INSERTION-ENGINEERING SERVICES  
PROCESS CHARACTERIZATION  
TASK ORDER NO. 1**

**BOOK 1 OF 2**

**DATABASE DOCUMENTATION BOOK**

**OO-ALC**

**MANPRC**

**(OVERVIEW LAYOUTS)**

**CONTRACT SUMMARY REPORT  
15 DECEMBER 1989**

**CONTRACT NO. F33600-88-D-0567  
CDRL SEQUENCE NO. B008**

Handwritten checkmark and "A-1" in a box.



**MCDONNELL DOUGLAS**  
*McDonnell Douglas Missile Systems Company*  
*St. Louis, Missouri 63166-0516 (314) 232-0232*

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**91 6 20 020**

**91-02842**



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1.0 IDENTIFICATION OF RCC

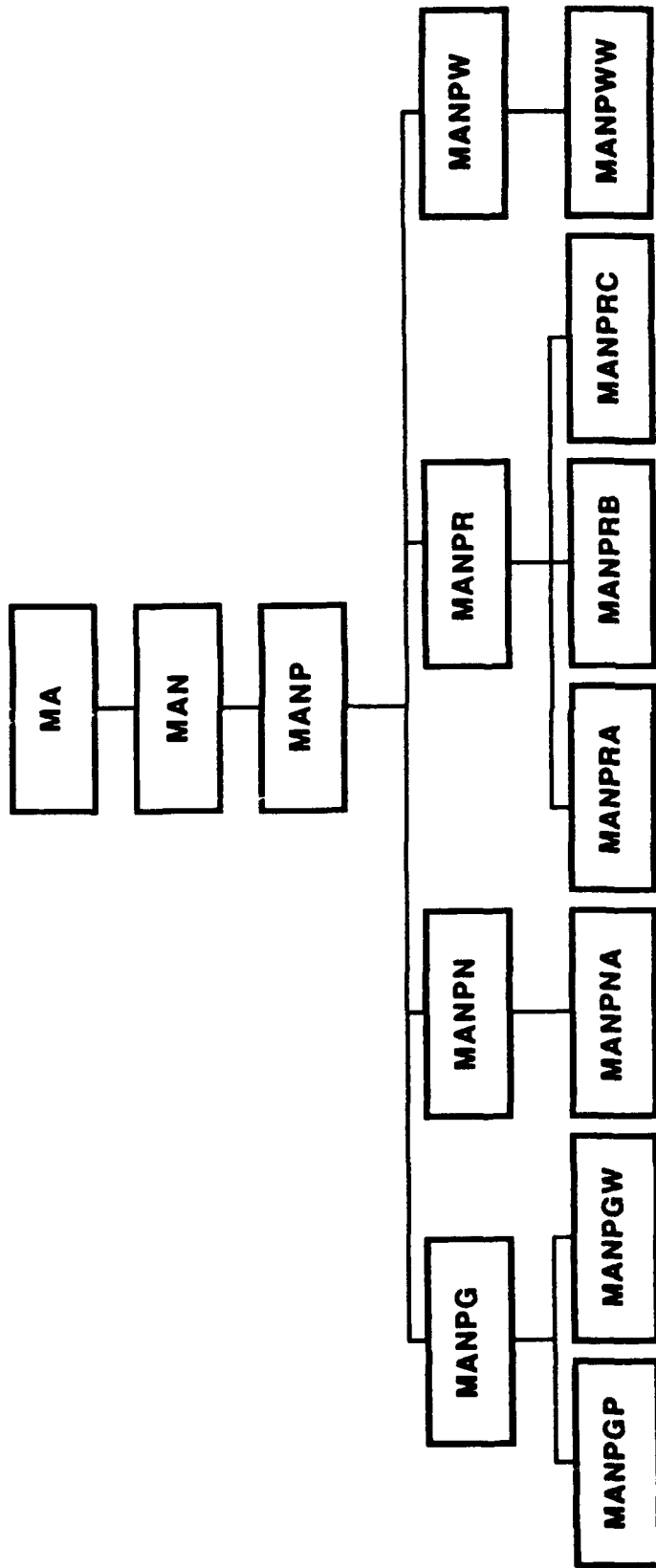
RCC *MANPRC* has been identified by the SOW of Contract F33600-88-D-0567 for Process Characterization.

## 2.0 GENERAL INFORMATION

↳ MANPRC is a Resource Control Center (RCC) under the <sup>Production</sup> (MANP) branch of the Industrial Products Division (MAN) at OO-ALC and performs various manufacturing and repair operations under the Repair Support Section (MANPR) relative to metal coating / metal protective (inorganic) surface finishes.

Approximately 90% of the workload in MANPRC is Management of Items Subject to Repair (MISTR) with the remaining 10% divided equally between Planned Depot Maintenance (PDM) and Temporary (MANUFACTURE).

The primary function of MANPRC is to support repairs of aircraft landing gear, including brakes, struts and wheels.



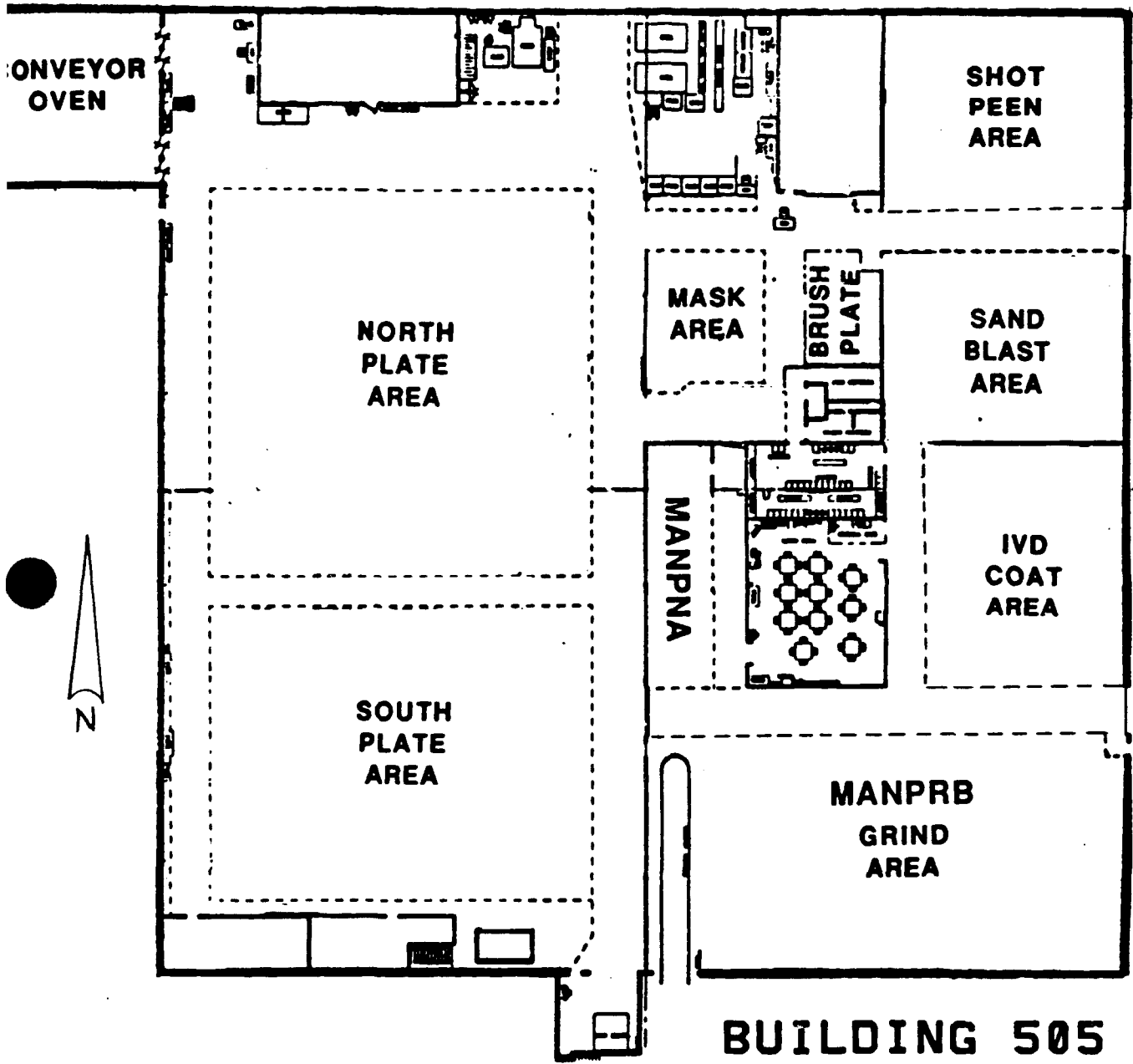
**LEGEND:**

MA = DIR. OF MAINT.  
 MAN = INDUSTRIAL PRODUCTS & L. G. DIVISION  
 MANP = PRODUCTION BRANCH  
 MANPG = LANDING GEAR SECTION  
 MANPNA = ASSEMBLY UNIT  
 MANPNA = DISASSEMBLY UNIT  
 MANPNA = NONDESTRUCTIVE TEST SUPPORT SECTION  
 MANPNA = NONDESTRUCTIVE TEST UNIT

MANPR = REPAIR SUPPORT SECTION  
 MANPRA = MACHINING SHOP REPAIR UNIT  
 MANPRB = GRINDING UNIT  
 MANPRC = PLATING UNIT  
 MANPWW = MISC. MANUFACTURING/REPAIR SECTION  
 MANPWW = FLAME SPRAY UNIT

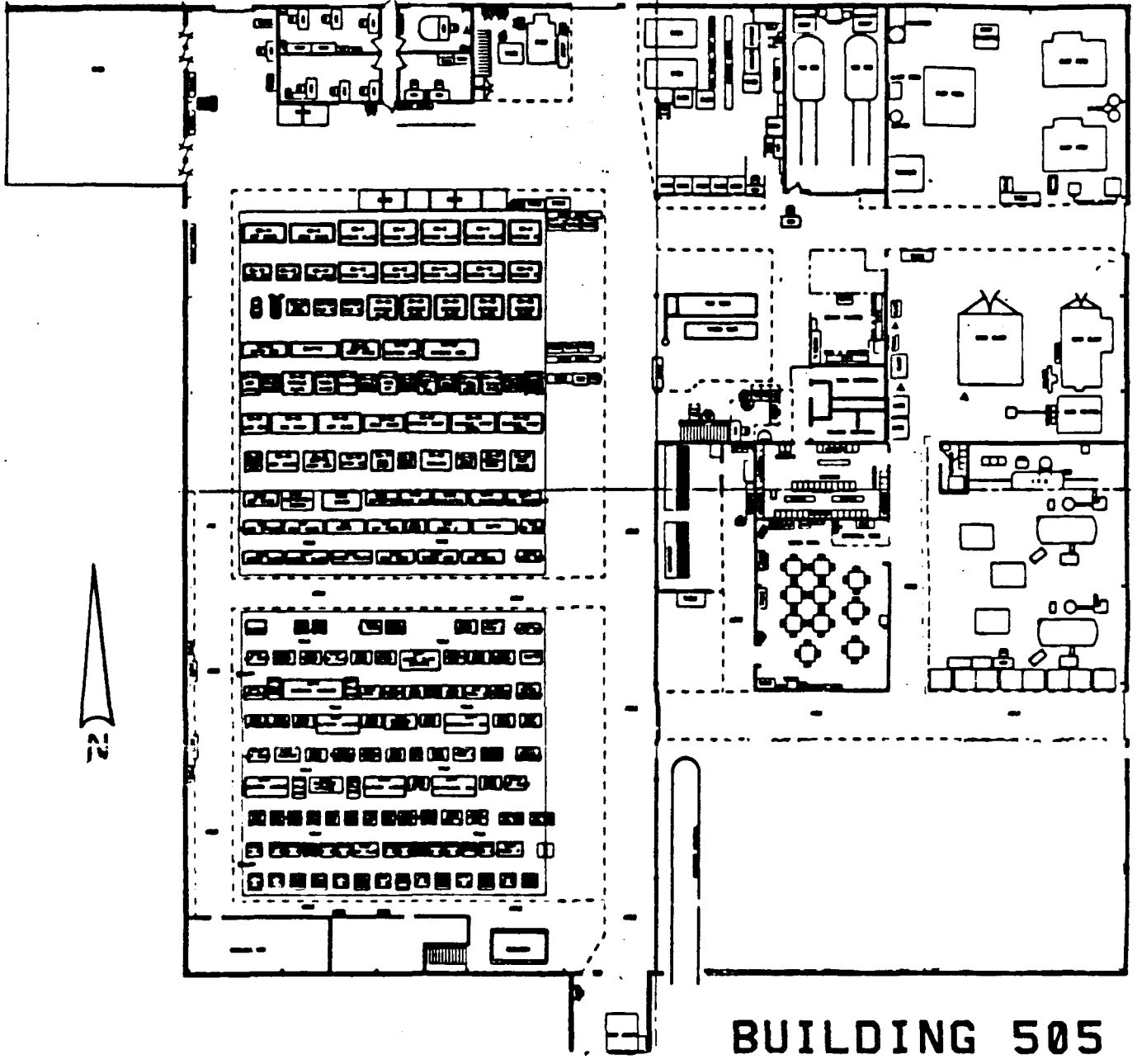
**OO-ALC RCC PROCESS CHARACTERIZATION COVERAGE**

**FIGURE 7.6.1-1**



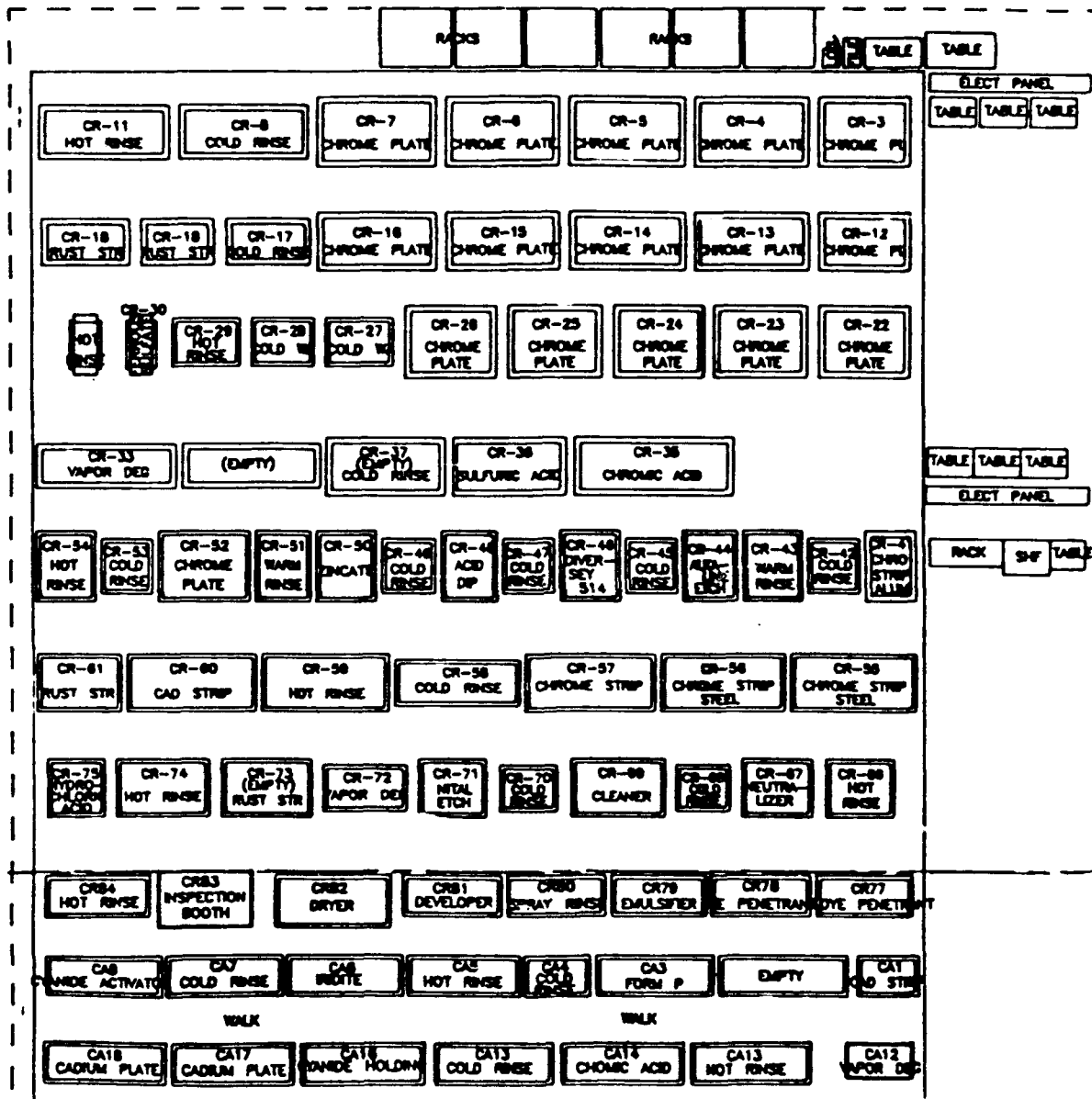
MANPRC WORK AREAS



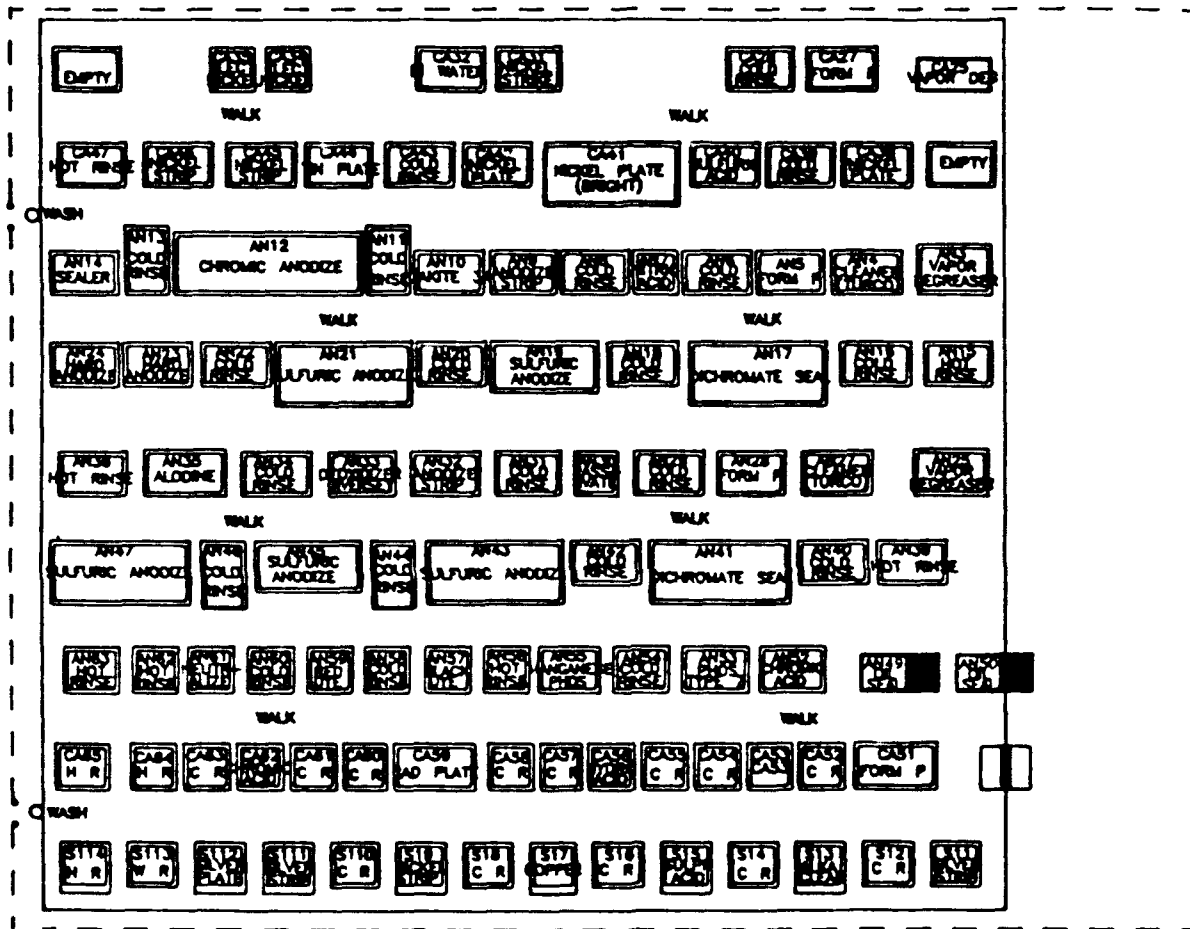


BUILDING 505

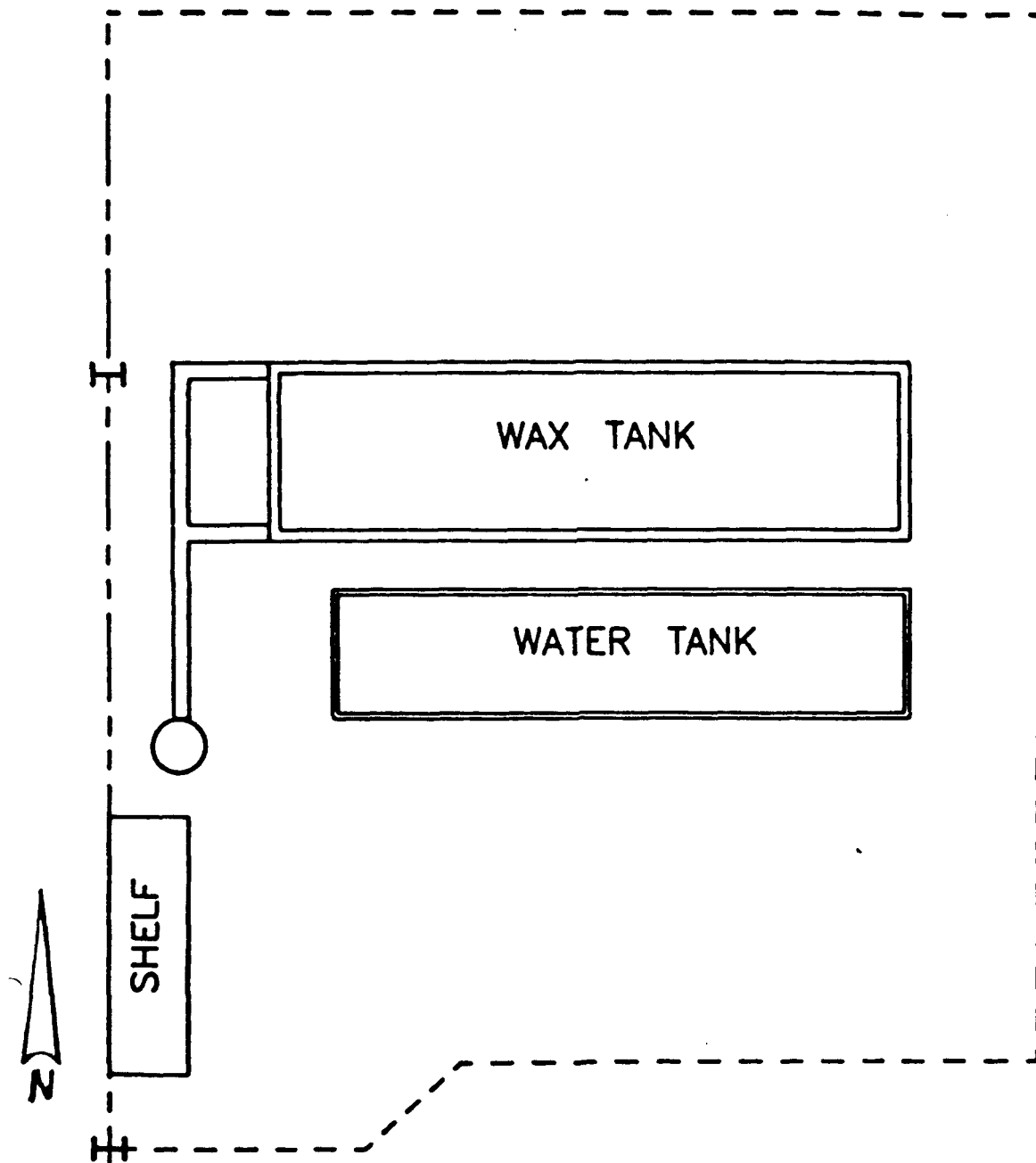
MANPRC AREA LAYOUT



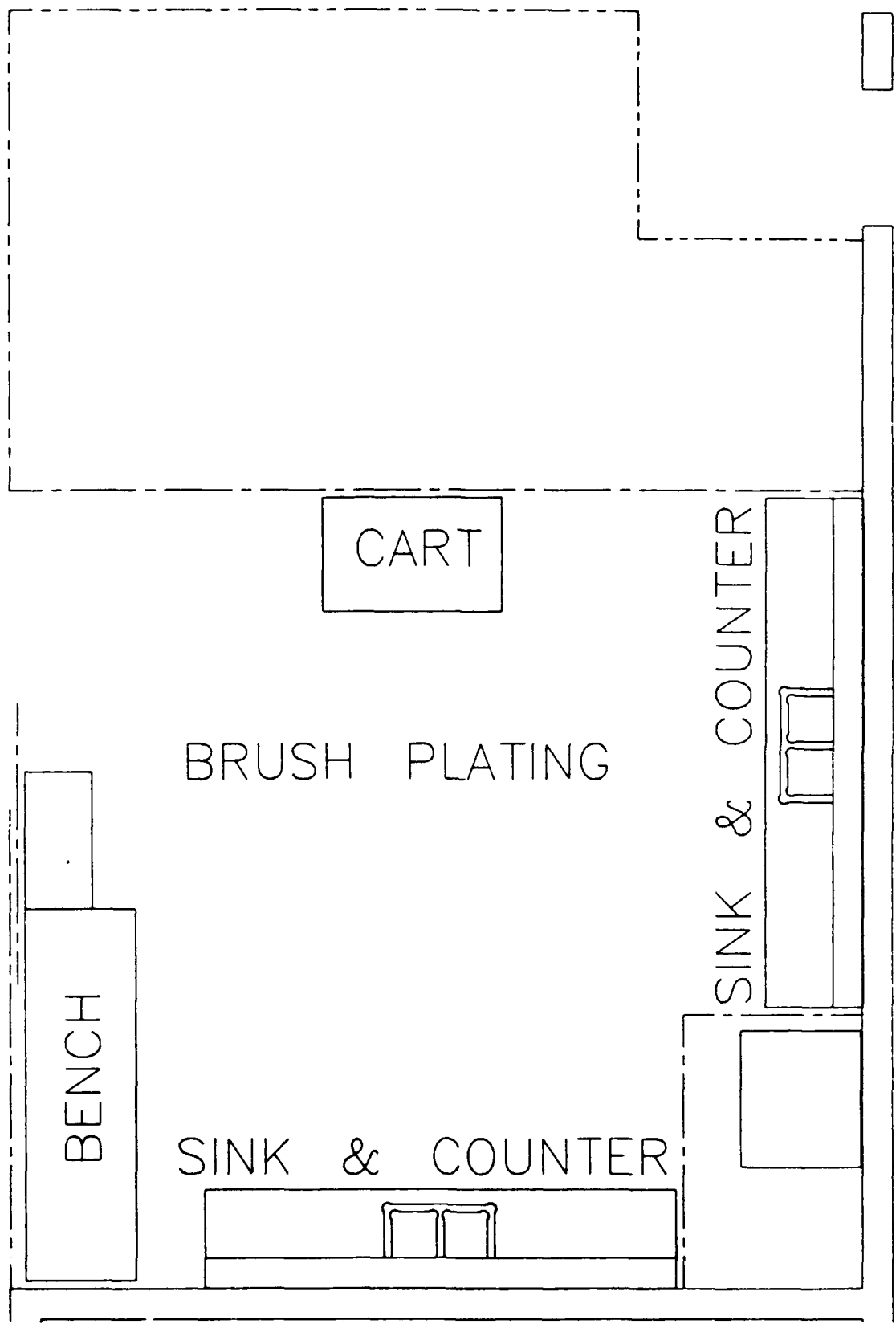
MANPRC NORTH PLATE AREA LAYOUT



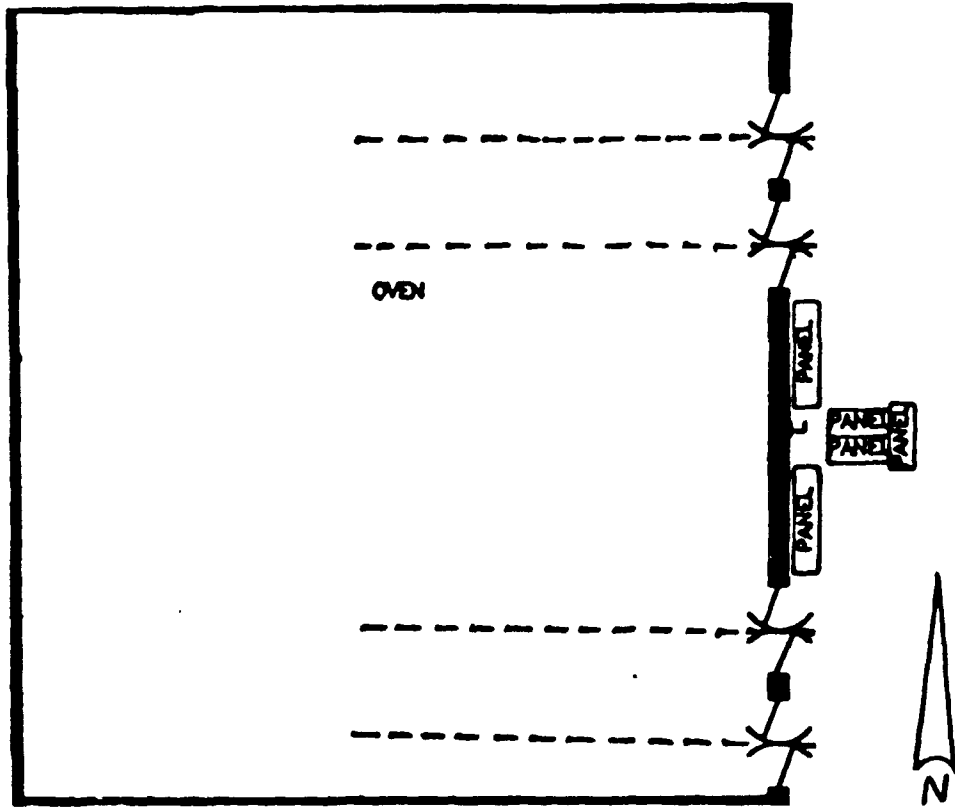
MHNPRC SOUTH PLATE AREA LAYOUT



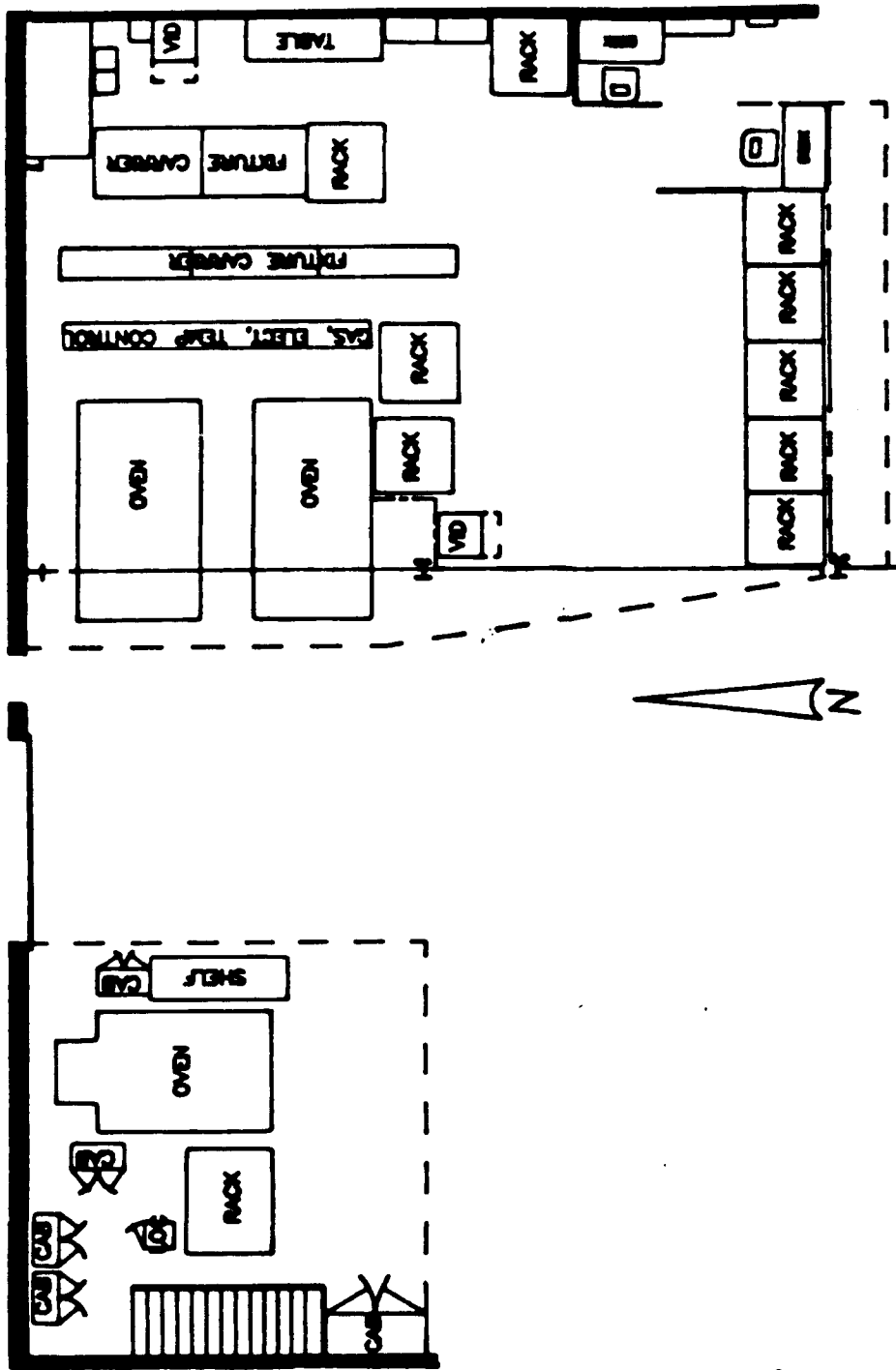
MTHNPRC HOT DIP MASKING AREA LAYOUT



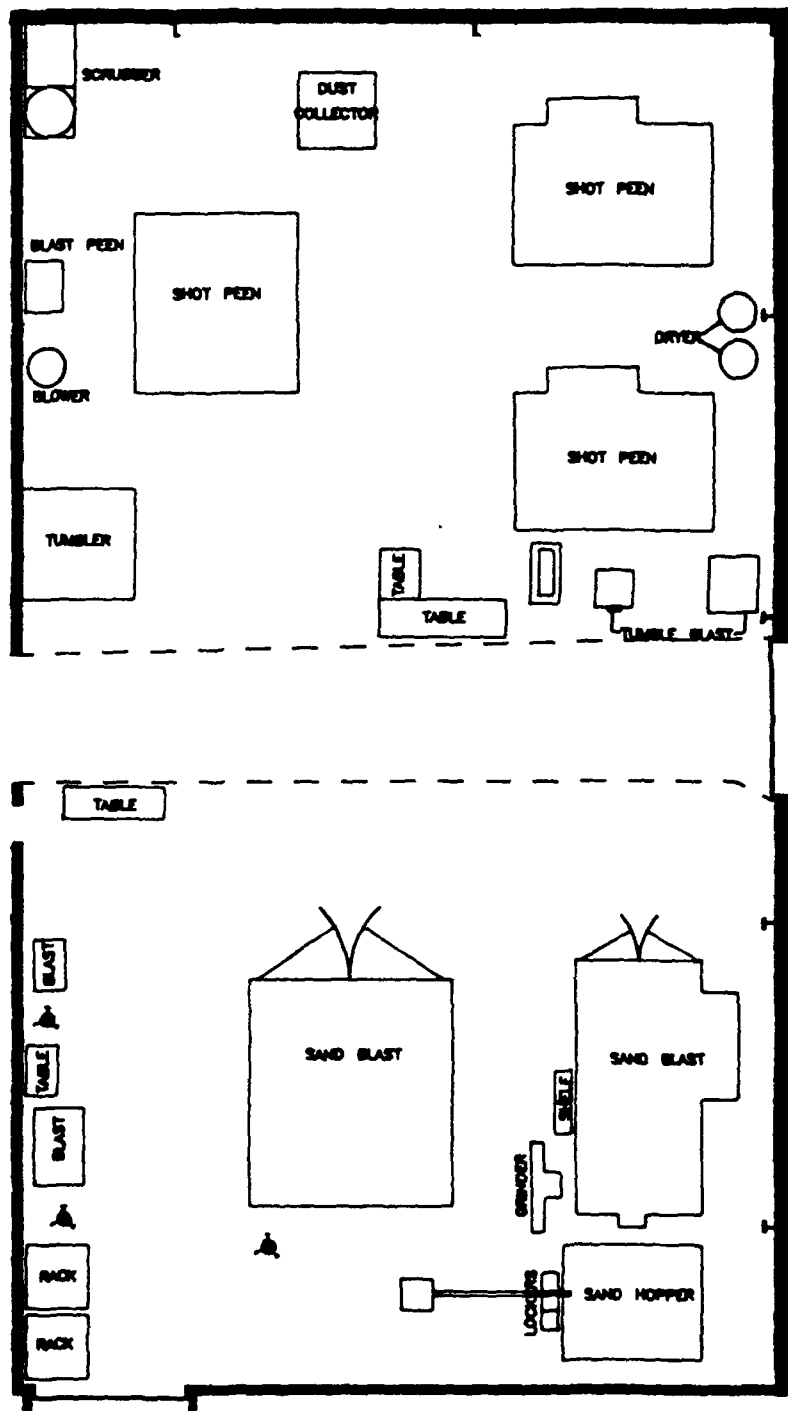
17ANPRC BRUSH PLATING AREA LAYOUT



MANARC CONVEYORIZED BALE OVEN

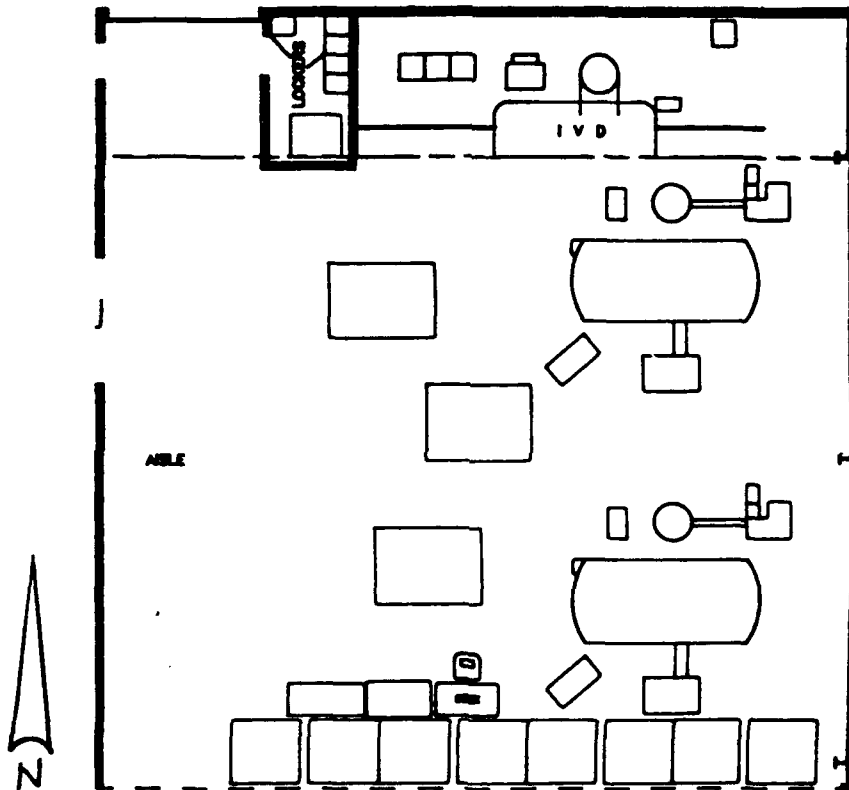


MANPRC BATCH BAKE OVENS



MANPRC SAND-BLAST/GRIT-BLAST AREAS





MANPRC ION-VAPOR DEPOSITION AREA

## OVERALL MANARC FACILITIES LAYOUT ASSESSMENT

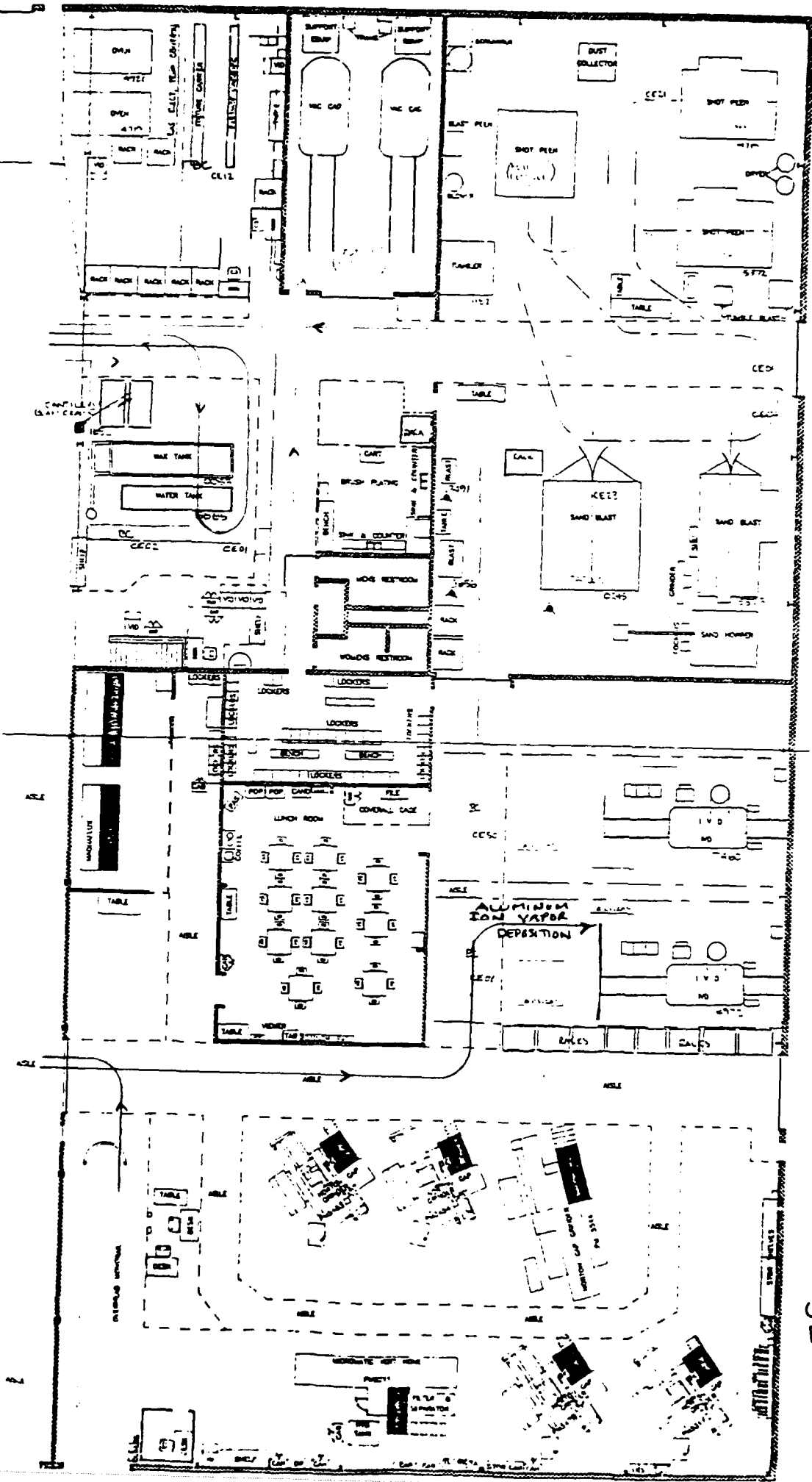
The overall assessment of the facilities is good with the exception of the wet-chemical tank areas (505N/505S). It is recommended that a Focus Study be made toward a total renovation of the two areas with emphasis on significant improvements in workflow and transport of parts via a suitable hoist system.

The layout configurations of the tanks are that of the late 1960's technology when the facility was designed for implementation (construction) approximately FY 72 era. The tanks in both areas are laid-out in the end-to-end style which doesn't allow for any versatility and economizing on floor space and allowing for expedient and time-saving workflow of parts. Parts must be removed from one monorail hoist track and placed on another monorail to complete the process.

Drag-out of chemical solutions with resultant contamination of other tanks result from insufficient strategically placed water rinse tanks - a some times. Also, the que of parts at either end of each end in conjunction with work in process (WIP) makes navigation of personnel difficult and dangerous. Improved schedules of work release could alleviate some of the condition along with applicable storage racks rather than a multitude of skids loaded with parts on floor access to the treatment lines.

R. Burnett - 6/7/72

THE OVERALL LAYOUT OF THE FACILITIES IS VERY GOOD, HOWEVER THE LAYOUT OF THE INDIVIDUAL PROCESS TANKS SHOULD BE RE-ANALYZED FOR BETTER FLOW OF PARTS. CURRENTLY THERE ARE PARTS THAT HAVE TO BE RE-CONNECTED TO ANOTHER MONITORIAL SYSTEM TO FINISH THE PROCESS. THERE ARE ALSO SEVERAL PLACES WHERE THE PART CONTAMINATES A TANK (DIPS SOLUTION INTO) WHILE BEING MOVED OVER IT TO GET TO ANOTHER TANK.



GENERAL  
PROCESS FLOW  
CHART  
20F2

## ASSESSMENT OF EQUIPMENT PER MANPRC

MANPRC occupies the entire floor area of Bldg. 505 with the exception of approximately 20% of the Building devoted to a large grinding machine plus an area for magnetic particle inspection and finally, one entire wet-chemical line (No. 8) is used for dye-penetrant inspection of castings. The area devoted for MANPRC comprises all equipment required to perform the mandated wet-chemical processing and the non-chemical coating operations such as grit-blasting, shot-peening and oven-baking (including a novel conveyorized oven for two widely-different bake cycles). The application of both metallic and non-metallic coatings to metal surfaces for corrosion resistance (chromate coating of aluminum and the cadmium plating of steel), engineering requirements (heavy chromium plating of bearing and journal surfaces on landing-gear cylinders) and for acceptable adhesion of organic coatings (anodizing of aluminum). In addition, a non-aqueous coating of commercially-pure aluminum is applied using the ion-vapor deposition process which greatly reduces the use of toxic cadmium plating (both from the cadmium metal itself in addition to the toxic cyanide electrolyte).

Excellent facilities exist for grit-blasting to remove both corrosion products and metal oxides, shot-peening for stress-relieving metallic surfaces and oven-baking to relieve both the effects of hydrogen embrittlement and service-induced stresses. While the existing facility for the hot melt

plastic masking is adequate although economically-expensive, the recommended use of a hot-melt wax maskant by McDonnell Douglas Missile Systems Co. (MDMSC) would be very economical but would entail the requisition and subsequent implementation of additional equipment for which suitable floor space is available (Refs. Task Order No. 7 Phase I Reports). The selective (brush) plating facility appears more than adequate for operations not only in the RCC but also remains portable to permit repair operations on operational aircraft.

MANPRC has approximately 110 wet-chemical tanks. These tanks, as well as that equipment previously-noted, are listed in the Equipment Profile (Sec. 5.0). An extensive renovation of Tank lines Nos. 16-19 was being performed during the Assessment. The original equipment/tanks for the RCC are approximately 17 years of age (FY 72 acquisition) per G. Roylance-Foreman. The chemical tanks are arranged end-to-end style in the technology of the late 1960 era and having each of nine monorail hoists servicing two lines with one monorail hoist servicing only one line (Line No. 19). Figures I and II show the 25-15 configuration of the wet-chemical areas and tank contents as of 5-23-89 lock-in date. Note that the 5-23-89 lock-in date was mandated due to the many on-going changes being made in MANPRC due partially to the extensive renovation previously noted.

Although the sizes of the tanks vary considerably both in footprint area and in solution volumes and in the physical shapes, the tanks appear to be adequate to contain the parts for processing. A better designed monorail hoist system with "parking" side-rails and with the same, existing tank arrangement would help considerably for movement of parts. The next overall renovation of MANPRC should include a Focus Study into a re-arrangement of the wet-chemical tanks in conjunction with the use of bridge cranes having remote-controlled (TV Remote Control-type), hand-held bridges and hoists. This type of part transport system is being considered by WR-NLC in their up-coming Facilities Improvement Project (FIP). Note reference to 17DMSC Task Order No. 5 - Phase I. The total re-arrangement of the tanks would allow for greater economic utilization of floor area while offering increased versatility in the performance of the many varied operations performed by MANPRC.

While some of the tank lines and/or chemical operation process flows have more than adequate water rinse tanks, other lines/processes do not. For example, tank lines No. 1, 2 and 4 have only one Cold Water Rinse tank located near end of line and only two Hot Water Rinse tanks exist for all of tank lines Nos. 1, 2, 3 and 4. This allows for needless drippage, to the main floor and the basement floor (through the steel grating), of extremely toxic

and corrosive hexavalent chromium solution.

Maintenance of not only the tanks and some of the ancillary equipment associated with the chemical operations could be improved. The deterioration of the cathode rod agitator rollers on tank CA-41 (Equipment No. 5849), containing a bright Watts Nickel plating solution, has progressed to the point that the 1.5 inch diameter solid copper buss is no longer contacting the hard rubber rollers placed at each end and at center of tank. A heavy lubricating grease has been applied to provide some lubricity to the center roller. Considerable chemical problems could result to the bright

Nickel Plate solution up to and including total discard and re-make if either the solution or the considerable amount of foam in the tank contacts the grease.

The facilities and equipment for hard chromium plating of landing gear parts is state-of-the-art utilizing the two-buss system. Cast lead "bird-cage" conforming anodes (used for the plating of outside surfaces of cylindrical parts and specially-designed conforming anodes (combination of lead and ethylene propylene-plastic) for inside surfaces of cylindrical parts are designed and fabricated within the ALC including the casting of lead-metal parts to the rather complex conforming anodes.

The two Ion-Vapor Deposition (IVD) facilities are becoming increasingly utilized for parts up to and including the C-141 Main Outer Cylinder. Size of the

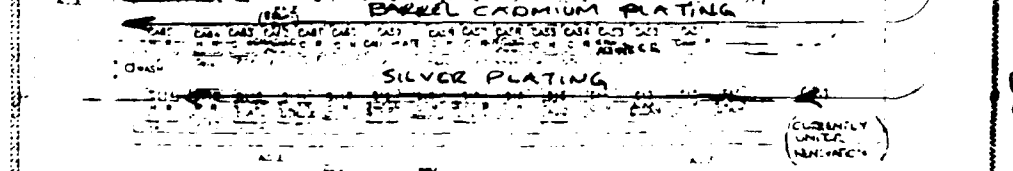
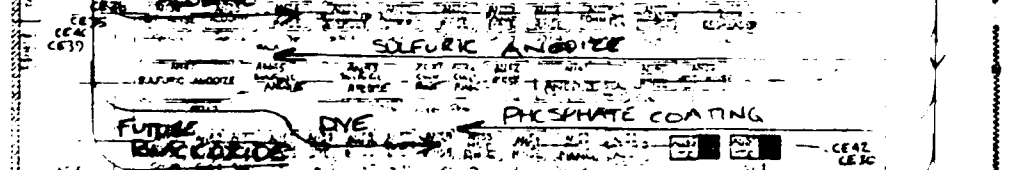
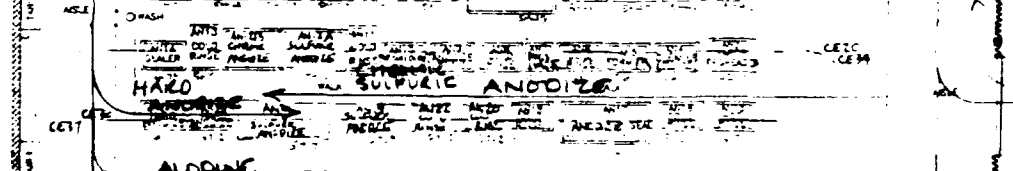
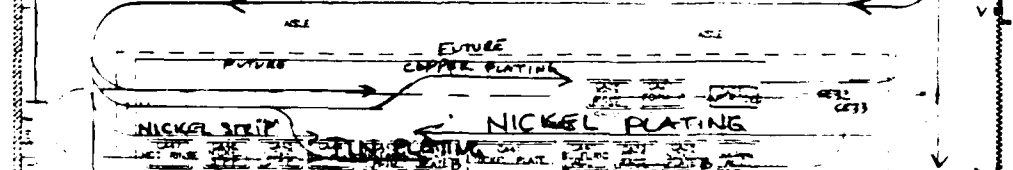
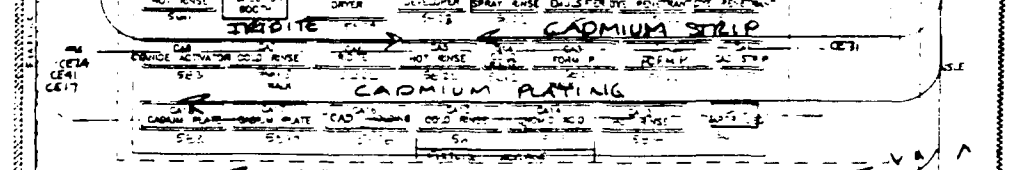
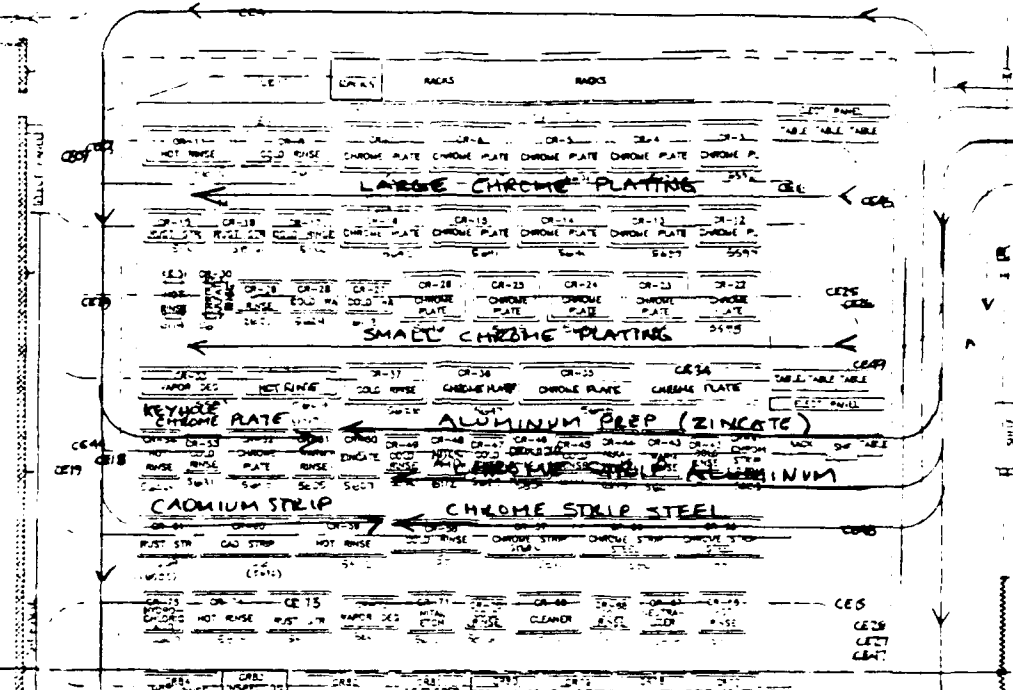
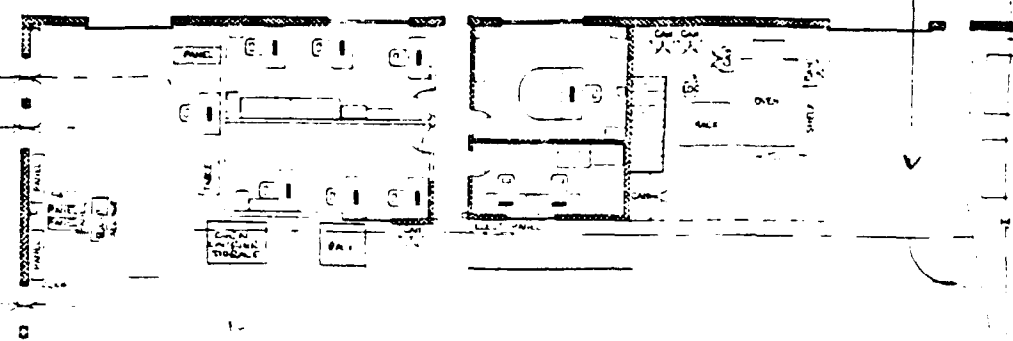


deposition chambers do not permit the processing of larger parts such as the B-52 and C-5 Main Outer Cylinders. The other main limiting factor on IVD aluminum deposition is the ratio of hole diameter to depth of hole to deposit the same thickness of aluminum as on outside surfaces. Parts with holes can be deposited to the same thickness only to a depth of a hole  $0.5 \times$  the diameter of the hole. One of the operators of the IVD machines, R. Newton, stated that he and five other personnel attended an IVD Training Course at St Louis, MO at INCAIR very recently. INCAIR recommended a deposition thickness of 0.015 inches vs the 0.005 inches presently performed and also the use of a glass-bead shot-peen stress relief following deposition. The glass-bead shot-peening is not available in MANPRC. A study is warranted concerning the acquisition and subsequent implementation of suitable glass-bead shot-peen equipment.

The storage of Work In Progress (WIP) requires some concentrated attention and study. Parts are typically blocking circles at periphery of the wet-chemical tanks areas making walking and the transport of parts difficult. Improved control of number of parts released for actual processing is needed to relieve this condition if only for safety considerations.

R. Bishoff - 4/6/89

14 CARRIERS  
 14 CARRIERS  
 ONE 24 FT  
 24 CARRIERS



GENERAL  
 PROCESS FLOW  
 CHART  
 1 OF 2

# EQUIPMENT PROFILE

<u>CODE</u>	<u>DESCRIPTION</u>
A	ALUMINUM
ACT	ACTIVATOR
ALKA	ALKALINE
ANZ	ANODIZE
BC	BIDGE CRANE
CAD	CADMIUM
CANT	CANTILEVER
CHR	CHROME, CHROMIC
CLN	CLEAN
CYANID	CYANIDE
DEG	DEGREASE
FS	FEROUS SULFATE
HYDRO	HYDROCHLORIC
IVD	ION VAPOR DEPOSITION
MANG	MANGANESE
NI	NICKEL
NIB	NICKEL BRIGHT
NIS	NICKEL SULFAMATE
NITR	NITRIC
PHOS	PHOSPHATE
S	STEEL
SILV	SILVER
STRIK	STRIKE
STRP	STRIP
SULF	SULFURIC
SULFM	SULFAMIC
VAR	VARIABLE

# EQUIPMENT PHOTOFILE

NAME \_\_\_\_\_ ALC \_\_\_\_\_ DATE \_\_\_\_\_ RCC \_\_\_\_\_ SHEET 9 OF \_\_\_\_\_

EQUIPMENT CODE	EQUIPMENT TYPE/DESCRIPTION	QUANTITY PER SHIFT			PREVENTIVE MAINT.			DOWNTIME			PERCENT USED FOR OTHER RCCs (i.e. TIME NOT AVAILABLE)	ENVELOPE UNIT		ALTERNATE EQUIPMENT CODE	SOURCE	
		1st	2nd	3rd	FREQ.	SHIFT	DOWN TIME	BREAKDOWN MTBF	UNSCHEDULED REPAIR TIME	MIN		MAX				
5601	WARM RINSE CR-43															
6115	ALKALINE CLEAN															
6111	COLDRINSE CR-44															
5805	DEOXIDIZER CR-45															
5629	COLDRINSE CR-46															
6112	NILIB-ASID CR-47															
5630	COLDRINSE CR-48															
5607	ZINCATE CR-49															
5605	WARM RINSE CR-50															
5631	COLDRINSE CR-51 (Remedy)															
5606	HOT RINSE CR-53															
	---															

## 2.2 EQUIPMENT

The equipment used in INANARC for metal coating by plating (brush and tank-type) is very conventional, using well-established equipment requirements. The equipment for ion-vapor deposition is rather sophisticated but is well-known and fully-developed. Ancillary operations relative to plating / metal ionizing are the grid-blast and shot-pec operations and the

# EQUIPMENT PROFILE

NAME _____		ALC _____		DATE _____		RCC _____		SHEET <u>6</u> OF _____			
EQUIPMENT CODE	EQUIPMENT TYPE/DESCRIPTION	QUANTITY PER SHIFT			DOWNTIME		PERCENT USED FOR OTHER RCCs (i.e. TIME NOT AVAILABLE)	ENVELOPE UNITS		ALTERNATE EQUIPMENT CODE	SOURCE
		1st	2nd	3rd	PREVENTIVE MAINT.	UNSCHEDULED BREAKDOWN REPAIR TIME		MIN	MAX		
					FREQ.	SHIFT	DOWN TIME	MTBF	MTTR		
0053	WAX-TANK										
5085	WATER BLANK										
5596	CHR-PLATE CR-3									5635 5597 5636 5637 5638 5641	5642
5635	CHR-PLATE CR-4									5596 5597 5636 5637 5638 5641	5642
5636	CHR-PLATE CR-5									5635 5597 5596 5637 5638 5641	5642
5637	CHR-PLATE CR-6									5635 5597 5596 5637 5638 5641	5642
5638	CHR-PLATE CR-7									5635 5597 5596 5637 5638 5641	5642
5597	CHR-PLATE CR-12									5635 5638 5596 5637 5638 5641	5642
5639	CHR-PLATE CR-13									5635 5638 5596 5597 5636 5639 5637 5641	5642
5640	CHR-PLATE CR-14									5635 5638 5596 5597 5636 5639 5637 5641	5642
5641	CHR-PLATE CR-15									5635 5638 5596 5597 5636 5639 5637 5641	5642
5642	CHR-PLATE CR-16									5635 5638 5596 5597 5636 5639 5637 5641	5641

# EQUIPMENT PROFILE

NAME \_\_\_\_\_ ALC \_\_\_\_\_ DATE \_\_\_\_\_ RCC \_\_\_\_\_ SHEET 7 OF \_\_\_\_\_

EQUIPMENT CODE	EQUIPMENT TYPE/DESCRIPTION	QUANTITY PER SHIFT			PREVENTIVE MAINT.			DOWNTIME			PERCENT USED FOR OTHER RCCs (e.g. TIME NOT AVAILABLE)	ENVELOPE UNITS		ALTERNATE EQUIPMENT CODE	SOURCE
		1st	2nd	3rd	FREQ.	SHIFT	DOWN TIME	MTBF	MTR	MIN		MAX			
5646	CHR-PLATE CR-24													5645 5576 5644 5648 5643 5649	
5645	CHR-PLATE CR-25													5646 5576 5644 5648 5643 5649	
5644	CHR-PLATE CR-24													5646 5576 5645 5648 5643 5649	
5643	CHR-PLATE CR-23													5646 5576 5645 5648 5644 5649	
5596	CHR-PLATE CR-22													5646 5643 5645 5648 5644 5649	
5650	CHR-PLATE CR-34														
5607	COLD RINSE CR-8														
5655	HOT RINSE CR-11														
5800	COLD RINSE CR-17														
5636	RUST STRIP CR-18														
5601	RUST STRIP CR-19														
5603	ES. - RINSE CR-30 (Ferrox Sulph)														

# EQUIPMENT PROFILE

NAME \_\_\_\_\_ ALC \_\_\_\_\_ DATE \_\_\_\_\_ RCC \_\_\_\_\_ SHEET 8 OF \_\_\_\_\_

EQUIPMENT CODE	EQUIPMENT TYPE/DESCRIPTION	QUANTITY PER SHIFT			PREVENTIVE MAINT.			DOWNTIME			PERCENT USED FOR OTHER RCCs (i.e. TIME NOT AVAILABLE)	ENVELOPE UNITS		ALTERNATE EQUIPMENT CODE	SOURCE
		1st	2nd	3rd	FREQ.	SHIFT	TIME	DOWN TIME	UNPLANNED BREAKDOWN REPAIR TIME	MTBF		MTR	MIN		
6113	COLD RINSE CR-27														
5624	COLD RINSE CR-28														
2625	HOT RINSE CR-29														
6114	HOT RINSE CR-31														
	CHR-PLATE CR-34												5596 5645 5643 5646 5644 5649	5649	
5646	CHR-PLATE CR-35												5596 5645 5643 5646 5644 5649		
5649	CHR-PLATE CR-36												5596 5645 5643 5646 5644 5649		
5626	COLD RINSE CR-37														
5604	---														
5599	CR-38 (EMPTY) VAPOR DEG CR-39														
5803	CHRSTIRP-A CR-41														
5627	COLD RINSE														



# EQUIPMENT PROFILE

NAME \_\_\_\_\_ ALC \_\_\_\_\_ DATE \_\_\_\_\_ RCC \_\_\_\_\_ SHEET 10 OF \_\_\_\_\_

EQUIPMENT CODE	EQUIPMENT TYPE/DESCRIPTION	QUANTITY PER SHIFT			PREVENTIVE MAINT.			DOWNTIME			PERCENT USED FOR OTHER RCCs (% TIME NOT AVAILABLE)	ENVELOPE UNITS		ALTERNATE EQUIPMENT CODE	SOURCE
		14	24	34	FREQ.	SHIFT	DOWN TIME	MTBF	UNPLANNED BREAKDOWN REPAIR TIME	MTTR		MIN	MAX		
5808	CHARSIRP-S CR-61														
5809	CHARSIRP-S CR-56														
5810	CHARSIRP-S CR-57														
5811	COLDRINSE CR-58														
5812	HOT-BLNSE CR-59														
5837	CAD-SIRP CR-60														
5867	HYDROACID CR-75														
5818	HOT-BLNSE CR-74														
5833	CAD-SIRP CA-1														
5826	FORMULA-P CR-2 (EMPTY)														
5827	FORMULA-P CA-3														
5812	COLDRINSE CA-4														

# EQUIPMENT PROFILE

NAME _____ ALC _____ DATE _____ RCC _____ SHEET <u>11</u> OF _____		EQUIPMENT TYPE/DESCRIPTION	QUANTITY PER SHIFT			PREVENTIVE MAINT.			DOWNTIME			PERCENT USED FOR OTHER RCCs (i.e. TIME NOT AVAILABLE)	ENVELOPE UNITS		ALTERNATE EQUIPMENT CODE	SOURCE	
			1st	2nd	3rd	FREQ.	SHIFT	DOWN TIME	MTBF	MTTR	MIN		MAX				
5826		HOT-RINSE CA-5															
5822		IRRLINE-- CA-6															
5813		SOLDERINSE CA-7															
5831		CYANIDACE CA-9															
5819		VALVE-DEG CA-12															
5834		HOT-RINSE CA-13															
5835		CHB--ACLD CA-14															
5813		SOLDERINSE SAFETY CAP															
5836		CAP--HOLD CA-16															
5837		CAD-PLATE CA-17															
5838		CAD-PLATE CA-18															
		-----															

# EQUIPMENT PROFILE

SHEET 12 OF     

RCC     

DATE     

ALC     

NAME     

EQUIPMENT CODE	EQUIPMENT TYPE/DESCRIPTION	QUANTITY PER SHIFT		PREVENTIVE MAINT.			DOWNTIME		UNPLANNED BREAKDOWN REPAIR TIME MTTR	PERCENT USED FOR OTHER RCCs (i.e. TIME NOT AVAILABLE)	ENVELOPE UNIT		ALTERNATE EQUIPMENT CODE	SOURCE
		1st	2nd	3rd	FREQ.	SHIFT	DOWN TIME	MTBF			MIN	MAX		
5817	RUST-SIRP CRETS (EMPTY)													
5808	VAPOR-DEG CR-72													
	-----													
	-----													
	-----													
	-----													
	-----													
5840	COLDLINE CA-28													
5839	FORMULA-P CA-27													
5820	VAPOR-DEG CA-25													
5842	----- CR-37 (EMPTY)													
5846	NI-PLATE CA-30 (Gatts)													

5835  
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5876  
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5881  
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5892  
5893  
5894  
5895  
5896  
5897  
5898  
5899  
5900

EQUIPMENT FILE

SHEET 13 OF

RCC

DATE

ALC

NAME

EQUIPMENT CODE	EQUIPMENT TYPE/DESCRIPTION	QUANTITY PER SHIFT			PREVENTIVE MAINT.			DOWNTIME			PERCENT USED FOR OTHER RCCs (% TIME NOT AVAILABLE)	ENVELOPE UNIT MIN MAX	ALTERNATE EQUIPMENT CODE	SOURCE
		1st	2nd	3rd	FREQ.	SHIFT	DOWN TIME	MTBF	MTTR	MTTR				
5847	SOLUBLE CA-39													
5848	SULF-ACID CA-40													
5849	NI-PLATE (Sulfonate) CA-41													
5850	NI-PLATE (Sulfonate) CA-42													
5851	SULFEMACID CA-43													
5852	TLN-PLATE (Sulfonate) CA-44													
5853	CHRS-ACID (Sulfonate) CA-45												5854	
5854	NI-SIRP CA-46												5853	
5855	PHOSPHATE (LUBRICANTS) CA-47													
0249	VAPOR-DEGS AN-3													
5681	CLN-TURCO AN-4													
5693	FDRM-P-R AN-5													

# EQUIPMENT PROFILE

NAME _____		ALC _____		DATE _____		RCC _____		SHEET 14 OF _____					
EQUIPMENT CODE	EQUIPMENT TYPE/DESCRIPTION	QUANTITY PER SHIFT			PREVENTIVE MAINT.		DOWNTIME		PERCENT USED FOR OTHER RCCs (0-8 TIME NOT AVAILABLE)	ENVELOPE UNITS		ALTERNATE EQUIPMENT CODE	BOUNCE
		1st	2nd	3rd	FREQ.	SHIFT	DOWN TIME	UNSCHEDULED BREAKDOWN REPAIR TIME		MIN	MAX		
							MTBF	MTTR					
5670	COLD RINSE AN-6												
5656	NITR-ACLD AN-7												
5671	COLD RINSE AN-8												
5679	ANOD-SIRP AN-9												
5707	DEZLDLE AN-10												
5698	COLD RINSE AN-11 EMPTY												
5714	CHR-ANOD (Types) AN-12A												
5699	COLD RINSE AN-13												
5678	SEAL (Metal Arch) AN-14												
5676	HOI-RINSE AN-15												
5700	COLD RINSE AN-16												
5613	ANOD SEAL (Sodium Dichromate) AN-17												

CHR Anod Type 2  
AN-12B



# EQUIPMENT PROFILE

NAME		ALC		DATE		RCC		SHEET 16 of 16		SOURCE	ATTN/DATE EQUIPMENT CODE	ENVELOP UNIT		PERCENT USED FOR OTHER RCCs (i.e. TIME NOT AVAILABLE)	UNPLANNED REPAIR TIME		DOWNTIME		PREVENTIVE MAINT.		QUANTITY PER SHIFT		EQUIPMENT TYPE/DESCRIPTION
												MIN	MAX		MTBF	MTTR	DOWN TIME	MTBF	MTTR	FREQ.	SHIFT	1st	
5705																							COLD RINSE AN-31
5680																							ANOD - SRR AN-32
5705																							REX - LTR AN-33
5706																							COLD RINSE AN-34
5672																							ANODINE -- AN-35
5656																							HOT - RINSE AN-36
5677																							HOT - RINSE AN-39
5663																							COLD RINSE AN-40
5674																							ANOD - SEAL AN-41
5664																							COLD RINSE AN-42
5716																							SULF - ANOD AN-43
5665																							COLD RINSE AN-44

# EQUIPMENT PROFILE

NAME _____ ALC _____ DATE _____ RCC _____ SHEET <u>17</u> OF _____		EQUIPMENT CODE	EQUIPMENT TYPE/DESCRIPTION	QUANTITY PER SHIFT			PREVENTIVE MAINT.			DOWNTIME			PERCENT USED FOR OTHER RCCs (i.e. TIME NOT AVAILABLE)	ENVELOPE UNITS		ALTERNATE EQUIPMENT CODE	SOURCE
				1st	2nd	3rd	FREQ.	SHIFT	DOWN TIME	MTBF	MTTR	MIN		MAX			
5715	SULF-ANOD	AN-45															
5666	COLD RINSE	AN-46															
5713	SULF-ANOD	AN-47															
5632	OIL-SEAL	AN-50															
5681	OIL-SEAL	AN-51															
5677	CHL-ACID	AN-52															
5694	PHOS-Z	AN-53															
5630	COLD RINSE	AN-54															
5675	MANG-PHOS	AN-55															
5660	HOT RINSE	AN-56															
5696	BLACK-DYE	AN-57															
5668	COLD RINSE	AN-58															



# EQUIPMENT PROFILE

NAME \_\_\_\_\_ ALC \_\_\_\_\_ DATE \_\_\_\_\_ RCC \_\_\_\_\_ SHEET 18 OF \_\_\_\_\_

EQUIPMENT CODE	EQUIPMENT TYPE/DESCRIPTION	QUANTITY PER SHIFT			PREVENTIVE MAINT.			DOWNTIME			PERCENT USED FOR OTHER RCCs (e.g. TIME NOT AVAILABLE)	ENVELOPE UNIT MIN / MAX	ALTERNATE EQUIPMENT CODE	SOURCE
		1st	2nd	3rd	FREQ.	SHIFT	DOWN TIME	BREAKDOWN MTBF	UNSCHEDULED REPAIR TIME	MTTR				
5617	RED-DYE AN-59													
5661	COLORINSE AN-60													
5661	NEUTRALIZ AN-61													
5662	HOI-RINSE AN-62													
5629	HOI-RINSE AN-63													
6010	FORMULA-P RA-57													
5614	COLORINSE CA-52													
5664	COLORINSE CA-53													
5665	COLORINSE CA-54													
5615	COLORINSE CA-55													
5666	HYDROACID CA-56													
5667	COLORINSE CA-57													

# EQUIPMENT PROFILE

NAME \_\_\_\_\_ ALC \_\_\_\_\_ DATE \_\_\_\_\_ RCC \_\_\_\_\_ SHEET 12 OF \_\_\_\_\_

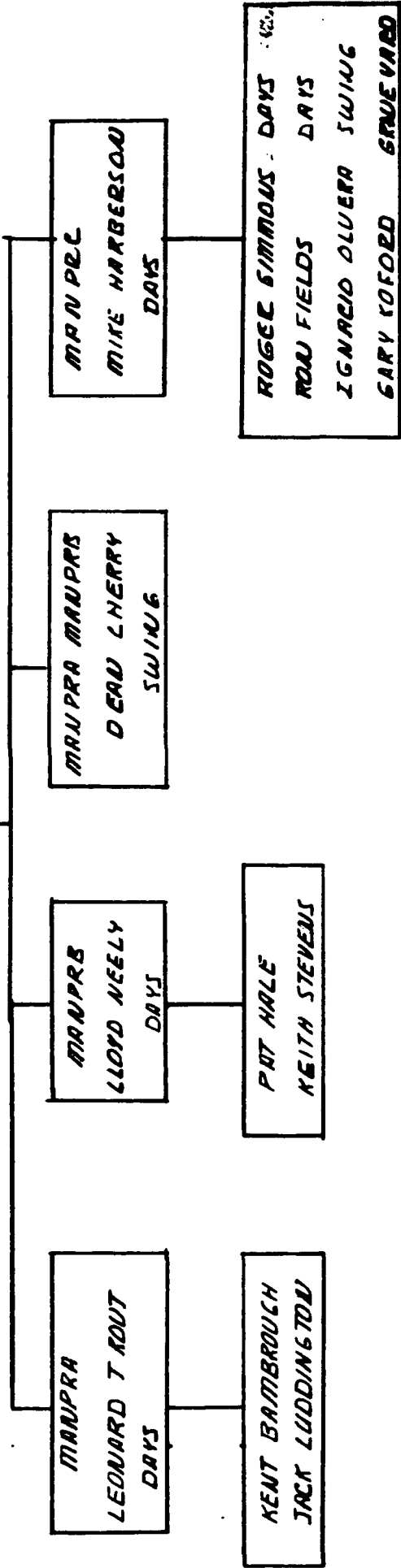
EQUIPMENT CODE	EQUIPMENT TYPE/DESCRIPTION	QUANTITY PER SHIFT			PREVENTIVE MAINT.			DOWNTIME			PERCENT USED FOR OTHER RCCs (% TIME NOT AVAILABLE)	ENVELOPE UNIT MIN / MAX	ALTERNATE EQUIPMENT CODE	SOURCE
		1st	2nd	3rd	FREQ.	SHIFT	DOWN TIME	MTBF	UNPLANNED BREAKDOWN REPAIR TIME	MTTR				
5616	COLD RINSE CA-58													
5668	CAD-PLATE CA-59													
5617	COLD RINSE CA-60													
5618	COLD RINSE CA-61													
5632	CHL-ACID CA-62													
5678	COLD RINSE CA-63													
5621	HOT RINSE CA-64													
5670	HOT RINSE CA-65													
5669	SILY-STRP SI-1													
5662	COLD RINSE SI-2													
5676	ALKACLEAN SI-3													
5659	COLD RINSE SI-4													

# EQUIPMENT MOBILE

NAME \_\_\_\_\_ ALC \_\_\_\_\_ DATE \_\_\_\_\_ RCC \_\_\_\_\_ SHEET 20 OF \_\_\_\_\_

EQUIPMENT CODE	EQUIPMENT TYPE/DESCRIPTION	QUANTITY PER SHIFT			PREVENTIVE MAINT.			DOWNTIME			PERCENT USED FOR OTHER RCCs (i.e. TIME NOT AVAILABLE)	ENVELOPE UNIT MIN      MAX	ALTERNATE EQUIPMENT CODE	SOURCE	
		1st	2nd	3rd	FREQ.	SHIFT	DOWN TIME	BREAKDOWN	REPAIR TIME	MTBF					MTTR
5072	SULE-ASLD SI-5														
5001	COLD RINSE SI-6														
5073	COP-STRIK SI-7														
5060	COLD RINSE SI-8														
5060	NI-STIRP-- SI-9														
5071	COLD RINSE SI-10														
5075	SILYSTRIK SI-11														
5074	SILYPLATE SI-12														
5079	WARM RINSE SI-13														
5050	HOT RINSE SI-14														
	-----														
	-----														

MAN PR  
BILL PHILLIPS



# MANPOWER FILE

NAME <u>ROZMAN, ESTER</u> ALC <u>00-ALC</u> DATE <u>17 MAY 69</u> RCC <u>MANPRC</u> SHEET <u>    </u> OF <u>    </u>		MANPOWER AVAILABLE (HOURS)												ALTERNATE SMALL COO/LEVEL				
SMALL COO/LEVEL	JOB DESCRIPTION	QUARTER	QUANTITY AVAILABLE						WORK WEEK						HOURS			
			WEEKEND		WEEKEND		WEEKEND		WEEKEND		WEEKEND		WEEKEND					
UP05	FORKLIFT	1-3-4	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	UP06 UP08 UP09
UP06	JR JOURN	1-3-4	2	1					5.6									UP07 UP08
UP06	BASE OPERATORS MISC ITEMS	1-3-4	5	2	1				5.6									
UP06	BASE OPERATORS MISC ITEMS	1-3-4	5	2	1				5.6									
UP06	BASE OPERATORS MISC ITEMS	1-3-4	5	2	1				5.6									
UP06	BST JOURN ALL BURNERS JOURNMAN JR JOURNMAN NOT TRAINERS	1-3-4	3	2	2													
UP09	PLT JOURN ALL PLATERS JOURNMAN JR JOURNMAN NOT TRAINERS	1-3-4	16	1	9													UP06

MANPRC PLATING SHOP  
27 AUG - 23 SEP 89

MICHAEL F. HARBERTSON, MACH GEN FRMN

JOANN, MARBLE ELTRPLTR TRG

ANODIZE-CAD PLATE

PUMPKERS

CHROME/IRRIDITE/

(17) DAYS  
\*\*\*\*\*  
SIMMONS, ROGER (S) WS-09  
CISOWSKI, DAN WG-09  
COPENHAVER, D. (A) WG-09  
DRAKE, DELL WG-09  
FRITZ, ROBERT WG-09  
MARONEY, LONNIE WG-09  
NEWTON, RICHARD WG-09  
PIERCE, THOMAS WG-07  
RIVERA, GREG WG-09  
SMUIN, STEPHEN WG-09  
VALDEZ, JOSEPH WG-07  
VILLARRRUEL, CATHY WG5P7  
WIGGINS, STEVEN WG-09

DAYS  
\*\*\*\*\*  
(S) WS-09  
EVERETT, MICHAEL WG5P7  
GREENWOOD, BRENT WG-07  
HAYBALL, JAN WG-07  
KITE, AMY WG5P7

BRUSH PLATE (17) DAYS  
\*\*\*\*\*  
FIELDS, RONDAL (S) WS-09  
BAKER, DEAN WG-07  
BILLMIRE, SHARON WG-09  
DODSON, JOANN WG5P7  
EGGLESTON, DALLAS WG-09  
HANSEN, GERALD WG-09  
HOLMES, GORDON WG-09  
JACOBSEN, LESLIE WG-07  
LARSON, DAVID WG-09  
ROYLANCE, GREG (A) WG-09  
SMITH, HARRY WG-09

CHROME/VAC/WCAD/  
BAKE: (17) SWING

CHROME/ANODIZE  
CAD/BAKE (13) GRAVE

\*\*\*\*\*  
OLVERA, IGNACIO (S) WS-09  
BURKDOLL, JAMES WG-09  
FRANCIS, WADE S. WG-07  
GALLEGOS, DAN WG-09  
HALL, MIKE WG-09  
HYER, STEVEN WG-09  
LICHT, SUSAN WG-09  
MAKI, JAMES WG-09  
MCATEE, JAMES (A) WG-09  
PERKINS, RANDY WG-09  
SHAW, LAWRENCE WG-09  
SMITH, BRENT WG-09  
SMITH, BRUCE WG-09  
STEWART, JEFFREY WG-09

\*\*\*\*\*  
KOFORD, GARY (S) WS-09  
BRADLEY, RICHARD WG-09  
CHAVEZ, JESUS WG-09  
FIELD, ROBERT WG-09  
NELSON, DALE WG-09  
NICKERSON, AMY WG-09  
PLAYER, MARLIN (A) WG-09  
SMITH, WILFORD WG-09  
SWANER, STEVEN WG-07  
THORNLEY, MARK WG-09  
WAYMAN, WILLIAM WG-09

SHOT PEEN DAYS  
\*\*\*\*\*  
ACKER, LESLIE WG5P8  
MARTIN, DAVID WG-08  
MILLETT, W. (US) (LO) WG-08  
SANCHEZ, MANUEL WG5P8  
SEIFERT, JACK WG-08  
VELASQUEZ, LEE WG-08

(S) - SUPERVISOR  
(A) - ALTERNATE  
(LI) - LOANED IN  
(LO) - LOANED OUT  
(US) - UNION STEWARD  
\* - ON CALL

SHOTPEEN SWING  
\*\*\*\*\*  
KELLER, EDWARD WG-08  
ROBBINS, MARK WG-08

SHOTPEEN GRAVE  
\*\*\*\*\*  
FACER, ROBERT WG-08  
NICHOLLS, RODNEY WG-08

PSU DAYS  
\*\*\*\*\*  
BODILY, LOY WG-05

PRC ASSIGNED:  
3711-WS-12 - 1  
3711-WS-09 - 4  
3711-WL-08 - 1  
3711-WG-09 - 37  
3711-WG-07 - 6  
3711-WG-05 - 2  
3760-WG-08 - 8  
3760-WG-05 - 2  
4740-WG-07 - 2  
4740-WG-05 - 2  
6010-WG-05 - 1

TOTAL: 65

PERSONAL DATA - PRIVACY ACT OF 1974 (PL93-579) FOR OFFICIAL USE ONLY  
 DATE 08-13-89 A-00370-061-D2-M08 PG 488

ACFCM (2) MAMPRC (2) RCC TOTAL LABOR ASSIGNMENT REPORT

RCC: MAMPRC FOREMAN CODE: <-----CURRENT ASSIGNMENT-----> <-----LOAN STATUS INFORMATION----->

EMPLOYEE NAME	IDENT	MC	DC	SK	OO	SH	SP	STATUS	RCC	DC	SK	DO	FC	SH	SP	EFF DATE	TERM DATE
FIELDS RON	408622832	C	21	1	1	1											J-0-M
KOFORD GARY L	528844357	C	21	1	1	3											
OLIVERA IGNACIO Z	317828181	C	21	1	1	2											
SIMMONS ROGER A	828708688	C	21	1	1	1											

DUTY CODE TOTALS:  
 PERSONNEL ASSIGNED 4  
 PERSONNEL BORROWED 0  
 PERSONNEL LOANED 4  
 NET STRENGTH 4

F/C TOTAL: NET STRENGTH 4

ACFCM (2) MANPRC (2) MANPRC FOREMAN CODE: C1

RCC: MANPRC FOREMAN CODE: C1  
 RCC TOTAL LABOR ASSIGNMENT REPORT  
 RCC DC SK DO FC SH SP J-O-N  
 EFF DATE TERM DATE

-----CURRENT ASSIGNMENT-----<----->  
 -----LOAN STATUS INFORMATION-----<----->

EMPLOYEE NAME	IDENT	MC	DC	SK	DO	FC	SH	SP	STATUS	RCC	DC	SK	DO	FC	SH	SP	J-O-N	EFF DATE	TERM DATE
ACKER LESLIE M	816641041	C	11	UP	1														
BAKER DEAN A	82887258	C	11	UP	1														
BILLMIRE SHARON L	828828166	C	11	UP	1														
DOOSON JOANN	828827938	C	11	UP	1														
EGGLESTON DALLAS	828883363	C	11	UP	1														
HANSEN GERALD M	828441826	C	11	UP	1														
HOLMES GORDON J	828484758	C	11	UP	1														
JACOBSEN LESLIE J	828131188	C	11	UP	1														
LARSON DAVID W	828828101	C	11	UP	1														
ROYLANCE GREGORY	828888888	C	11	UP	1														
SANCHEZ MANUEL	828700377	C	11	UP	1														
SEIFERT JACK Y	828888474	C	11	UP	1														
SMITH HARRY E	828888308	C	11	UP	1														
VELASQUEZ LEE I	828804020	C	11	UP	1														

DUTY CODE TOTALS:  
 PERSONNEL ASSIGNED 14  
 PERSONNEL BORROWED 0  
 PERSONNEL LOANED 0  
 NET STRENGTH 14

F/C TOTAL: 14



RCC TOTAL LABOR ASSIGNMENT REPORT

ACFCM (2) MANPRC (2)

RCC: MANPRC FOREMAN CODE: C2

-----CURRENT ASSIGNMENT-----> <-----LOAN STATUS INFORMATION----->

EMPLOYEE NAME	IDENT	MC	DC	SK	DO	SH	SP	STATUS	RCC	DC	SK	DO	FC	SH	SP	EFF DATE	TERM DATE
COPENHAVER DENNIS	184349805	MC	11	UP	1	1	1										J-0-M
DRAKE DELL R	529585983	C	11	UP	1	1	1										
EVERETT MICHAEL	528841857	C	11	UP	1	1	1										
FRITZ ROBERT P	320807087	C	11	UP	1	1	1										
GREENWOOD BRENT	528820704	C	11	UP	1	1	1										
HAYBALL JAN W	528721140	C	11	UP	1	1	1										
NEWTON RICHARD L	507685609	C	11	UP	1	1	1										
PIERCE THOMAS G	528288244	C	11	UP	1	1	1										
RIVERA GREG H	52888102	C	11	UP	1	1	1										
SMUIN STEPHEN R	528882820	C	11	UP	1	1	1										
VALLDEZ JOSEPH D	528747338	C	11	UP	1	1	1										
VILLARUEL CATHY	528808851	C	11	UP	1	1	1										
WIGGINS STEVE J	528708828	C	11	UP	1	1	1										

DUTY CODE TOTALS:  
 PERSONNEL ASSIGNED 13  
 PERSONNEL BORROWED 0  
 PERSONNEL LOANED 0  
 NET STRENGTH 13

F/C TOTAL: 13

ACFCM (2) MANPRC (2) MANPRC (2)  
 RCC TOTAL LABOR ASSIGNMENT REPORT

RCC: MANPRC FOREMAN CODE: C3

-----CURRENT ASSIGNMENT-----<-----LOAN STATUS INFORMATION----->

EMPLOYEE NAME	IDENT	MC	DC	SK	DO	SH	SP	STATUS	RCC	DC	SK	DO	FC	SH	SP	EFF DATE	TERM DATE
BOOILY LOY R	528608156	C	11	UP	1	2											J-O-M
BURKDOLL JAMES K	528608852	C	11	UP	1	2											
FRANCIS WADE	528117038	C	11	UP	1	2											
GALLEGOS DANIEL	528600937	C	11	UP	1	2											
HALL MICHAEL R	518448535	C	11	UP	1	2											
HYER STEVEN K	528663417	C	11	UP	1	2											
KELLER EDWARD A	580383484	C	11	UP	1	2											
LICHT SUZAN	528784108	C	11	UP	1	2											
MARI JAMES M	528688503	C	11	UP	1	2											
MARONEY LONNIE R	5286880841	C	11	UP	1	2											
MARTIN DAVID W	263707398	C	11	UP	1	1											
MCATEE JAMES M	528542611	C	11	UP	1	2											
PERKINS RANDY S	528666453	C	11	UP	1	2											
ROBBINS MARK E	528944590	C	11	UP	1	2											
SHAW LAWRENCE B	528889790	C	11	UP	1	2											
SMITH BRENT L	528841153	C	11	UP	1	2											
SMITH BRUCE L	528841201	C	11	UP	1	2											
STEWART JEFFREY E	528680884	C	11	UP	1	2											

DUTY CODE TOTALS:  
 PERSONNEL ASSIGNED 18  
 PERSONNEL BORROWED 0  
 PERSONNEL LOANED 18  
 NET STRENGTH 18

F/C TOTAL: NET STRENGTH 18

ACFCM (2) MANPRC (2) RCC TOTAL LABOR ASSIGNMENT REPORT

RCC: MANPRC FOREMAN CODE: C4

-----CURRENT ASSIGNMENT-----> <-----LOAN STATUS INFORMATION----->

EMPLOYEE NAME	IDENT	MC	DC	SK	DO	SH	SP	STATUS	RCC	DC	SK	DO	FC	SH	SP	EFF DATE	TERM DATE
BRADLEY RICHARD M	829138608	C	11	UP	1	3											
CHAVEZ JESUS V	863689834	C	11	UP	1	3											
FACER ROBERT N	828878718	C	11	UP	1	3											
FIELD ROBERT H	828840918	C	11	UP	1	3											
NELSON DALE B	828827076	C	11	UP	1	3											
NICKOLLS ROONEY B	828884883	C	11	UP	1	3											
NICKERSON AMY J	828782837	C	11	UP	1	3											
PLAYER MARLIN W	828608423	C	11	UP	1	3											
SMITH WILFORD D	828883888	C	11	UP	1	3											
SWANNER STEVEN	828784891	C	11	UP	1	3											
THORNLEY MARK R	828700748	C	11	UP	1	3											
WAYMAN WILLIAM	284228881	C	11	UP	1	3											

DUTY CODE TOTALS: PERSONNEL ASSIGNED 12  
 PERSONNEL BORROWED 0  
 PERSONNEL LOANED 0  
 NET STRENGTH 12

F/C TOTAL: NET STRENGTH 12

PERSONAL DATA - PRIVACY ACT OF 1974 (PL93-579) FOR OFFICIAL USE ONLY  
 DATE 08-13-89 A-G0376-G61-D2-MG8 PG 483

ACFCR (2) MANPRC (2) RCC TOTAL LABOR ASSIGNMENT REPORT

RCC: MANPRC FOREMAN CODE: C5

<-----CURRENT ASSIGNMENT-----> <-----LOAN STATUS INFORMATION----->

EMPLOYEE NAME	IDENT	MC	DC	SK	DO	SH	SP	STATUS	RCC	DC	SK	DO	FC	SH	SP	EFF DATE	TERM DATE	J-O-N
CISOWSKI DANIEL	929628859	C	11	UP	1	1												
MARBLE JOSEPHINE	259842480	C	11	UP	1	1												
DUTY CODE TOTALS:																		
PERSONNEL ASSIGNED 2																		
PERSONNEL BORROWED 0																		
PERSONNEL LOANED 0																		
NET STRENGTH 2																		
F/C TOTAL: NET STRENGTH 2																		

PERSONAL DATA - PRIVACY ACT OF 1974 (PL83-579) FOR OFFICIAL USE ONLY  
 DATE 08-13-89 A-00370-061-D2-W06 PG 494

ACFCM (2) MANPRC (2) RCC TOTAL LABOR ASSIGNMENT REPORT  
 RCC: MANPRC FOREMAN CODE: RC

<-----CURRENT ASSIGNMENT-----> <-----LOAN STATUS INFORMATION----->

EMPLOYEE NAME IDENT MC DC SK DO SH SP STATUS EFF DATE TERM DATE  
 KITE AMY R 829180108 C 11 UP 1 1

DUTY CODE TOTALS: PERSONNEL ASSIGNED 1  
 PERSONNEL BORROWED 0  
 PERSONNEL LOANED 0  
 NET STRENGTH 1  
 P/C TOTAL: NET STRENGTH 1  
 RCC TOTAL: NET STRENGTH 64

MARK SAID THAT THIS IS MEANT TO BE A  
SHORT TERM QUICK FIX. HE WOULD LIKE TO  
EVENTUALLY REPLACE PM303 VAPOR DEGREASER  
WITH A WARM DETERGENT WASH AND CLEAN  
RINSE. HOWEVER THIS IS OVER A YEAR  
AWAY.

BOB BISHOP ASKED HOW MANY PEOPLE RON FIGLDS  
HAS IN PLATING?

RON TOLD ME

5 ON FIRST

5 ON SECOND

5 ON THIRD

10/14/47



DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS OGDEN AIR LOGISTICS CENTER (AFLC)  
HILL AIR FORCE BASE, UTAH 84056

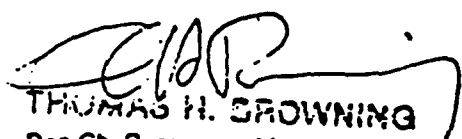
REPLY TO  
ATTN OF: MAW

AUG 2 1988

SUBJECT: FY89 Approved Resource Control Center (RCC) Rates

TO MAB      MAK      MAN      MAQ      MAR      MAS

1. The attached list of FY89 RCC rates has been approved by Headquarters AFLC/MAJ and will be used in the G004L system for pricing all temporary work orders.
2. These rates may be used in estimating the cost of new requirements. An actual bill of material (BOM) may be used for direct expense material instead of the rate; this will provide more equitable pricing. Other direct costs for temporary travel duty (TDY) will have to be added to obtain the total cost.
3. Any questions relating to these rates should be directed to Mrs Daphne Gale, MAWFB, extension 72452/3.

  
**THOMAS H. BROWNING**  
 Dep Ch. Resources Management Division  
 Directorate of Maintenance

1 Atch  
FY89 RCC Rates

UNITED STATES AIR FORCE



SEPTEMBER 18, 1947

FY89 APPROVED RATES

RCC	DIRECT LABOR	OPER OVHD	GEN & ADMIN	TOTAL BASE RT	DIR MATRL	TOTAL RATE
MBPAA	\$18.93	\$12.69	\$8.32	\$39.94	\$10.88	\$50.82
MBFAB	\$18.78	\$13.05	\$8.32	\$40.15	\$11.18	\$51.33
MBFAC	\$18.97	\$12.88	\$8.32	\$40.17	\$11.79	\$51.96
MBPAE	\$19.51	\$12.46	\$8.32	\$40.29	\$0.00	\$40.29
MBPAH	\$18.93	\$13.03	\$8.32	\$40.28	\$14.81	\$55.09
MBPAS	\$19.11	\$13.12	\$8.32	\$40.55	\$0.00	\$40.55
MBPBC	\$18.05	\$13.50	\$8.32	\$39.87	\$3.80	\$43.67
MBPDA	\$20.75	\$14.96	\$8.30	\$44.01	\$1.79	\$45.80
MBPDB	\$21.40	\$16.90	\$8.30	\$46.60	\$1.39	\$47.99
MBPDC	\$20.82	\$10.99	\$8.00	\$39.81	\$1.33	\$41.14
MBPMA	\$0.00	\$5.07	\$5.29	\$10.36	\$5.31	\$15.67
MBFMB	\$0.00	\$8.28	\$8.32	\$16.60	\$5.92	\$22.52
MBPMC	\$0.00	\$22.97	\$9.94	\$32.91	\$0.00	\$32.91
MBPSA	\$17.43	\$10.48	\$7.86	\$35.77	\$0.00	\$35.77
MBPSB	\$16.64	\$11.16	\$8.14	\$35.94	\$0.00	\$35.94
MBPSC	\$18.47	\$10.70	\$8.14	\$37.31	\$0.00	\$37.31
MBPSD	\$19.97	\$14.60	\$7.86	\$42.43	\$0.00	\$42.43
MBPSE	\$18.18	\$18.00	\$7.93	\$44.11	\$0.00	\$44.11
MBFSK	\$17.16	\$10.64	\$7.93	\$35.73	\$0.00	\$35.73
MBPSM	\$16.99	\$10.50	\$7.93	\$35.42	\$0.00	\$35.42
MBPSP	\$20.43	\$10.96	\$7.93	\$39.32	\$0.00	\$39.32
MBPSS	\$17.99	\$11.21	\$7.93	\$37.13	\$0.00	\$37.13
MKLAA	\$19.73	\$11.17	\$8.24	\$39.14	\$2.91	\$42.05
MKLBB	\$19.26	\$27.71	\$8.24	\$55.21	\$0.00	\$55.21
MKLCC	\$20.65	\$9.65	\$8.24	\$38.54	\$3.63	\$42.17
MKLDD	\$19.38	\$47.26	\$8.23	\$74.87	\$0.00	\$74.87
MKLEE	\$19.59	\$12.42	\$8.24	\$40.25	\$6.06	\$46.31
MKLFF	\$19.90	\$15.18	\$8.24	\$42.32	\$8.25	\$50.57
MKLGG	\$20.49	\$26.70	\$8.24	\$55.43	\$0.00	\$55.43
MKPAA	\$19.20	\$20.28	\$8.23	\$47.71	\$2.11	\$49.82
MKPAC	\$19.30	\$21.03	\$8.32	\$48.65	\$8.05	\$56.70
MKPAC	\$18.85	\$28.60	\$8.30	\$55.75	\$13.51	\$69.26
MKPCD	\$20.40	\$48.25	\$8.28	\$76.93	\$10.51	\$87.44
MKPCF	\$18.81	\$26.05	\$8.27	\$53.13	\$18.91	\$72.04
MKPDA	\$2.16	\$7.10	\$8.22	\$17.48	\$3.00	\$20.48
MKPDB	\$19.44	\$5.50	\$8.15	\$33.09	\$0.00	\$33.09
MKPEA	\$19.00	\$12.84	\$8.24	\$40.08	\$10.81	\$50.89
MKPEB	\$18.60	\$12.40	\$8.24	\$39.24	\$3.86	\$43.10
MKPEB	\$20.91	\$6.98	\$8.08	\$35.97	\$0.09	\$36.06
MKPFA	\$19.63	\$26.12	\$8.31	\$54.06	\$9.08	\$63.14
MKPFB	\$18.84	\$13.76	\$8.31	\$40.91	\$26.82	\$67.73
MKPIC	\$19.79	\$10.91	\$8.23	\$38.93	\$6.87	\$45.80
MKPKA	\$19.40	\$43.39	\$8.31	\$71.10	\$17.36	\$88.46
MKPKB	\$19.79	\$10.91	\$8.23	\$38.93	\$6.87	\$45.80
MKPKC	\$21.01	\$38.43	\$8.29	\$67.73	\$19.18	\$86.91





MSAAA	:\$22.41	\$11.12	\$8.20	\$41.73	\$0.52	\$42.25
MSABB	:\$23.89	\$10.60	\$8.20	\$42.69	\$1.38	\$44.07
MSACC	:\$23.06	\$9.96	\$8.20	\$41.22	\$0.00	\$41.22
MSADD	:\$22.44	\$10.79	\$8.20	\$41.43	\$1.60	\$43.03
MSFAA	:\$21.36	\$12.29	\$8.44	\$42.09	\$0.00	\$42.09
MSFBB	:\$17.95	\$11.34	\$8.44	\$37.73	\$0.00	\$37.73
MSFCC	:\$23.03	\$11.06	\$8.19	\$42.28	\$0.00	\$42.28
MSFDD	:\$23.03	\$11.06	\$8.19	\$42.28	\$0.00	\$42.28
MSFEE	:\$21.36	\$12.29	\$8.44	\$42.09	\$0.00	\$42.09
MSMAA	:\$21.69	\$12.29	\$8.20	\$42.18	\$1.29	\$43.47
MSMBB	:\$22.44	\$10.79	\$8.20	\$41.43	\$1.60	\$43.03
MSMCC	:\$23.03	\$11.06	\$8.19	\$42.28	\$0.00	\$42.28

## RCC/MANPRC REPAIR PROCESS ASSESSMENT

The function of the RCC is to provide support relative to the application of corrosion-resistant coatings, engineering-type metallic coatings for wear-resistance and finally, coatings to metal surfaces to provide improved adhesion of organic coatings to various aircraft landing-gear parts for both repair and re-manufacture purposes. The major operations performed in the RCC are: 1) anodizing and chromate conversion coating of aluminum and phosphating of ferrous metals to provide both adhesion of organic coatings and corrosion resistance; 2) application of hard chromium electrodeposits to high-strength steel bearing and journal surfaces for wear-resistance; 3) application of electrodeposits of cadmium, nickel and silver to various metallic substrates for both corrosion-resistance and engineering requirements and finally; 4) ion-vapor deposition (IVD) of aluminum for improved corrosion resistance as a substitute for toxic cadmium deposits and meeting all stringent environmental concerns. In addition, an up-to-date brush-plating facility functions for the application of metallic coatings and the anodizing of aluminum to selected, localized areas on both disassembled parts in the RCC confines and also on assembled parts on functional aircraft while in a hangar-facility or on the flight-line tarmac.

The processes used to perform the noted operations are

- generally consistent with established private industry and with AF T.O. 42C2-1-7 and are adequately maintained by the Process Control Laboratory in conjunction with the RCC supervision. The masking of parts prior to metal finishing utilizing a hot-melt plastic (cellulose acetate butyrate) has been strongly recommended to be substituted with a hot-melt wax material with very significant economic and processing advantages as reported in Task Order No. 7 (Phase I) Contract Summary Report and Quick Fix Plan (Revision A) dated 18 May 1968.
- Two Quick Fix opportunities have been submitted per the Task Order No. 1 RCC Assessment relative to the existing use of the hot-melt plastic maskant. The RCC also utilizes two chemical solutions not found in T.O. 42C2-1-7 with one of which (Formula "P-R"), used for the alkaline (etch) cleaning of aluminum alloys only by RCC/MAAFRC instead of the authorized solution (C-205). The RCC personnel like the results of the alkaline etch cleaner to obtain a very clean aluminum surface quickly and is also simpler to chemically analyze by the Process Control Laboratory. A third Quick Fix opportunity has been submitted
- detailing the recommendation to utilize a separate Chromic Acid solution (other than the existing procedure using a chrome plating solution) to perform

The reverse-current etching of high-strength steel landing-gear parts immediately prior to chrome plating, while the existing procedure is a significant improvement over the former use of a reverse-current etch in 50% sulfuric acid, the build-up of iron and other alloying elements in the high-strength steel (Alloy 300M) could be detrimental to the corrosion-resistance of the hard chromium electrodeposits. McDonnell Aircraft Company (MACAIR) utilizes a separate Chromic Acid/Sulfuric Acid tank similar to the Chromium plating tanks for reverse-current etching of the Alloy 300M high-strength steel landing-gear parts to prevent contamination of the chromium plating tanks. MACAIR does use industry-preferred reversible-rect 2 bus bar system to deposit thick deposits of chromium efficiently and without trivalent chromium problems (often associated with the old 3-bus bar configuration) via the use of the preferred non-fluoride catalyst or mixed-catalyst type of solution formulation (T.O. 42C2-1-7/C-407).

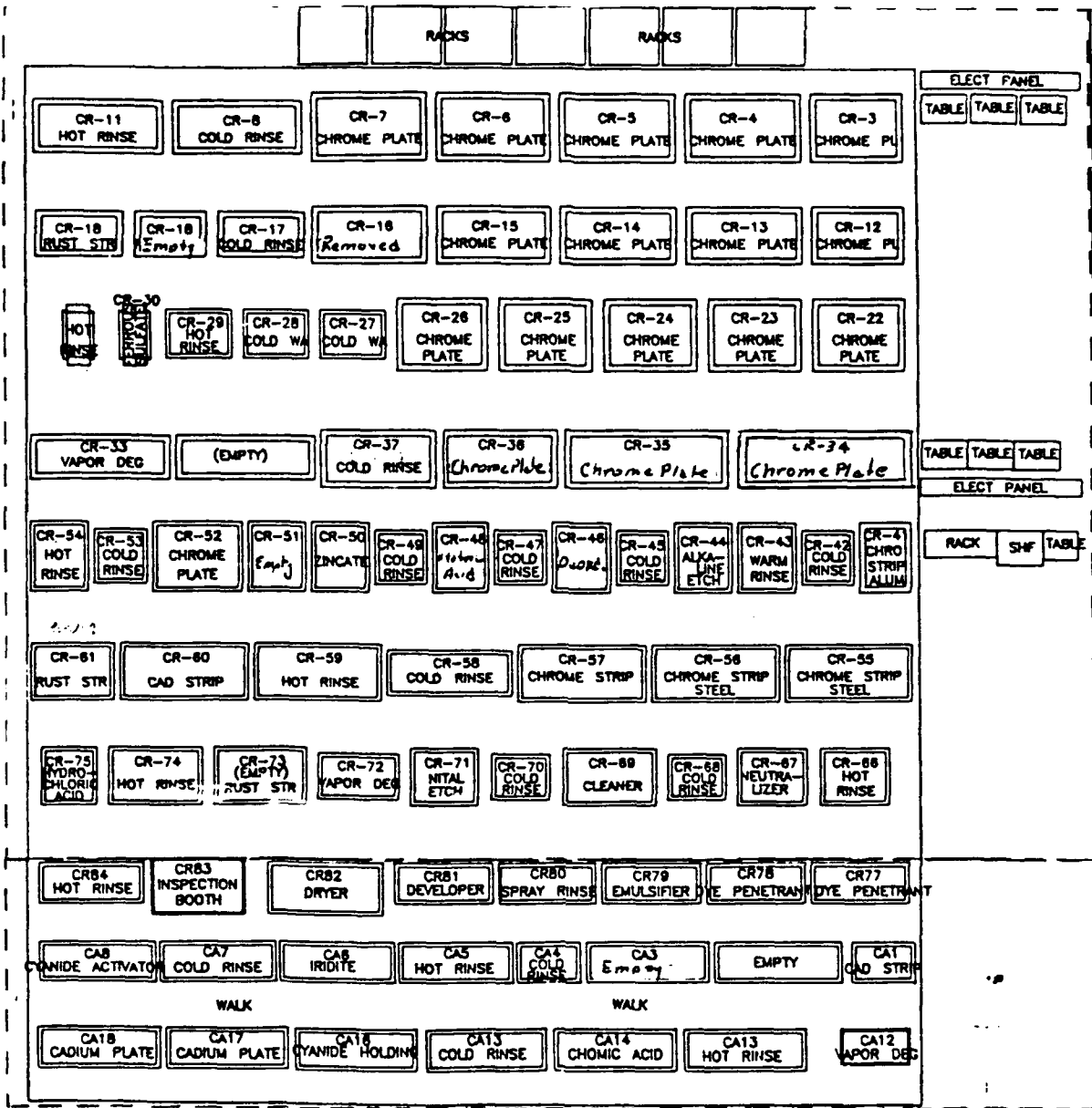
The RCC is staffed with knowledgeable and experienced supervision and mechanics. Closer technical support and involvement with day-to-day problems by both the Process Engineering and Process Control laboratory personnel would be beneficial. McDonnell Douglas Corp. (MDC) mandates very close

manufacturing process support from not only the manufacturing process and equipment engineers and industrial engineers but also close involvement and cooperation with Quality Engineering laboratory support personnel.

The elimination of vacuum-cadmium deposition system and replacement with ion-vapor deposition (IVD) of aluminum has been a very positive technological and environmentally-acceptable decision by the RCC. Also, the use of the virtually non-toxic 1,1,1-trichloroethane vapor degreasing solvent instead of the rather toxic perchloroethylene solvent in present use by three other Air Logistics Centers (ALC's); i.e. DC-ALC, SA-ALC and SRT-ALC eliminates the use of high Volatile Organic Compounds (VOC) recently curtailed to a maximum of 25 ppm by the Environmental Protection Agency (EPA).

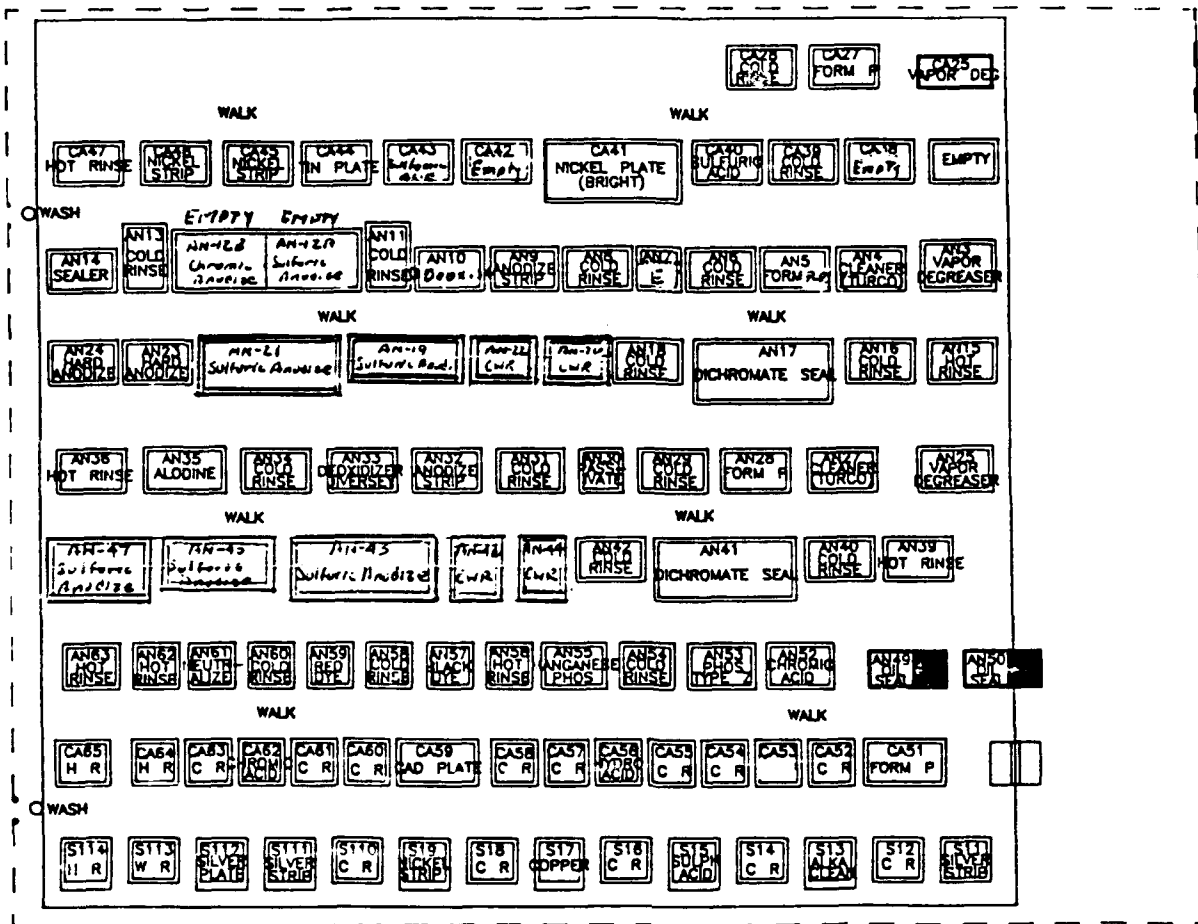
The RCC has very adequate means of over-baking for both stress-relief of certain parts in addition to hydrogen embrittlement relief (consisting of both batch-type ovens and a conveyorized oven-cure utilizing two time-cycles simultaneously). The facilities for both abrasive grit-blasting and shot-blasting to impart compressive-type stress to metal surfaces are more than adequate and are well-maintained.

R. Bristoff - 6/1/89



CONFIGURATION AND CONTENTS OF NORTH VIET-CHEMICAL  
PROCESS TANKS IN RCC/FANPRC OF DO-ALL

FIGURE I



CONFIGURATION AND CONTENTS OF SOUTH WET-CHEMICAL  
PROCESS TANKS IN RCC/TANRC OF OO-HLC

FIGURE II



ELECTROLESS NICKEL LINE IS CURRENTLY DONE IN SMALL MAKE SHIFT TANKS/BUCKETS SET INSIDE A TANK TO WARM IT.

ATTACHED IS A LAYOUT ILLUSTRATING THE VARIOUS REASONS FOR EQUIPMENT BEING DOWN, ALSO A LISTING OF THE CHEMICALS USED IN EACH OF THE PLATING TANKS.

THERE ARE FUTURE PLANS FOR AN ELECTROLESS NICKEL LINE, COPPER LINE, BLACK OXIDE, AND GLASS REFINING, THERE ARE ALSO PLANS TO MOVE THE OFFICES AND LUNCH ROOM TO ANOTHER BUILDING AND USE THE LUNCH ROOM AS STORAGE SPACE, AND THE OFFICE SPACE AS STORAGE SPACE WITH MORE CHROME PLATING TANKS THE AREA WHERE THE VAC CAD IS WILL BE USED FOR FIXTURE OR PART STORAGE. ALL OF THE ABOVE PLANS ARE STILL JUST PLANS AND MIGHT BE CHANGED.

14 CARRIERS

ONE 4 HD  
CIL

ONE 24 HD  
CIL  
24 CARRIERS

REMOVED FOR REPAIRS  
W/ DRILL LINING REPLACEMENT  
(CONTAMINATION)

WATER LEAKS  
INTO SOLUTION

HEATING ELEMENT  
NOT OPERATIONAL

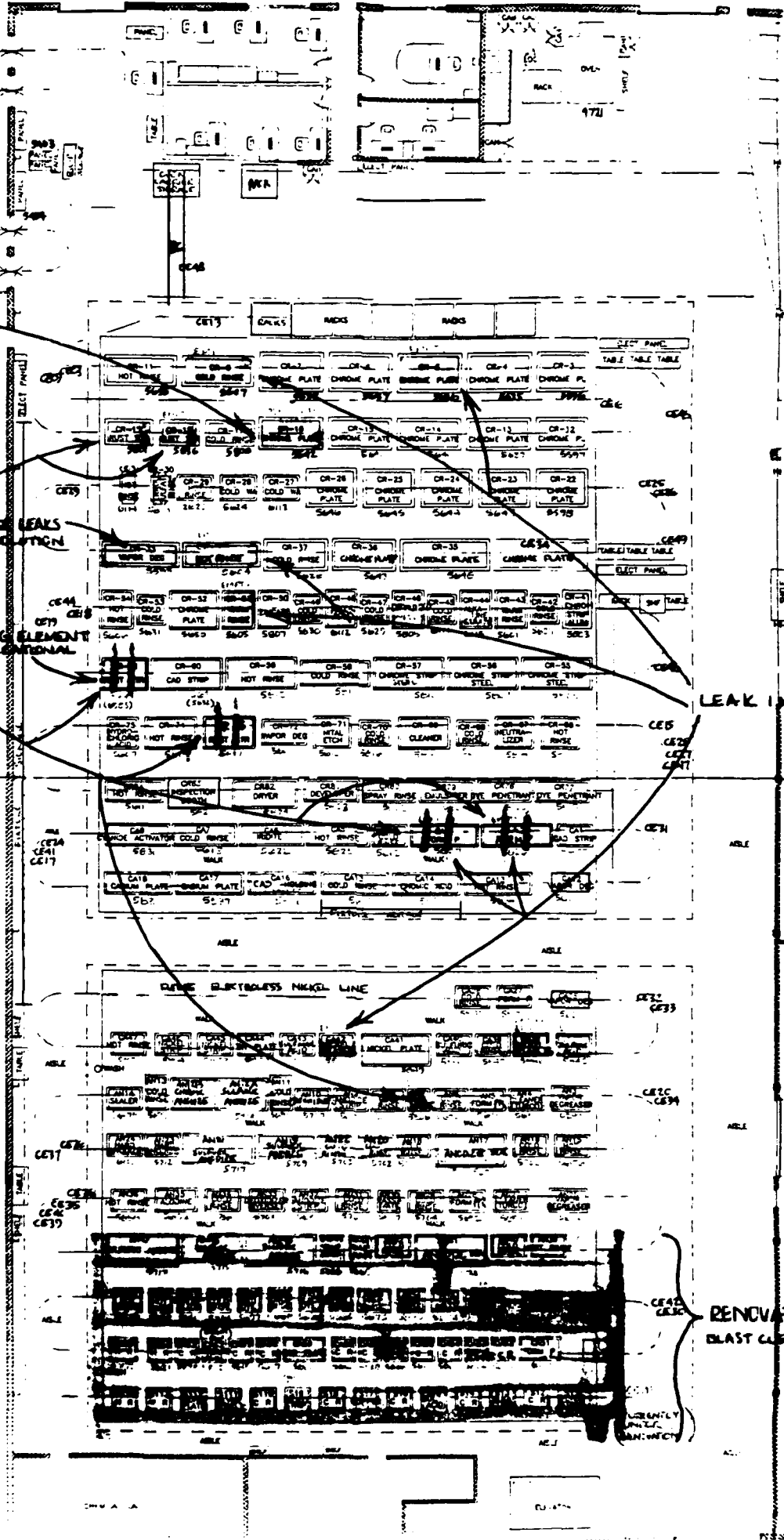
LACK OF CHEMICAL  
ADDITIVES

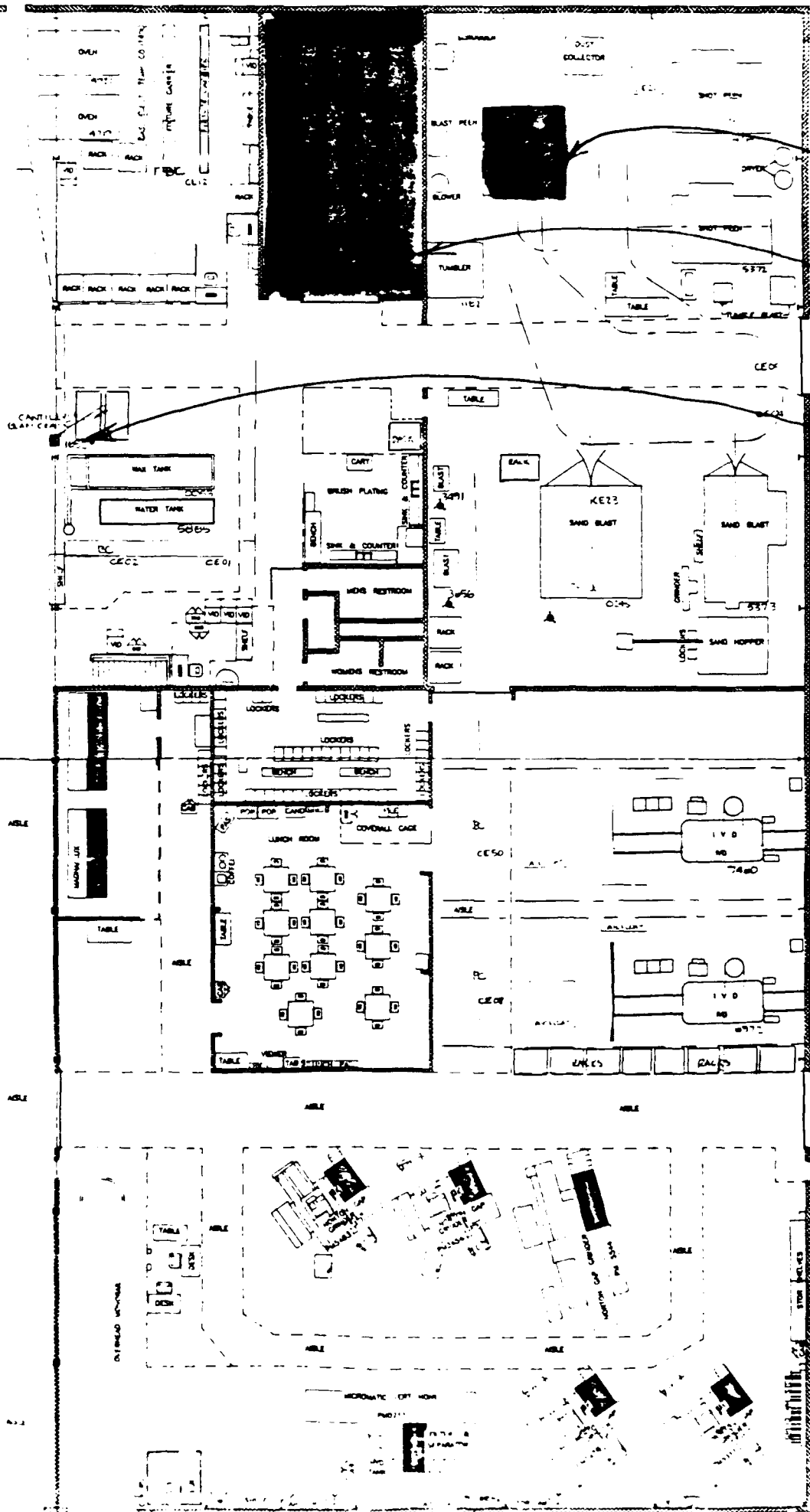
LEAK IN TANK

CRANE TRACK

RENOVATION  
BLAST CLEAN TANKS

NON OPERATIONAL  
EQUIPMENT  
LAYOUT





BEING REMOVED  
NOT OPERATIONAL

BEING REMOVED  
IVD REPLACES PZDLESS

NOT FUNCTIONAL  
FOR APPLICATION  
(CRANE HEIGHT)

The testing frequencies below are for normal usage. Any solution consistently out of tolerance will be analyzed more frequently than listed to insure operation in tolerance. Concentrations listed are as per required specifications, standards, manufacturers' recommendations, or laboratory direction. Test frequency is defined as any time within the calendar period listed and approximately the specified period apart: e.g., once/week will be within the calendar week, not necessarily exactly seven days apart.

**PLATING SHOP**

Operation (Tank No)	Chemicals	Operating		Optimum Concentration (oz/gal)	Testing Frequency
		Limit (oz/gal)			
1. Alkaline Cleaner (CR-44)	Trisodium Phosphate Sodium Carbonate	3.0 - 5.0 1.0 - 3.0		4.0 2.0	Once/month
2. Alkaline Cleaner (SI-3)	Sodium Hydroxide Trisodium Phosphate (12 H <sub>2</sub> O)	8 - 12 11 - 16		10 13.8	Once/month Once/month
3. Anodize Sealer (AN-17, 41)	Sodium Dichromate (2 H <sub>2</sub> O) pH	5 - 9 5.0 - 6.5		7 No optimum	Once/2 weeks Once/2 weeks
4. Anodize Strip (AN-9, 32)	Chromic Acid Phosphoric Acid Sulfate	2 - 4 4 - 8 0.11 max		3.0 5	Once/2 weeks Once/2 weeks Once/2 weeks
5. Black Dye	pH	5.8 - 6.0		5.9	As requested
6. Bright Dip (CA-14, 62)	Chromic Acid	pH 2-4		3.0	Once/month
7. Cadmium Plate (CA-17, 18, 59)	Cadmium Total Sodium Cyanide Sodium Hydroxide Sodium Carbonate Iron Ratio NaCN/Cd	2.8 - 3.2 12 - 18 1.5 - 4 0 - 5 600 ppm max 4 - 6		3 16 1.8	Once/2 weeks Once/2 weeks Once/month Once/year Once/3 months

~ CAD STRIP  
(CA1, CR60)

AMMONIUM NITRATE

Operation (Tank No)	Chemicals	Operating Limit (oz/gal)	Optimum Concentration (oz/gal)	Testing Frequency
8. Cad Holding (CA-16)	Sodium Cyanide Sodium Hydroxide	8 - 18 2 - 12	14 8	Once/month Once/month
9. Cyanide Activator (CA-8, CA-53)	Sodium Cyanide Sodium Hydroxide	5 - 8 2 - 4	6.6 3	Once/month Once/month
10. Chemical Conversion coat for aluminum (AN-35)	Chromic Acid Potassium Ferro- cyanide, Barium Silico-fluoride pH	0.5 - 2.5 No Control; Add in proportion to CrO <sub>3</sub> 1.4 - 1.7	1.2 0.36 0.32 1.6	Once/2 weeks Once/2 weeks Once/2 weeks Once/2 weeks
11. Chromic Acid (AN-52)	pH	2 - 4		Once/month
12. Chromium Plate (CR-3, 4, 5, 6, 7, 12, 13, 14, 15, 16, 22, 23 24, 25, 26, 34, 35, 36, 52)	Chromic Acid Sulfuric Acid Chromic Acid/ Sulfuric Acid Ratio Iron Trivalent Chromium	30 - 36 0.30 - 0.36 80 - 120  0 - 5 gm/l 0 - 4 gm/l	33 0.33 100	Once/2 weeks Once/2 weeks Once/2 weeks  Once/year Once/year
13. Chromium Strip Acid (Aluminum) CR-41	Sulfuric Acid Sodium Chloride	150 - 200 gm/l 0.22 g/l max	175 gm/l	Once/month Once/3 months
14. Chromium Strip Caustic (Steel) (CR-55, 56, 57)	Sodium Hydroxide	9 - 11	10	Once/2 weeks
15. Chromic Acid Anodize (AN-12B)	Chromic Acid pH Sodium Chloride Sulfate Cr <sup>+3</sup>	4 - 14 Less than 0.85 0.22 g/l max 0.53 g/l (0.07 oz/gal) max 4 g/l max	10	Once/month Once/month Once/3 months Once/month once/year

Operation (Tank No.)	Chemicals	Operating Limit (oz/gal)	Optimum Concentration (oz/gal)	Testing Frequency
16. Copper Strike (SI-7)	Copper Rochelle Salt Free Sodium Cyanide Sodium Carbonate	3.5 - 4.3 4 - 8 0.2 - 0.5 4 - 8	4.0 6 0.4	Once/month Once/month Once/month Once/year
17. Deoxidizer (AN-10, 33) CR-40	TABCO 9004 ALKALUMÉ Devossey	4 - 12	8	Once/2 weeks
18. Ferrous Sulfate Rinse (CR-30)	pH	2 - 3.5		After solution change (change once/month)
19. Formula P (CA-2, 3, 27, 51)	Sodium Hydroxide Trisodium Phosphate (dodecahydrate) Sodium Carbonate	0.5 - 3.0 4.0 - 12.0 1 - 6	1.5 8.0 3.5	Once/2 weeks Once/2 weeks Once/2 weeks
20. Formula P-R (AN-5, 28)	Rust Stripper Aluminum	2.0 - 4.0 2.5 max	3.0	Once/2 weeks
21. 15% Hydrochloric Acid (CA-56)	Hydrochloric Acid	10 - 20%	15%	Once/month
22. Iridite (CA-6)	<del>50% HYDROCHLORIC ACID</del> Rohdip 218	2 - 3%	2.3%	Monthly
23. Nickel Plate (bright) (CA-38, 42)	Nickel Boric Acid pH Chloride	9 - 12 4 - 8 3.8 - 4.4 1.5 - 3.0	10.9 5.5 4.0 2.4	Once/month Once/month Once/month Once/month
24. Nickel Plate (sulfamate) (CA-41, 44)	Nickel Boric Acid pH Surface tension	8.0 - 12.0 Check bag 3.6 - 4.8 Less than 35 dynes/cm	10.2 6.0 4.5	Once/2 weeks Once/2 weeks Once/2 weeks Once/2 weeks
— NEUTRALIZE Z (AN-6)	Sulfate Hardness <del>100-120</del>	Less than 0.2 Greater than Rc 36		Once/2 weeks Once/year

Operation (Tank No)	Chemicals	Operating Limit (oz/gal)	Optimum Concentration (oz/gal)	Testing Frequency
25. Woods Nickel (SI-9)	Nickel Hydrochloric Acid	7 - 9 11 - 19	8 14	Once/month Once/month
- NICKEL SULFAMATE ACID PULSE BATCH (CA-37)	SULFAMIC ACID	25 gal		
- NICKEL STRIP (CA-45)				
- HOLDING PUMP TAKE FOR NICKEL STRIP (CA-46)				
- NICKEL ACETATE STRIP (AN-14)	NICKEL ACETATE			
29. Nitric Acid (50% V/V) (CR-48)	Nitric Acid	55 - 82	62	Once/month
30. Passivate (AN-30, Q7)	Sodium Dichromate (2H <sub>2</sub> O) Nitric Acid	2.7 - 4.1 27 - 34	3.4 30.5	Once/2 weeks Once/2 weeks
31. Phosphatize Manganese (AN-53)	Total Acid (TA) TA/FA Ratio Iron	16 - 21 5.5 - 7.0 0.27 - 0.4	19.5 6.0 0.3	As required As required As required
32. Red Dye (AN-59)	pH	5 - 7	6	As required
33. Rust Stripper (CR-19, 61, CR-15, 13)	Rust Stripper	25 - 32	28	Once/month
34. Silver Plate (SI-12)	Potassium Hydroxide Silver Cyanide Free Potassium Cyanide Potassium Carbonate	0 - 4 10 - 15 7 - 12 2 - 15	1 13 10 2	Once/month Once/month Once/month Once/year

<u>Operation (Tank No)</u>	<u>Chemicals</u>	<u>Operating Limit (oz/gal)</u>	<u>Optimum Concentration (oz/gal)</u>	<u>Testing Frequency</u>
35. Silver Strike (SI-11)	Free Potassium Cyanide Silver Cyanide Potassium Carbonate	7 - 9 0.2 - 0.5 6 - 8	8 0.3 6	Once/month Once/month Once/year
36. Silver Strip (SI-1)	Sodium Cyanide Sodium Hydroxide	11 - 13 1 - 3	12 2.0	Once/month Once/month
37. Sulfuric Acid (CA-40, SI-5)	Sulfuric Acid	5 - 10%	8%	Once/month
38. Sulfuric Anodize Hard (AN-23, 24)	Sulfuric Acid Aluminum Oxalic Acid Sodium Chloride	225 - 270 gm/l 20 g/l max 1.4 - 1.6 0.22 g/l max	250 gm/l 1.5	Once/2 weeks Once/2 weeks Once/2 weeks Once/3 months
39. Sulfuric Anodize Soft (AN-19, 21, 43, 45, 47) AN-2A	Sulfuric Acid Aluminum Sodium Chloride	170 - 220 gm/l 20 g/l max 0.22 g/l max	195 gm/l	Once/ 2 weeks Once/month Once/3 months
40. Sulfamic Acid (CA-43)	Sulfamic Acid	80 - 120 gm/l	100 gm/l	Once/month
41. Tin (CA-44)	Sodium Hydroxide Sodium Stannate	1 - 2 8 - 14	1.5 12	Once/month Once/month
42. Turco 4215S (AN-4, 27)	Turco 4215S	4 - 8	6	Once/month
43. Zincate (CR-50)	Sodium Hydroxide Zinc Oxide Ferric Chloride (6H <sub>2</sub> O) Rochelle Salts	60 - 70 10 - 13 No control Add in proportion to ZnO	65 12 0.12 1.2	Once/month Once/month

- OIL SEAL (AN49)
- OIL SEAL (RESERVATIVE)  
(AN50)
- VA FOR RESERVATIVE  
(CR-33, CR-72, CA-12,  
CR-25, AN-3, AN-25)



GRIT BLAST

ALUMINUM TITANIUM OXIDE  
GARNET

180 GRIT

**PERCENT OF OTHER WORKLOAD FOR RCC**  
 (80/20 LISTING)  
 RCCs

JOB TYPES	MANPGP	MANPGW	MANPNA	MANPRA	MANPRB	MANPRC	MANPWW
TEMPORARY	13.72	2.35	15.11	1.40	1.05	1.35	1.05
MANUFACTURE	0.00	0.00	0.92	0.00	4.51	2.74	12.50
PDM	1.00	0.00	22.79	0.04	0.07	4.39	22.44
ARMAMENT	0.00	0.23	1.26	0.04	0.03	4.18	2.38
HYDRAULICS	0.00	0.05	7.00	1.11	2.67	3.88	13.99
<i>MISER</i>	85.28	11.37	52.92	97.41	91.67	83.46	97.64

## WORKLOAD

THE LOAD WITHIN MANIPRC CONSISTS OF APPROX. 90% MISTR, 5% PDM, 5% TEMPORARY. ALL OF THE WORK HAS BEEN PREVIOUSLY DISASSEMBLED AND IS READY TO BE CLEANED AND PROCESSED ACCORDINGLY.

FLUCTUATIONS USUALLY OCCUR NEAR THE BEGINNING OF THE QUARTER WITH THIRTY PERCENT OF THE TOTAL WORKLOAD FOR THE QUARTER. FIFTY PERCENT NEAR THE END OF THE QUARTER AND TWENTY PERCENT IN THE MIDDLE OF THE QUARTER. THIS IS DUE TO OTHER AREAS CLEANING UP THEIR INVENTORY LEVEL AND SCHEDULING PUSHING ITEMS THRU.

\*RS, SB, KF

THE HIGHEST VOLUME ATTAINED IN THIS RCC PER QUARTER IS 170,000<sup>EST.</sup> PARTS. THIS NUMBER INCLUDES NUTS/BOLTS. AN ESTIMATE OF <sup>LARGE</sup> PARTS (NOT INCLUDING NUTS/BOLTS) IS 60,000 TO 70,000 PARTS PER QUARTER.

\* RS

# MANPOWER PROFILE

<u>CODE</u>	<u>DESCRIPTION</u>	<u>COMMENTS</u>
UP05	FORKLIFT DRIVER (MATERIAL HANDLER)	ALTERNATES : UP06, UP08, UP09 (CAN USE PALET JACKS, FORKLIFTS)
UP06	JR JOURNEYMAN (BAKE OPERATORS ONLY)	ALTERNATES : UP09
UP08	BLASTER JOURNEYMAN	NO ALTERNATES BLASTING EQUIPMENT OPERATORS INCLUDES ALL BLASTER JOURNEYMAN AND JR. JOURNEYMAN
UP09	PLATER JOURNEYMAN	ALTERNATES UP06 PLATING EQUIPMENT OPERATORS INCLUDES ALL PLATING JOURNEYMAN AND JR JOURNEYMAN EXCEPT BAKE OPERATORS

## ASSUMPTIONS :

- PUMP TECHNICIANS, TRAINIES, AND FOREMAN ARE NOT INCLUDED BECAUSE THEY DO NOT WORK DIRECTLY ON THE PART, UNLESS ACCOMPANIED BY OTHERS.
- ALL UP06, UP08, UP09 ARE QUALIFIED TO OPERATE FORKLIFTS OR A QUALIFIED OPERATOR TEMPORARILY SWITCHES JOBS WITH THE UNQUALIFIED OPERATOR
- ALL UP06 ARE JR JOURNEYMAN ON ALL PLATING OPERATIONS TO BE AN ALTERNATE PLATER
- ALL UP09 ARE QUALIFIED FOR EVERY PLATING PROCESS

# WORKFORCE

THE PBN RCC HAS 64 DIRECT LABORERS AND NO INDIRECT AS OF 7 MAY 1989. THE BREAKDOWN IS AS FOLLOWS

# EMPLOYEES	SKILL LEVEL/CODE	WORKSTATIONS QUALIFIED FOR	EXPERIENCE AVG. YRS.
1	WG05/6910	FORKLIFT	3
6	WG05/3711	TRAINING ("GOFER")	1
2	WG07/4709	PUMP (TECHNICIAN)	5
8	WG07/3711	ASSOCIATE JOURNEYMAN	4
7	WG08/3709	JOURNEYMAN BLAST	9
34	WG09/3711	JOURNEYMAN ALL OUT BLAST	11
6	WS09/3711	FOREMAN, TRAINER	16
<u>64</u>			

ALL ASSOCIATE JOURNEYMAN REQUIRE JOURNEYMAN SUPERVISION. BUT CAN WORK THEIR WORK STATION ALONE WITH JOURNEYMAN APPROVING THEIR WORK. TWO ASSOCIATE JOURNEYMAN ARE ~~NOT~~ BEING TRAINED ONLY ON BLAST AREA. THE OTHER FIVE ARE BEING TRAINED ON EVERYTHING BUT BLAST AREA.

CURRENTLY THERE ARE THREE FORKLIFT DRIVERS, TWO ON DAY SHIFT AND ONE ON EVENING SHIFT. THERE ARE        EMPLOYEES THAT ARE ALSO CROSS TRAINED TO RUN FORKLIFTS WHEN NECESSARY.

TRAINER'S "GOFER" DO VARIOUS ODD JOBS I.E., REMOVING MASKING, MOVING PARTS, RINSING AND DEBRASSING, SETUP OF FIXTURES, ETC..

OVERALL ~~THE~~ <sup>EACH OF THE</sup> INDIVIDUAL WORKERS HAVE AN ADEQUATE OUTLOOK/ATTITUDE OF THEIR JOBS. SOME HATE WHAT THEY DO AND COMPLAIN ABOUT WORK CONDITIONS BUT VERY FEW OF THEM. THE WORK ENVIRONMENT IS THEIR BIGGEST COMPLAINT I.E., THE HEAT, AND SMELL. THERE IS A FEAR ~~FOR~~ SAFETY WITH ALL THE CHEMICALS THAT ARE USED IN THE BUILDING. BECAUSE OF THIS FEAR AND WORKERS COMPLAINING IN PUBLIC, THE PLATING SHOP WORKERS JOB IS NOT A "MUCH SOUGHT AFTER POSITION" WITH OTHER RCC EMPLOYEES IN THIS ALL.



MANPRC PLATING SHOP  
7 MAY - 3 JUN 89

-IGNACIO Z. OLVERA, MACH GEN FRMN

- DAN CISOWSKI, ELTRPLTR TRG

\*\*\*\*\*

ANODIZE-CAD PLATE

PUMPERS

CHROME/IRRIDITE/  
BRUSH PLATE (16) DAYS

(18)

DAYS

\*\*\*\*\*

--- FIELDS, RONDAL (S) -WS-09  
BEENS, JACQUELINE WG5P7  
COPENHAVER, D. (A) WG-09  
DRAKE, DELL WG-09  
EVERETT, MICHAEL WG5P7  
FRITZ, ROBERT WG-07  
GALLEGOS, DAN WG-09  
MARONEY, LONNIE WG-09  
MARBLE, JOSEPHINE WG-09  
NEWTON, RICHARD WG-09  
PIERCE, THOMAS -WG-07  
RIVERA, GREG WG-09  
SMUIN, STEPHEN WG-09  
VALDEZ, JOSEPH -WG-07  
VILLARUEL, CATHY WG5P7  
WIGGINS, STEVEN WG-09

(S) -WS-09  
GREENWOOD, BRENT WG-07  
HAYBALL, JAN -WG-07-

	D	S	G	TL
05 TRAN	6	-	-	6
05 PCKL	-	1	-	1
07 JJ	5	1	2	8
07 PMP	2	-	-	2
08 BLST	3	2	2	7
09 PLT	15	9	10	34
09 SUPR	4	1	1	6
TL	35	14	15	64

BILLMIRE, SHARON (S)WS-09  
BAKER, DEAN -WG-07-  
DODSON, JOANN -WG5P7-  
EGGLESTON, DALLAS WG-09  
MANSEN, GERALD WG-09  
HOLMES, GORDON WG-09  
JACOBSEN, LESLIE WG-07-  
LARSON, DAVID WG-09  
ROYLANCE, GREG (A) WG-09  
SMITH, HARRY WG-09

SHOT PEEN DAYS  
\*\*\*\*\*

ACKER, LESLIE -WG5P8-  
MARTIN, DAVID WG-08-  
SANCHEZ, MANUEL -WG5P8-  
SEIFERT, JACK WG-08-  
VELASQUEZ, LEE WG-08-

CHROME/VAC/CAD/  
BAKE (16) SWING  
\*\*\*\*\*

SIMMONS, ROGER (S)-WS-09  
BURKDOLL, JAMES WG-09  
FRANCIS, WADE S. -WG-07-  
HALL, MIKE WG-09  
HYER, STEVEN -WG-07-  
LICHT, SUSAN WG-09  
NAKI, JAMES WG-09  
MCATEE, JAMES (A) WG-09  
PERKINS, RANDY WG-09  
SHAW, LAWRENCE WG-09  
SMITH, BRENT WG-09  
SMITH, BRUCE WG-09  
STEWART, JEFFREY WG-09

CHROME/ANODIZE  
CAD/BAKE (13) GRAVE  
\*\*\*\*\*

KOFORD, GARY (S) -WS-09  
BRADLEY, RICHARD WG-09  
CHAVEZ, JESUS WG-09  
FIELD, ROBERT WG-09  
NELSON, DALE WG-09  
NICKERSON, AMY WG-09  
PLAYER, MARLIN (A) WG-09  
SMITH, WILFORD WG-09  
SWANER, STEVEN WG-07-  
THORNLEY, MARK WG-09  
WAYMAN, WILLIAM WG-09

MILLET, W (US) (LO) WG-08 -

(S) - SUPERVISOR  
(A) - ALTERNATE  
(LI) - LOANED IN  
(LO) - LOANED OUT  
(US) - UNION STEWARD  
# - ON CALL

SHOTPEEN SWING  
\*\*\*\*\*  
KELLER, EDWARD WG-08-  
HOBBS, MARK WG-08-

SHOTPEEN GRAVE  
\*\*\*\*\*  
FACER, ROBERT WG-08-  
NICHOLLS, RODNEY WG-08-

PRC ASSIGNED:  
3711-WS-09 - 4  
3711-WG-09 - 34  
3769-WG-08 - 10 (ILO)  
3711-WG-07 - 11  
4749-WG-07 - 3  
6910-WG-05 - 1

PSU SWING  
\*\*\*\*\*  
BODILY, LOY -WG-05-

LARSON, DAVID (LO) WG-09 -

TOTALS: 63 (ILO)

YELLOW = DAYS  
GREEN = SWING  
BLUE = MIDNIGHT

# MATERIAL HANDLING

THE MAJORITY OF THE MATERIAL IS MOVED BY FORTY FIVE OVERHEAD CRANES (SIX ON THE FIVE INDIVIDUAL BRIDGE CRANES), OPERATED FROM A NETWORK OF TRACKS ILLUSTRATED ON DRAWING, BY A FORKLIFT. MOVING PALLETS OF WORK, MANUALLY, FORTY CARRIERS ON <sup>THE</sup> FOUR HOUR CONTINUOUS CONVEYOR OWN, AND TWENTY-FOUR CARRIERS ON TWENTY-FOUR HOUR CONTINUOUS CONVEYOR OWN, AND A CANTILEVER BEAM CRANE.

THE EQUIPMENT THAT IS SELDOM EVER USED IS: THE CANTILEVER BEAM CRANE, THE OVERHEAD CRANE "CE 13", THE BRIDGE CRANES OVER THE IVD EQUIPMENT, AND NEXT TO THE OFFICES. THIS IS BECAUSE THERE ARE BETTER WAYS TO MOVE PARTS I.E., FORKLIFT.

SEVENTY FIVE PERCENT OF THE <sup>MATERIAL</sup> FLOW IN & OUT OF THE BLDG IS THROUGH THE NORTH CENTRAL DOOR DOCKING AREA AND PERFORMED BY ANOTHER DEPARTMENT'S FORKLIFT AND TRAILER OPERATORS. THE TRAILER IS LEFT OUTSIDE THE DOOR AND LOADED/UNLOADED BY MANPRC FORKLIFT OPERATORS AND MOVED TO A TEMPORARY STAGING AREA INSIDE BUILDING. THAN MOVED TO THE NEXT WORK STATION DEPENDING ON WORK PRIORITY AND QUEING EMPTY SPACE. THE OTHER TWENTY FIVE PERCENT COMES FROM THE OVERHEAD MONORAIL SYSTEM (USUALLY THE LARGER PARTS) AND MOVED TO A TEMPORARY STAGING AREA OR TO THE NEXT WORK STATION DEPENDING ON THE WORK PRIORITY AND QUEING EMPTY SPACE. OCCASIONALLY THE OUTSIDE DOOR TO THE BLAST AREA IS USED TO MOVE MATERIAL IN/OUT OF BUILDING.

THE EQUIPMENT IS GENERALLY IN GOOD CONDITION EXCEPT FOR THE FORKLIFTS. THEY USUALLY END UP BORROWING FROM OTHER DEPARTMENTS.

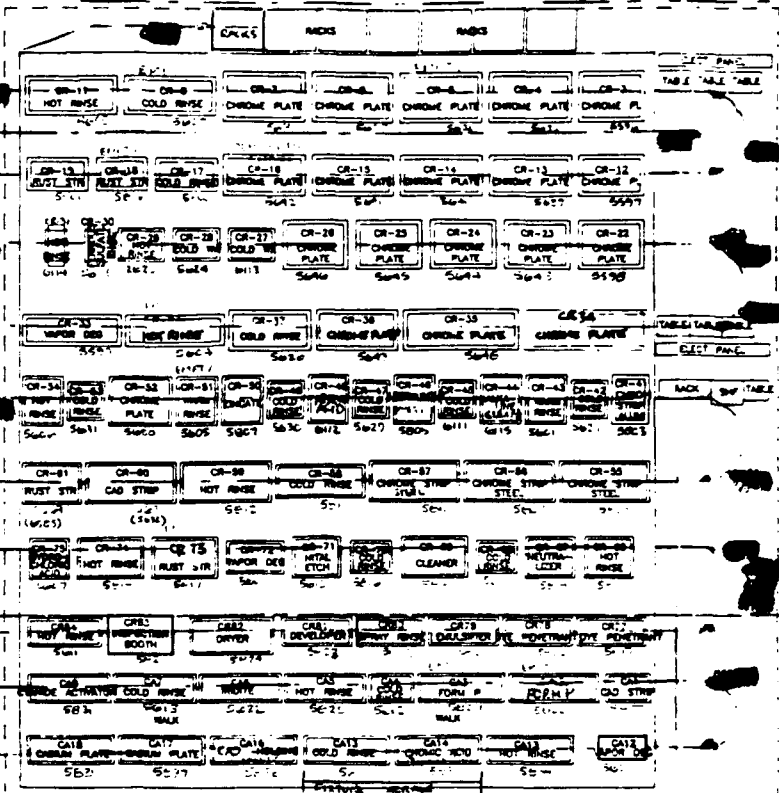
IT WAS SUGGESTED IN A MEETING WITH SEVERAL <sup>(FORMER & LEAD JOURNEYMEN)</sup> MANUFACTURING PERSONNEL TO BUILD SOME WAY TO MOVE THE PARTS WITHOUT DISCONNECTING THEM FROM MONORAIL LOOP TO MONORAIL LOOP. ANAN SHAH IS MAKING PLANS TO CONNECT THE LOOPS AND ADD AN EXTRA RAIL EVERYWHERE POSSIBLE FOR STORAGE. THIS SYSTEM WILL BE CONNECTED WITH ROPE CONTROL DERAILERS.

14 CARRIERS

ONE 4 HD  
CPL

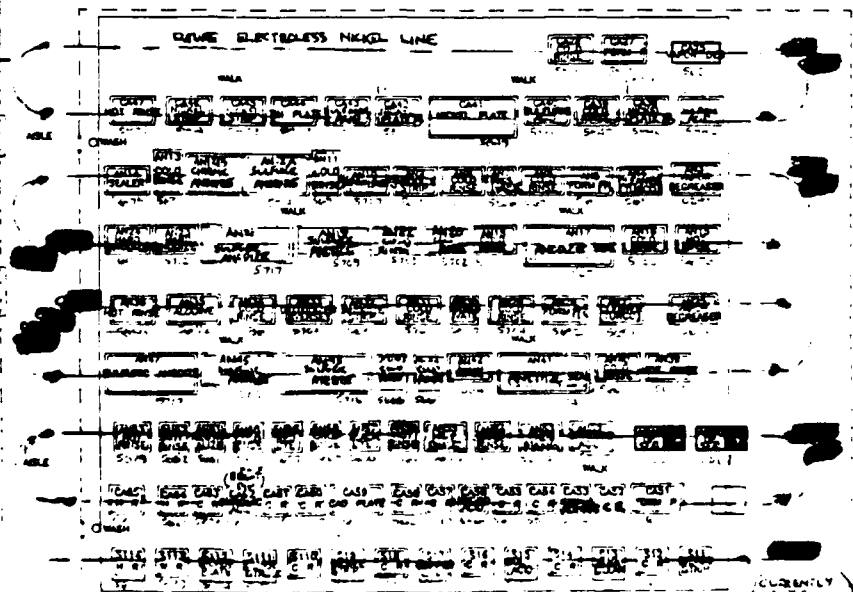
ONE 24 HD  
36 TL  
24 CARRIERS

LOADING AREA



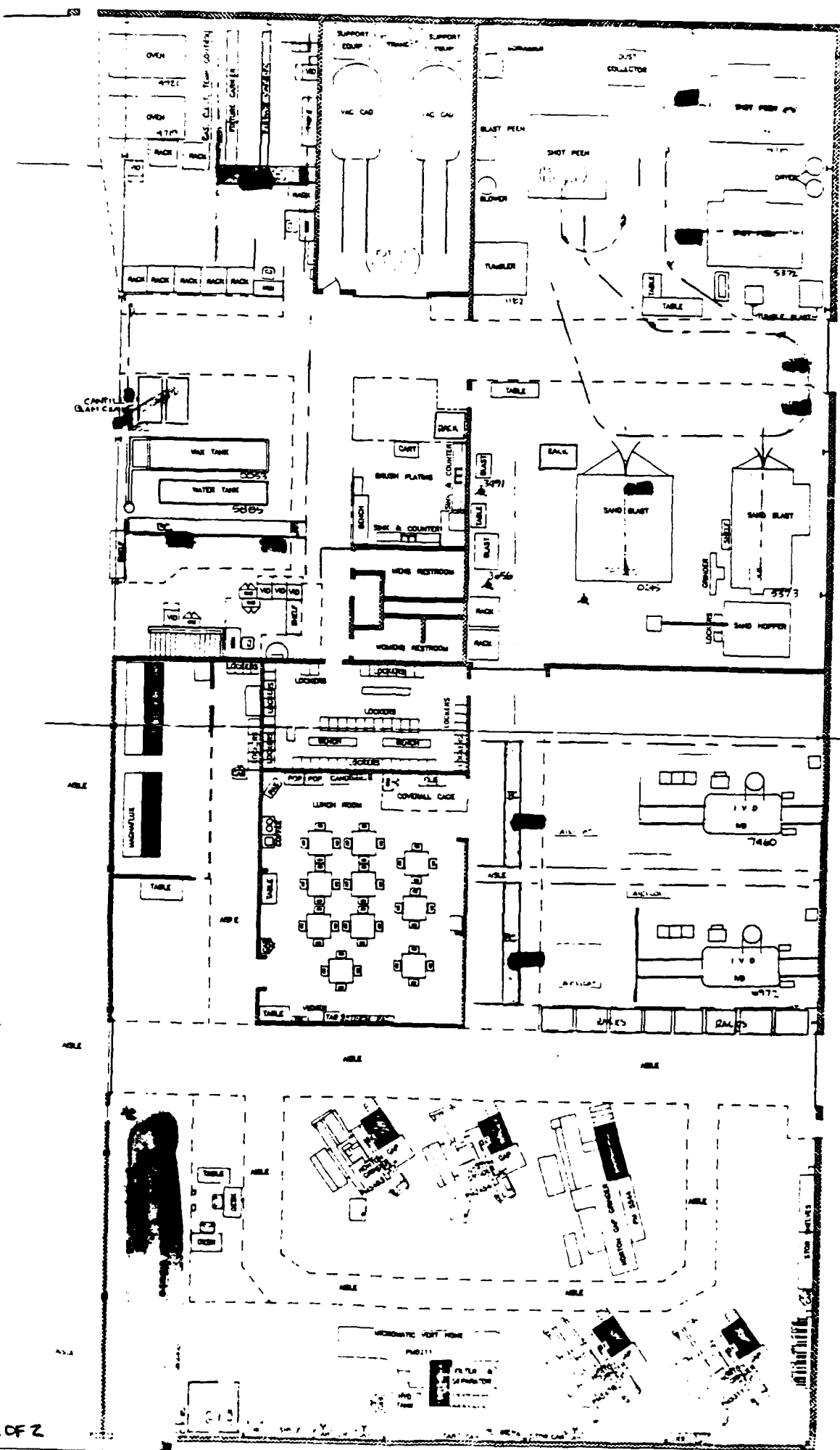
CRANE TRACK  
BLADE CRANE  
OVERHEAD CRANE

DRIVE ELECTROLESS NICKEL LINE



MATERIAL HANDLING LAYOUT





## STORAGE

THERE ARE SEVERAL TYPES OF <sup>WORK</sup> STORAGE REQUIREMENTS  
(1) STORAGE AREA OF PARTS WAITING FOR REWORK DISPOSITION;  
(2) QUEING AREA FOR WORK BEING WORKED ON, SETUP TO BE WORKED ON, OR NEXT IN LINE TO BE WORKED ON (WIP); (3) STAGING AREA FOR ANY WORK NOT COVERED BY PREVIOUS CATEGORIES.

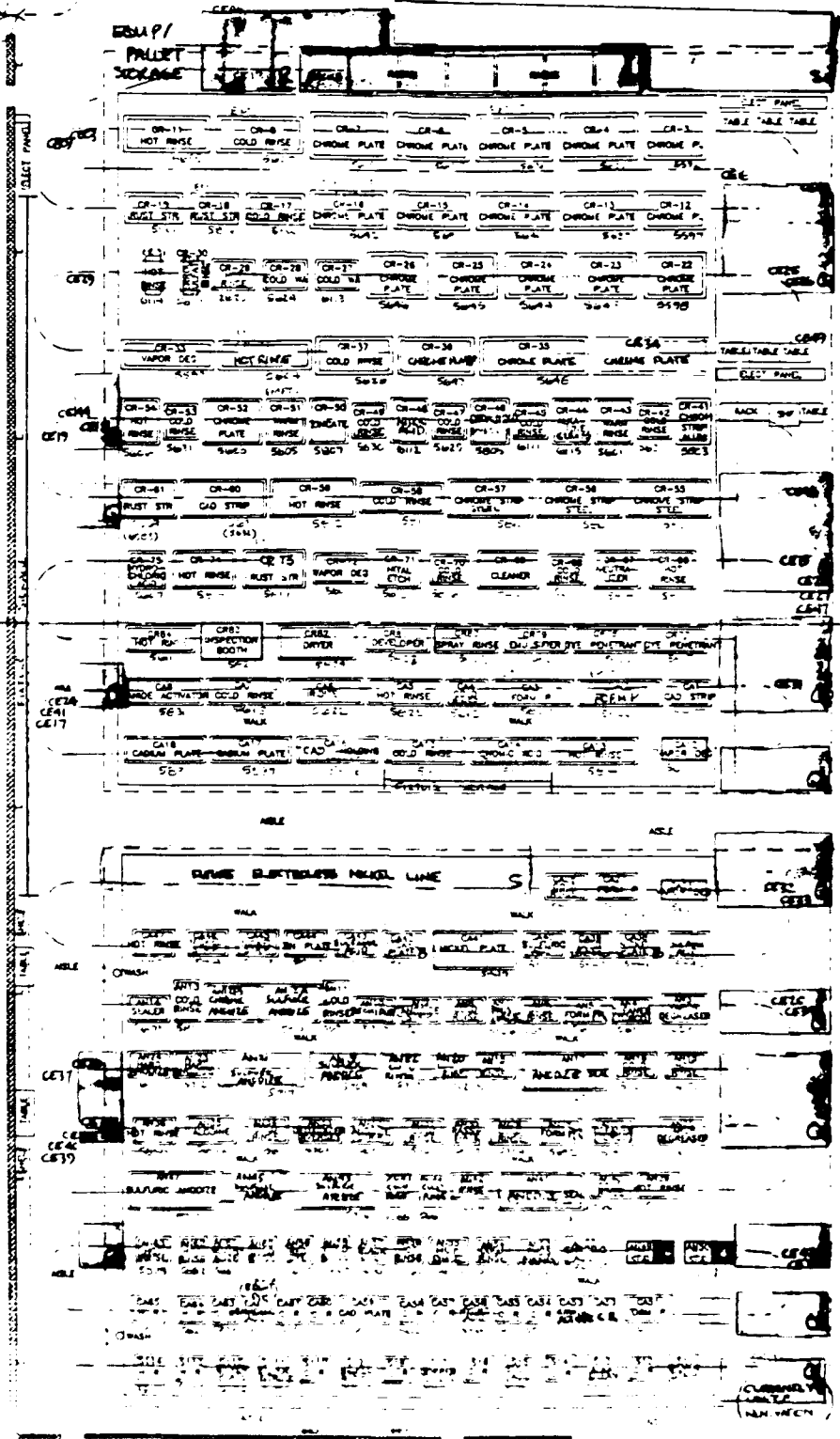
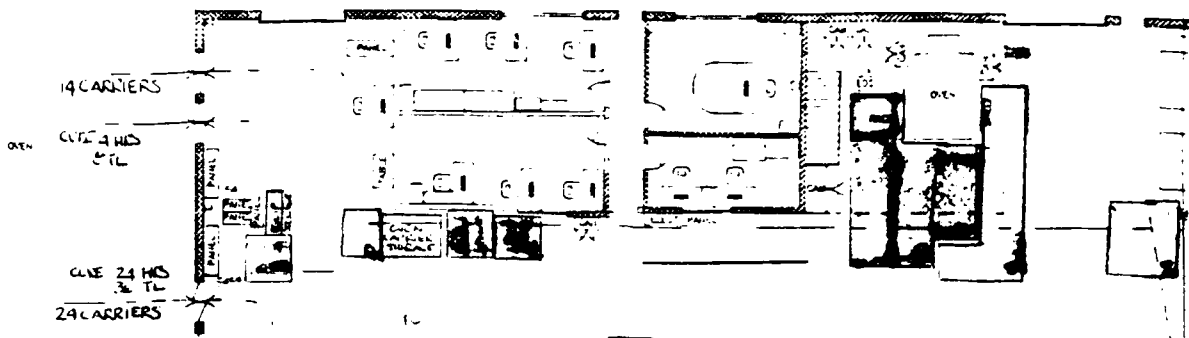
THE CURRENT SITUATION IS THE WORK IS STORED NEAR THE ENTRANCE WHEREVER THERE IS SPACE OR AS CLOSE TO THE NEXT OPERATION WHEREVER THERE IS SPACE. THIS TYPE OF INVENTORY AND STORAGE SYSTEM TENDS TO NATURALLY VIOLATE THE "FIRST IN/ FIRST OUT" RULE CAUSING WORK TO <sup>THE</sup> SIT IN STORAGE FOR LONG PERIODS OF TIME. \*RG,RF

THE RACKS ALONG THE NORTH END OF THE BUILDING ARE FOR STORAGE OF WORK REQUIRING REWORK DISPOSITION, BUT THE RACKS ARE CURRENTLY FILLED TO CAPACITY WITH REWORK AND WIP FROM OTHER RACKS (PNA, RB3, TEMPORARY PREWORK, ETC.)  
<sup>THOSE A</sup> <sup>5</sup> <sup>PARLET SIZED SHELVES PER RACK.</sup>  
FIXTURE STORAGE IS CURRENTLY FILLED TO CAPACITY BUT THERE ARE PLANS TO MAKE THE VAC CAD ROOM A FIXTURE STORAGE <sup>PART STORAGE</sup> ANNEX.

THEY ARE ALSO MAKING PLANS TO CREATE MORE STAGING AREA BY DISMANTLING OFFICE SPACE (IN DISTANT FUTURE). THIS <sup>LUNCH ROOM</sup> SPACE WILL ALSO BE USED FOR ADDITIONAL PLATING LINES. \*RS,RF

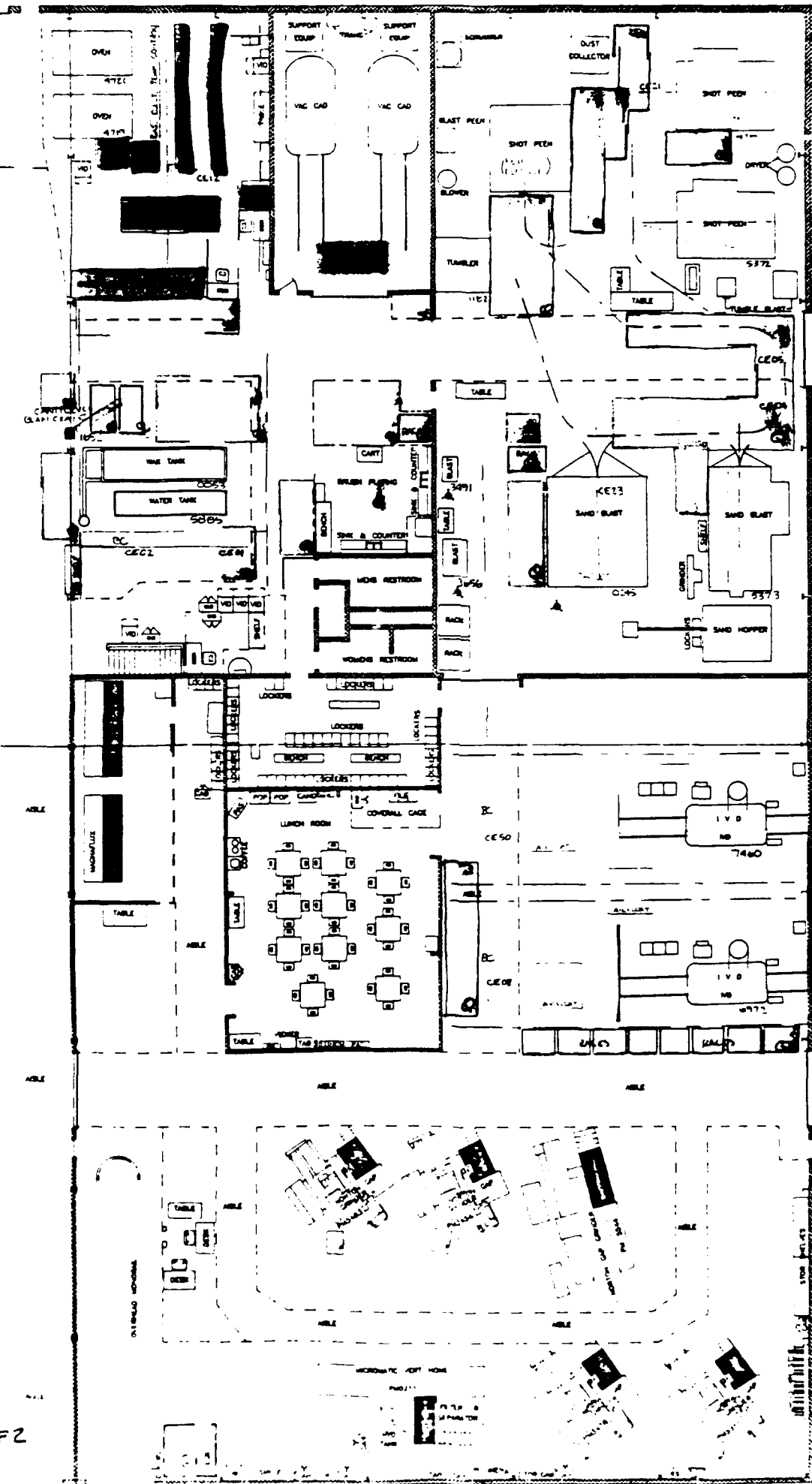
THE GENERAL AREAS FOR STORAGE ARE HIGHLIGHTED IN LAYOUT.

IN A MEETING WITH MANUFACTURING PERSONNEL IT WAS SUGGESTED TO MAKE A <sup>MORE</sup> MONORAIL STORAGE SYSTEM. ANAN SHAH IS PLANNING TO DO THIS WITH A MONORAIL STORAGE SYSTEM, WHERE PARTS ARE HUNG WITH FIXTURE ON MONORAILS BETWEEN LOOPS AND IN CURRENT LUNCH ROOM. <sup>THE LUNCH ROOM</sup> ~~IT~~ MIGHT STORE MORE IF IT HAS DIFFERENT LEVEL. HOWEVER THIS PLAN REQUIRES MORE FIXTURING AND A METHOD OF GETTING TO PARTS WITHOUT MOVING ALL THE PARTS ON THE MONORAIL LINE (EASY ACCESS TO STORED PARTS ANYWHERE ON THE SYSTEM)



CRANE TRACK  
FIXTURE PALLET  
QUEING PALLET  
STAGING PALLET

STORAGE LAYOUT



## 2.8 PROCESS FLOW CHARTS

Aluminum Conversion Process

" Anodize Process

" Anodize Strip Process

Cadmium Plating of High-Strength Landing Gear Parts

LHE (Low Hydrogen Embrittlement) Cadmium Plating Process

Cadmium Stripping Process

Chromium Stripping Process

Chromium Plating Process

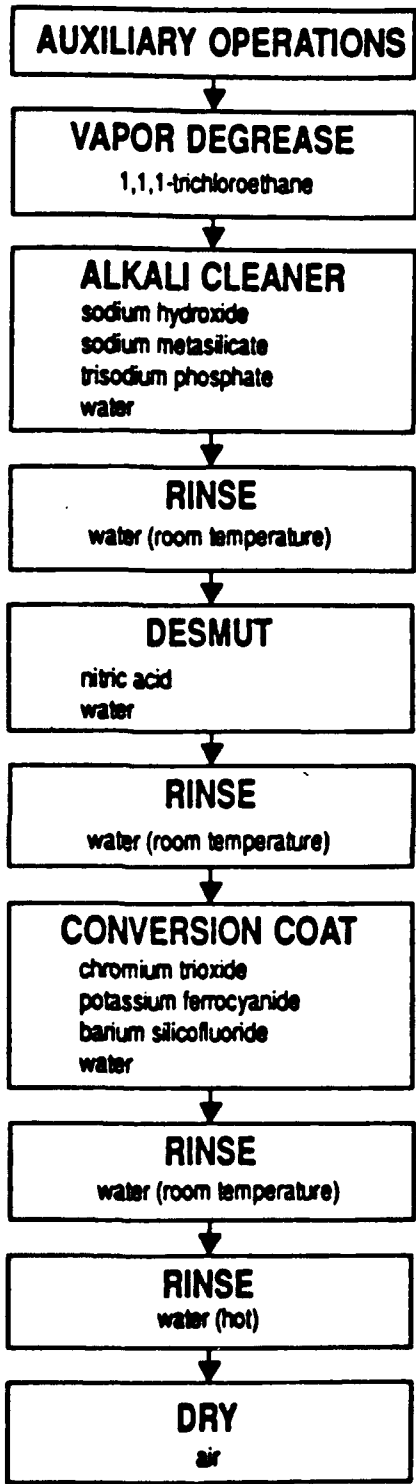
Nickel Plating Process

Silver Plating Process

Tin Plating Process

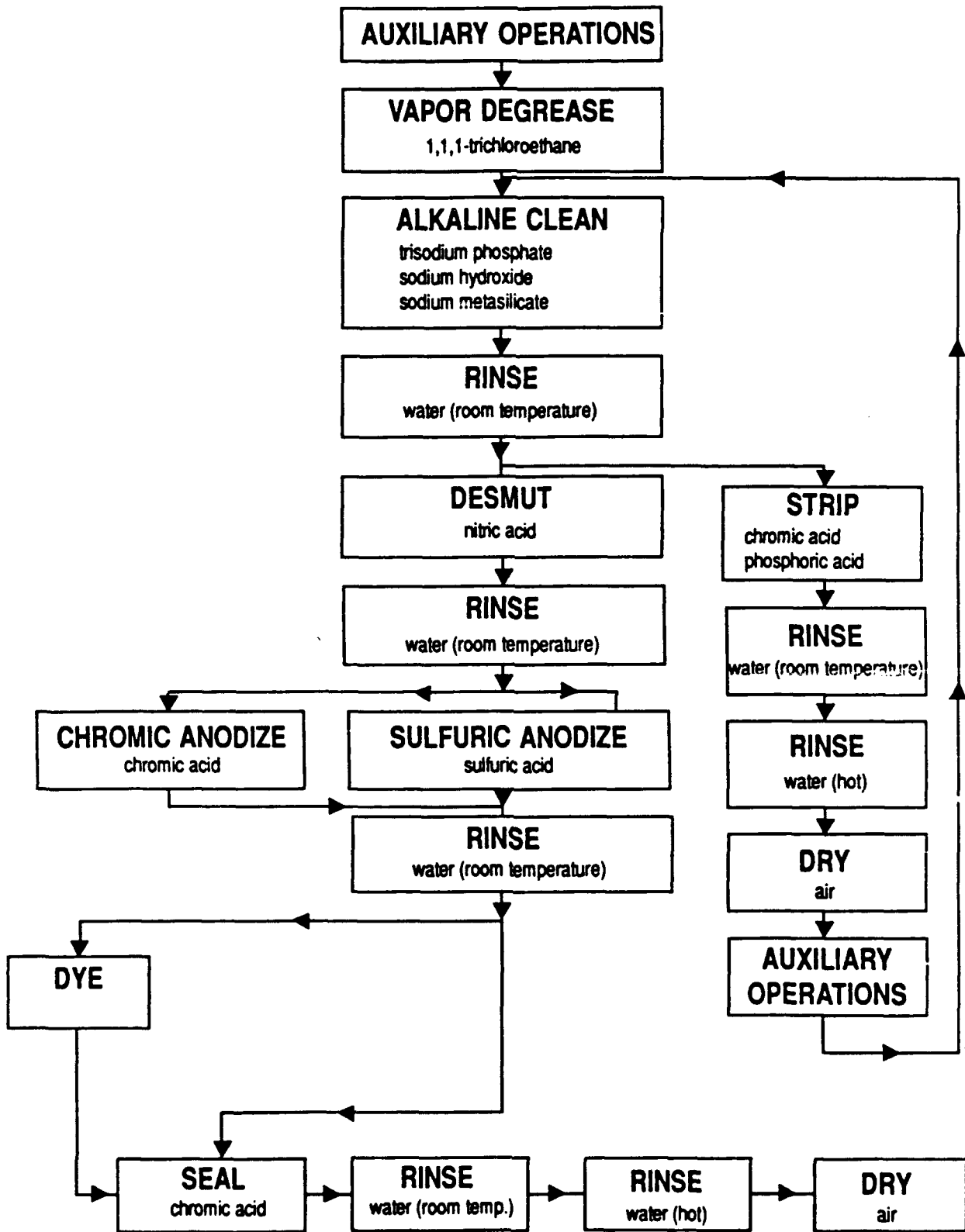
Passivation (of Stainless Steels) Process

Phosphate Coating Process (on Ferrous Metals)



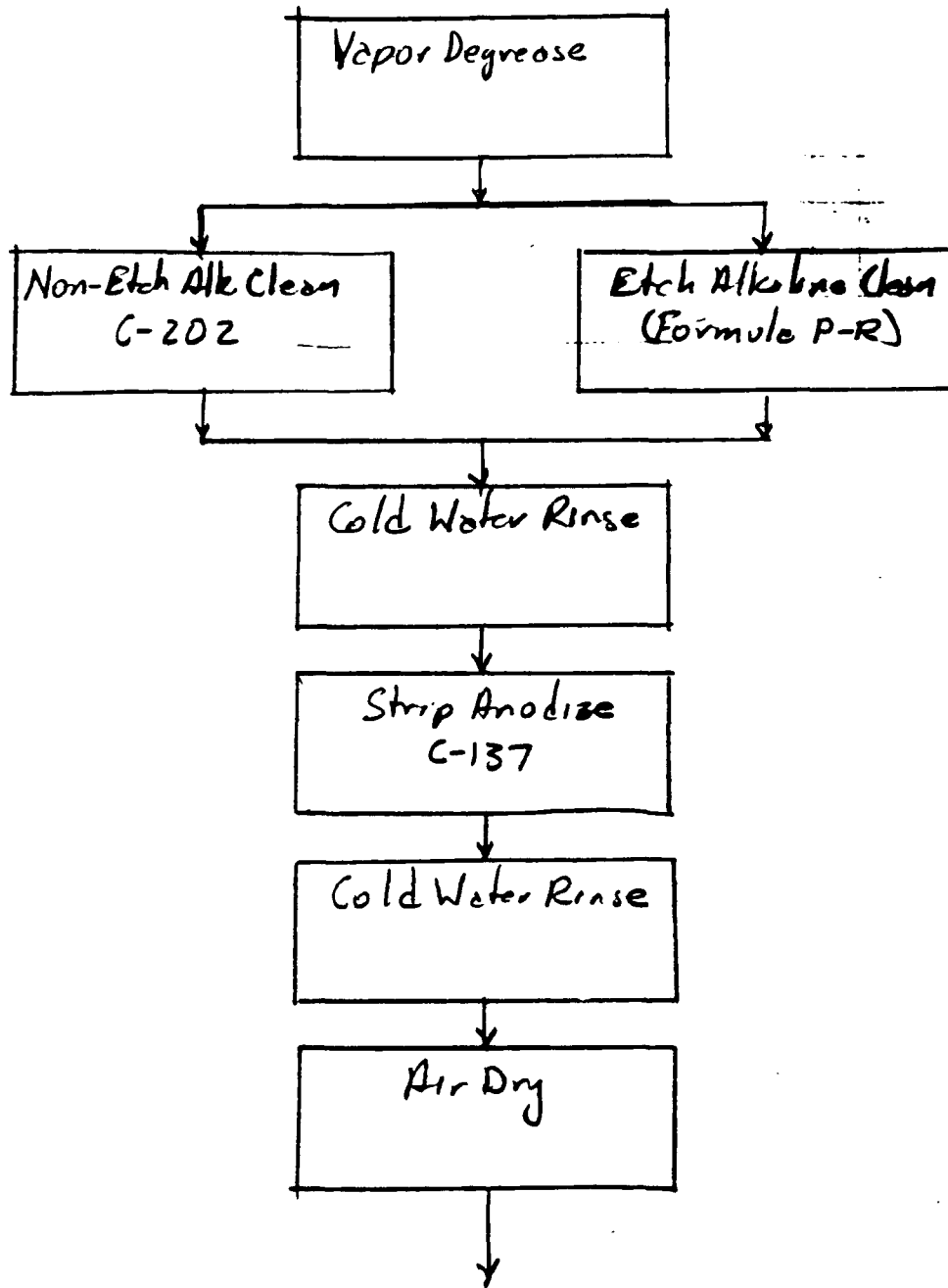
## ALUMINUM CONVERSION PROCESS

LSC-20049



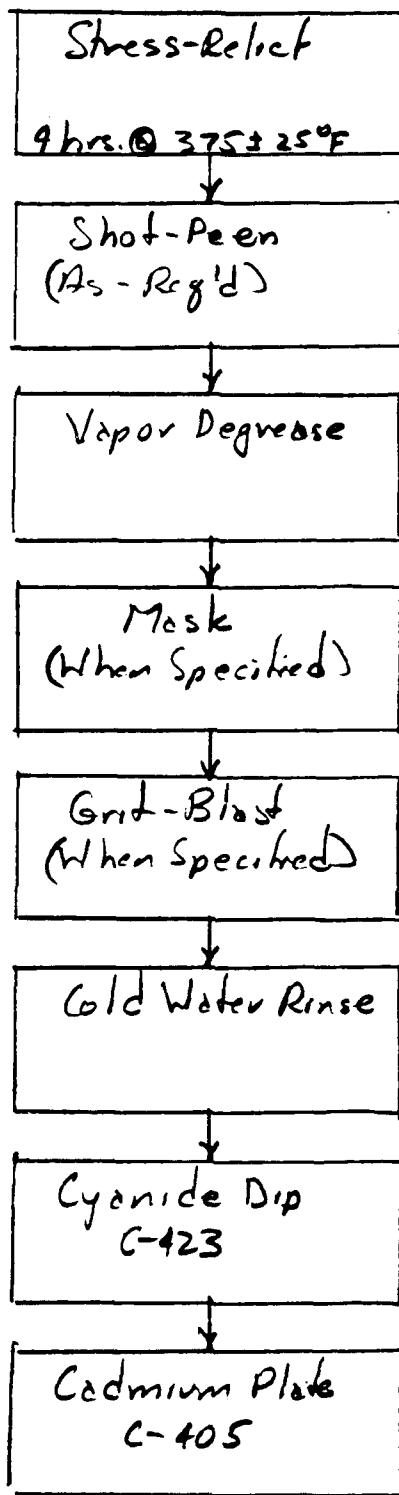
**ANODIZE PROCESS**

LSC-20054A

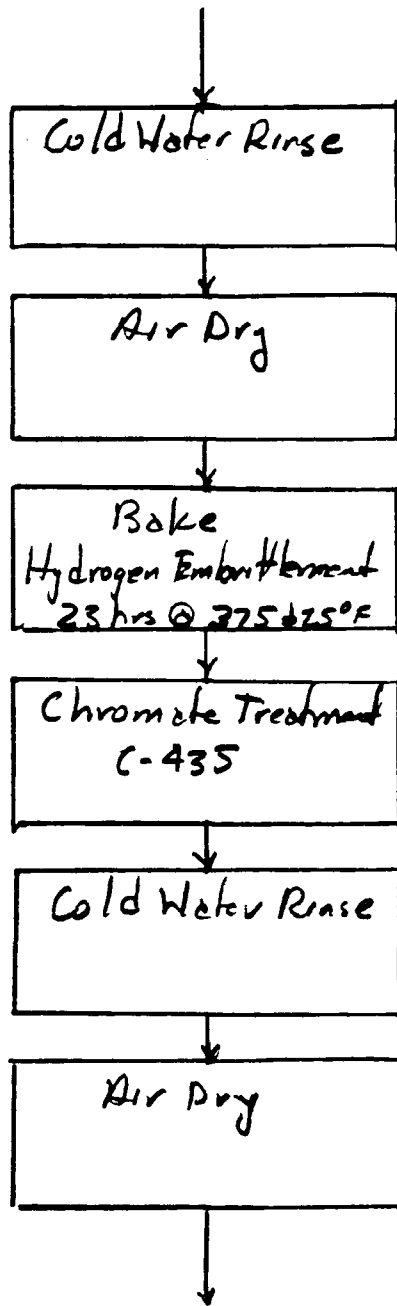


Aluminum Anodize Strip/00-ALC





Continued on Next Page



Cadmium Plating of High-Strength Landing  
Gear Parts / 00-ALC

Py. 2 of 2

**VAPOR DEGREASE**  
1,1,1-trichloroethane

**AUXILIARY OPERATIONS**

**STRIP**  
ammonium nitrate  
water

**RINSE**  
water (room temperature)

**AUXILIARY OPERATIONS**

**RINSE**  
water (room temperature)

**ETCH**  
hydrochloric acid

**RINSE**  
water (room temperature)

**LHE CADMIUM PLATE**  
cadmium oxide  
titanium metal  
sodium cyanide  
sodium hydroxide  
sodium carbonate

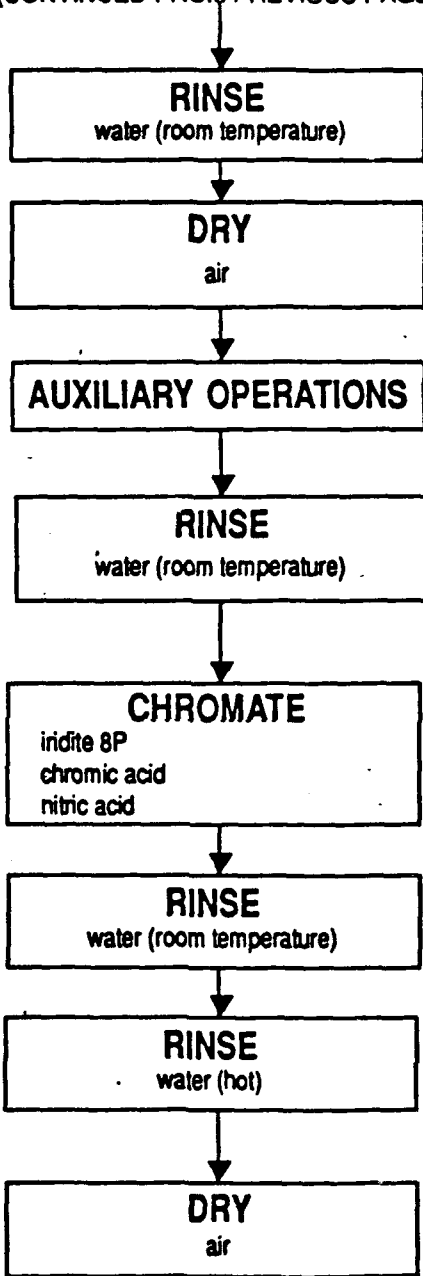
**RINSE**  
water (room temperature)

**CHROMATE**  
chromic acid  
nitric acid

(CONTINUED ON NEXT PAGE)

**LHE CADMIUM PLATING PROCESS**

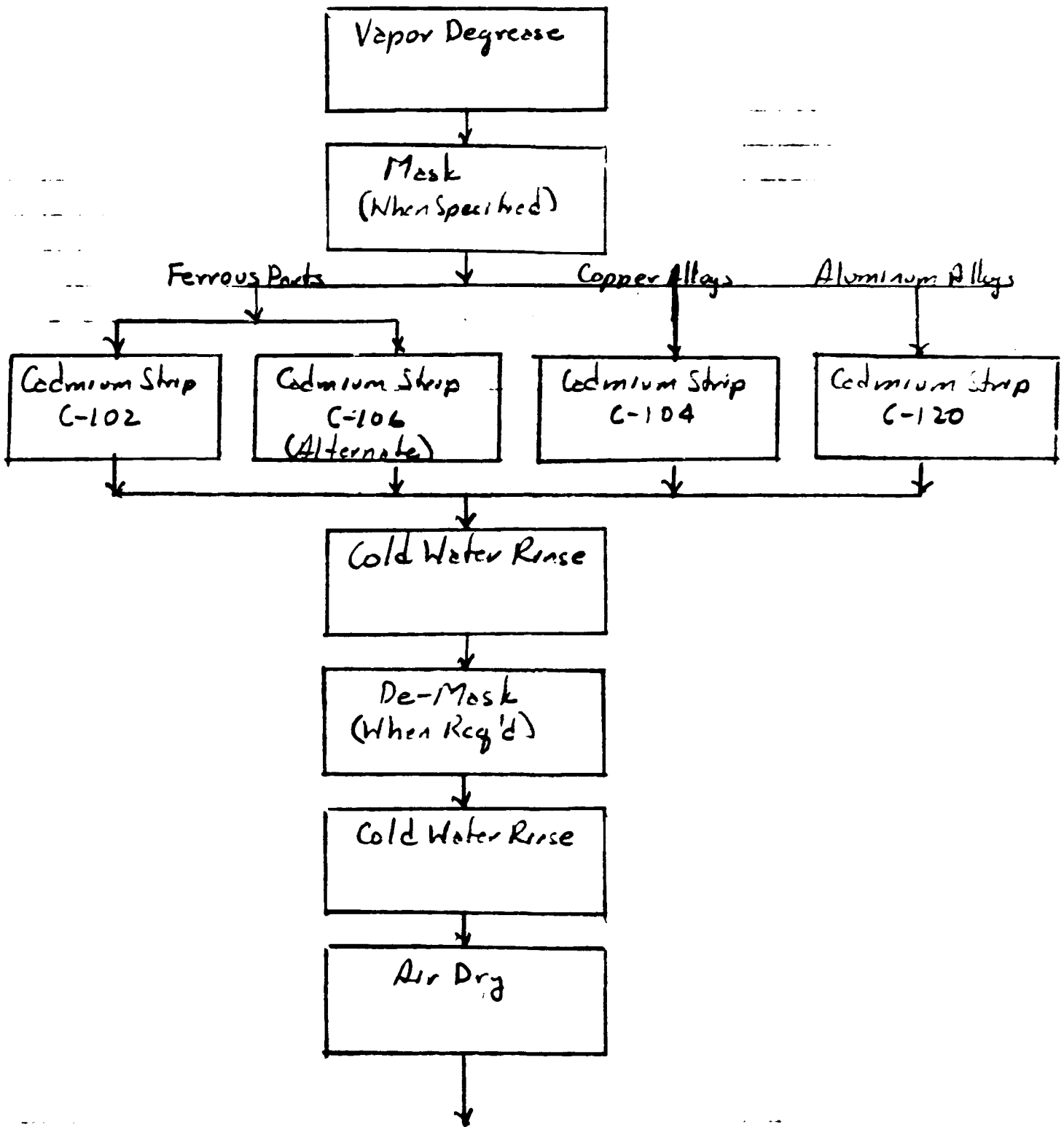
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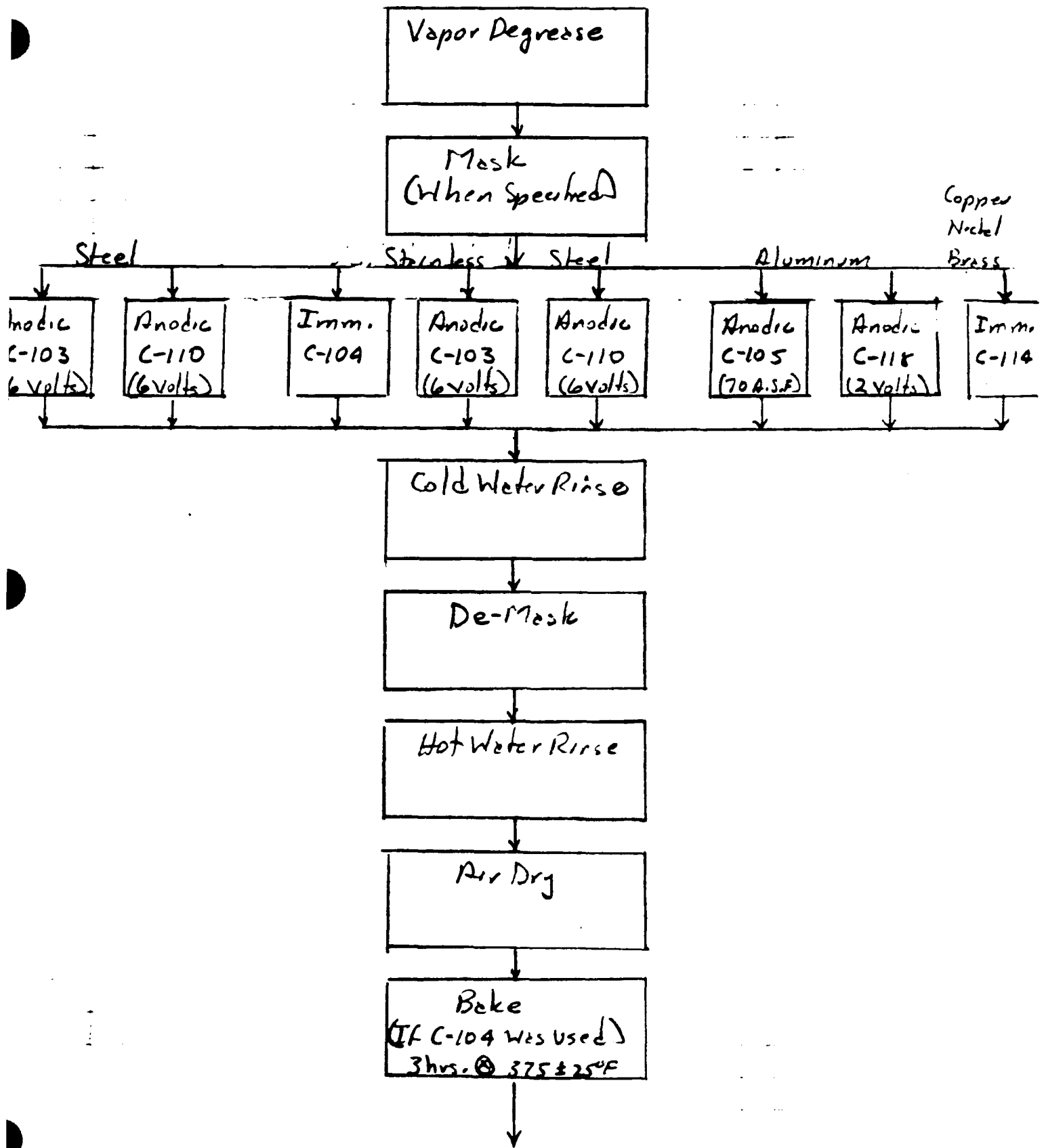
## LHE CADMIUM PLATING PROCESS

LSC-20058A

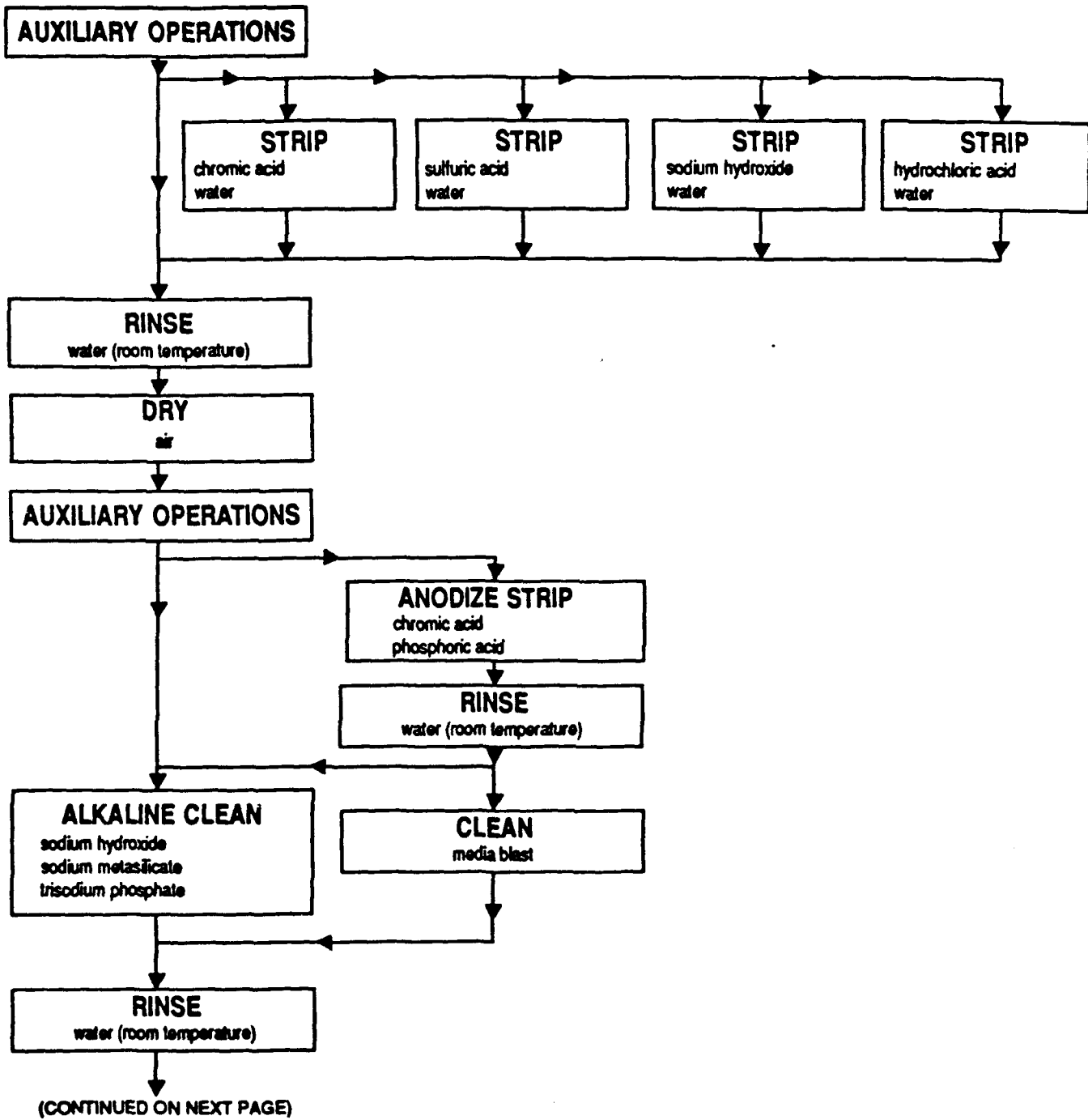
Pa. 2002



Cadmium Plate Stripping / T.O. 4262-1-7



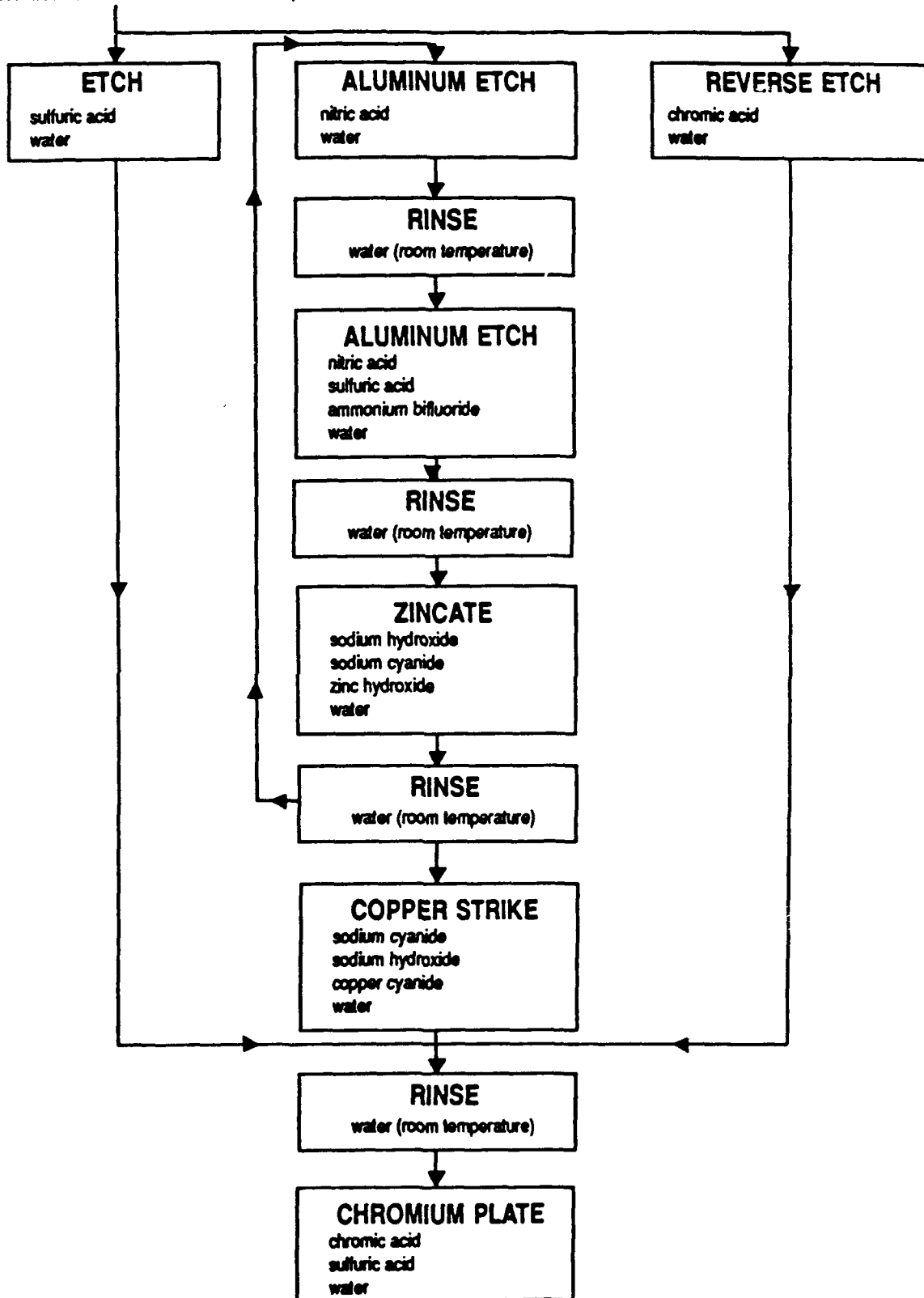
Chromium Stripping / T.O. 4262-1-7



**CHROMIUM PLATING PROCESS**

LSC-20064A

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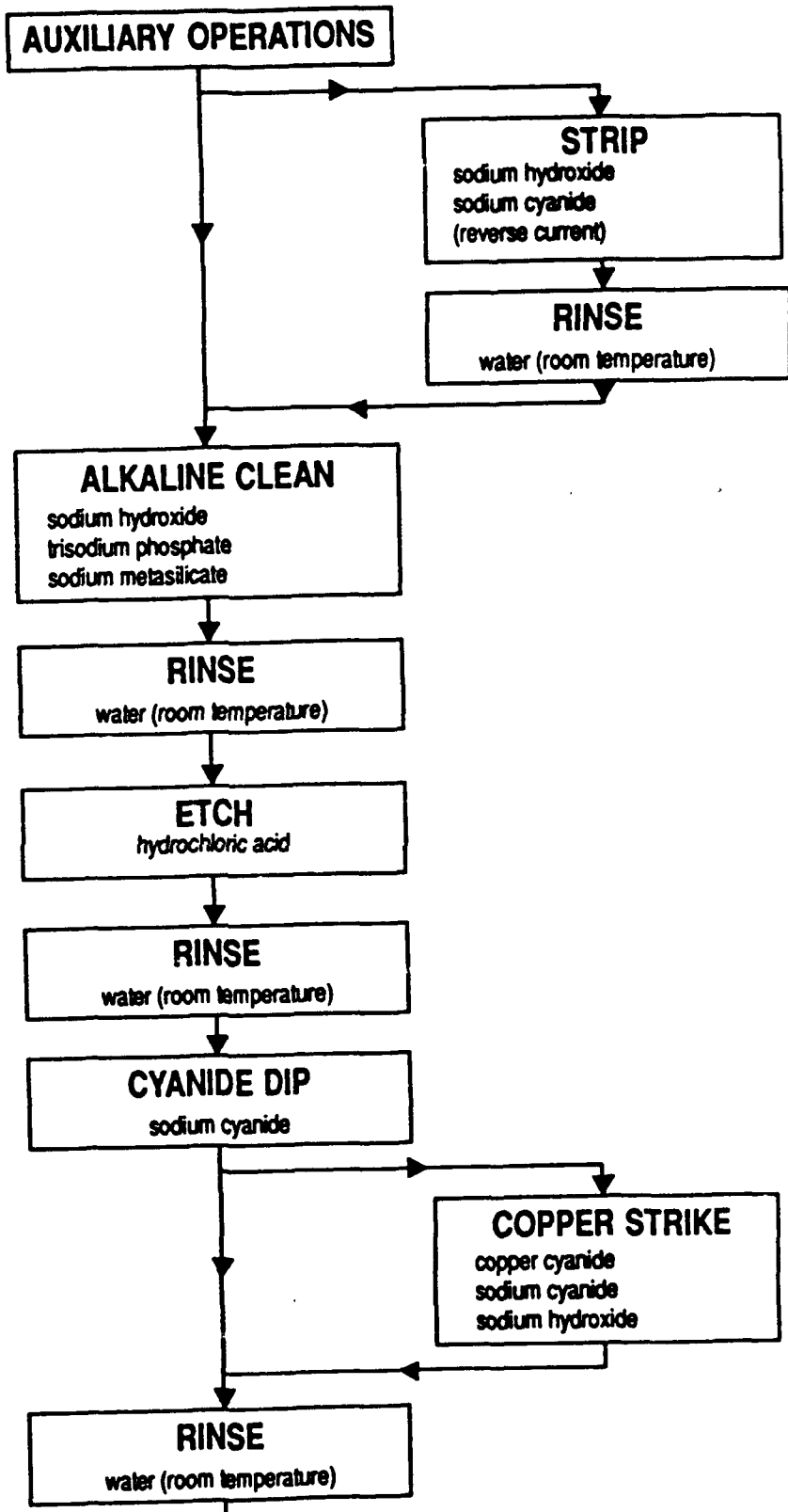
### CHROMIUM PLATING PROCESS

LSC-20064A







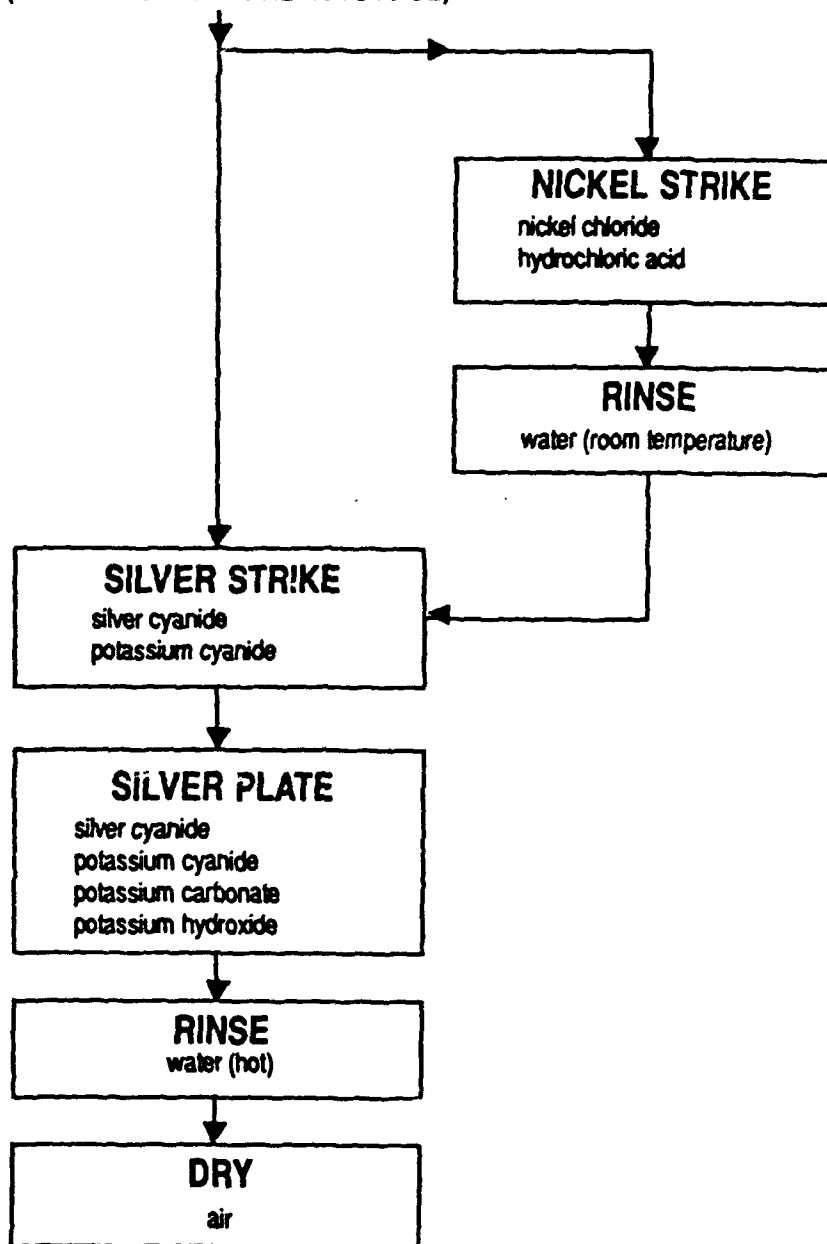


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**SILVER PLATING PROCESS**

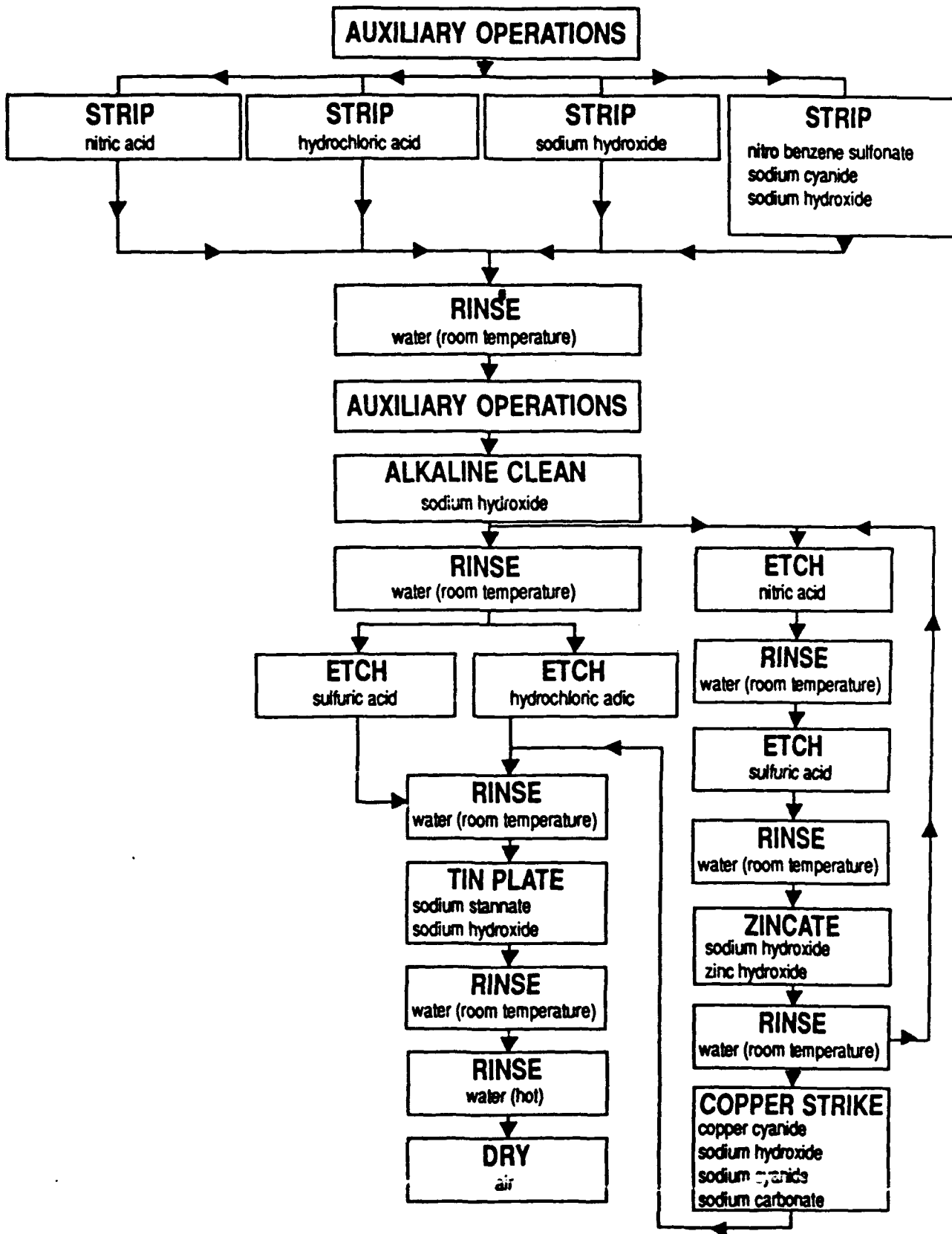
LSC-20065A

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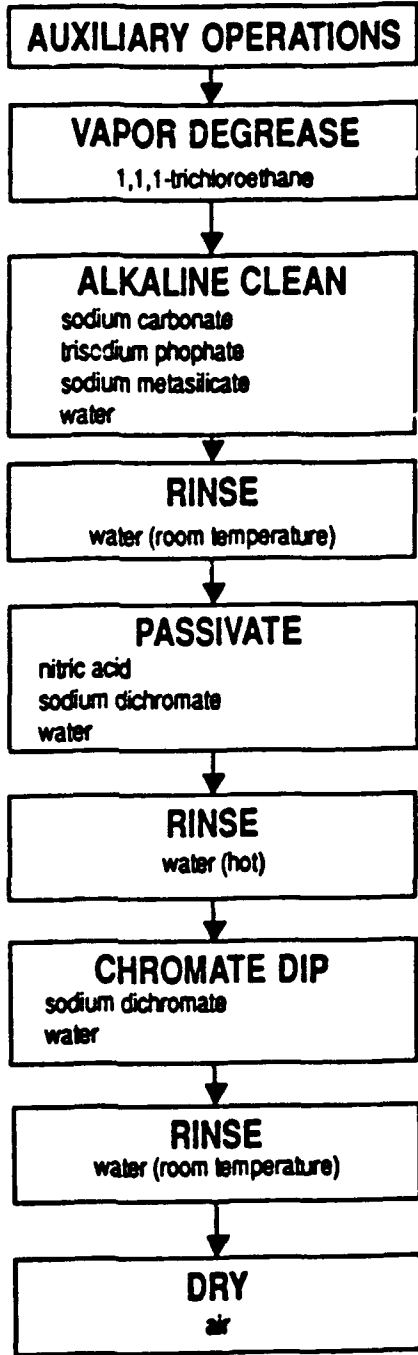
## SILVER PLATING PROCESS

LSC-20065A



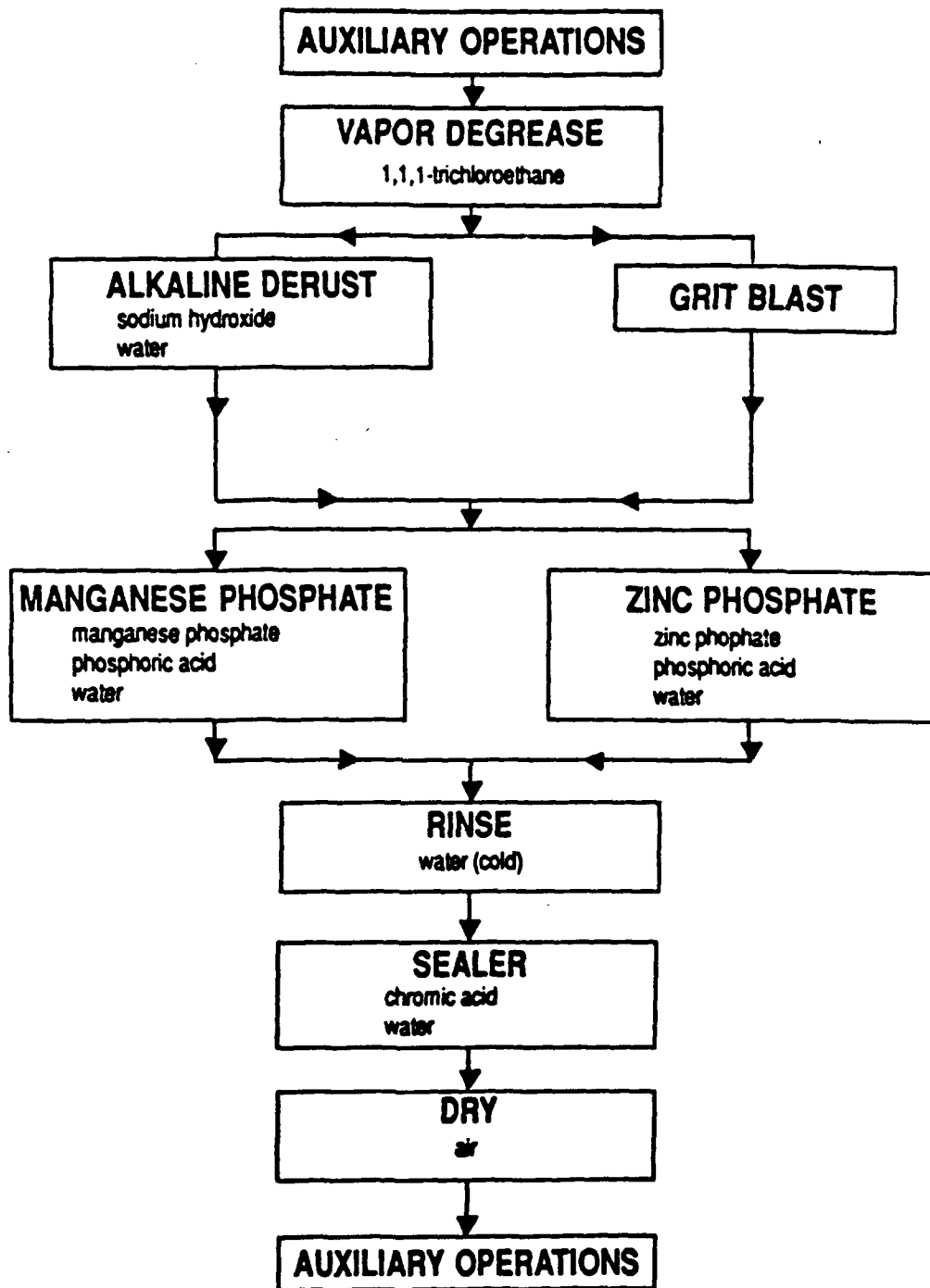
**TIN PLATING PROCESS**

LSC-20063A



**PASSIVATION PROCESS**

LSC-20060



**PHOSPHATE COATING PROCESS**

LSC-20056

# OPERATION PROFILE

OPERATION DESCRIPTION		CODE	DSC
CODE	DSC	CODE	DSC
ALOO	ALODINE		
ANZ1	CHROMIC ANODIZE	RINS	RINSE: HOT, WARM, COLD
ANZ2	SULFURIC ANODIZE		
ANZ3	HARD ANODIZE		
BAKE	BAKE 4 HR, 24 HR, VARIABLE	SEAL	SEAL
BLST	GLASS, GRIT BLAST		
BRSH	ANY BRUSH PLATING	SANZ	STRIP ANODIZE
BEAD	GLASS BEAD	SCAD	STRIP CADMIUM
CAD	CADMIUM PLATE	SCHR	STRIP CHROMIUM
CHR	CHROMIUM PLATE	SNI	STRIP NICKEL
CLN	DEGREASE, ALKALINE, FORMULA P, P-K	SRUS	STRIP RUST
COAT	DRY FILM LUBRICANT, PAINT	SSI	STRIP SILVER
COP	COPPER PLATE	STIN	STRIP TIN
DMSK	DEMASK	SKCO	STRIKE COPPER
DEOX	DEOXIDIZE	SKNI	STRIKE NICKEL
DIP	DIP, ACTIVATOR, CHEM RINSE	SKSI	STRIKE SILVER
DRY	SHOP AIR		
DYE	RED, BLACK	SILV	SILVER PLATE
ETCH	ANY EXCEPT FORM P		
HAND	HAND OPERATION	TIN	TIN PLATE
IRID	IRIDIUM		
IVD	ION VAPOR DEPOSITION	ZINC	ZINCATE
MASK	MASK, <del>DESIGN</del>	ZZZZ	CHILD WCD ENDPOINT
MOVE	MOVE		
NIB	NICKEL BRIGHT		
NIEL	ELECTROLESS NICKEL		
NIS	NICKEL SULFAMATE		
PASS	PASSIVATE		
PEEN	GLASS, SHOT PEEN		
PHOS	PHOSPHATE MANGANESE		
PRES	PRESERVATIVE		



GENERAL PROCESS FLOW

ALODINE	CLN CLN RINS CLN RINS	DEOX RINS ALOD RINS RINS (warm) DRY	NICKEL		CLN RINS ETCH RINS NIS RINS DMSK
ANODIZE	CLN CLN RINS CLN RINS	DEOX RINS ANZ: 0.3* RINS SEAL (+NICKEL) RINS RINS (HOT) DRY	STRIP ANODIZE	CLN ? MASK?	CLN RINS SANE RINS RINS (HOT) DRY
CADMIUM		MASK RINS CAD RINS RINS (HOT) DMSK	STRIP CADMIUM	? CLN? ? MASK? ? DMSK?	SEAD RINS DRY
CHROMIUM		MASK ETCH CHR RINS CLN SRUS DMSK	STRIP CHROMIUM	? CLN? ? MASK? ? DMSK?	SCHR RINS RINS (HOT) DRY
IRIDATE (CHROMATE CONVERSION) COATING		DIP RINS IRIO RINS (warm) DRY	STRIP RUST		CLN MASK SNI RINS DMSK
IVD		CLN MASK IVD DMSK	STRIP SILVER	? CLN? ? MASK?	SRUS RINS DRY SSI RINS DRY

GENERAL PROCESS FLOW

PHOSPHATE	CLN MASK BLST	RINS (HOT) PHOS RINS DIP DRY BAKE SEAL DRY	GULIT BLAST (ALUMINUM OXIDE) (GARNET)	CLN MASK BLST DMASK
SILVER	? CLN ? ? MASK ?	CLN RINS ETCH RINS SKCO RINS SILNI RINS SKSI SILV RINS (WARM) RINS (HOT)	GLASS BEAD  DRY FILM LUBRICANT  DE-RODGE	BEAD CLN  COAT BAKE  CLN

PER	TECH	S	S	W	F	PF	A/R	REV	DESCRIPTION		BASE	PFD	STD	A
SUB	T	K	NR	A	FA	SUPPORT	(OCC)		STANDARD	SUPPLEMENTAL	HOURS	TIME	HOURS	DLY PCT C
STEP	D	L	K	C	DC	ELEMENT	FACT	STORED						
0001	S	N	UP	EA	B	K	88183	.74	PERCENT ENGR 66.4	F-15 MAIN OUTER CYLINDER	3.05		2.25	
0001			UP	01		00		.00		PART NUMBER/NSN	.000	.000	.000	0
									68A410702-1005	1620010760547				
									68A410702-1006	1620040753562				
0022			UP	01		24		1.00		DEGREASE	.097	.023	.120	4
0010	E								RWB-CV-D1	1.00 VAPOR CL (DEGR)HOOK/BASKET	.08709		.107	
0020	E								RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0023			UP	01		24		.95		STRIP CAD	.262	.060	.309	.5 10
0010	E								ZCD-ST-M1	1.00 STRIP CAD ID/OD MED/LRG PART	.25260		.313	
0020	E								RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0024			UP	01		24		.05		STRIP RUST	.262	.003	.016	.3 1
0010	E								ZCD-ST-M1	1.00 STRIP RUST	.25260		.313	
0020	E								RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN C-F DOC	.01001		.012	
0098			UP	01		24		1.00		DEGREASE	.097	.023	.120	4
0010	E								RWB-CV-D1	1.00 VAPOR CL (DEGR)HOOK/BASKET	.08709		.107	
0020	E								RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0100			UP	01		24		.05		STRIP CHROME MED PART O.D.	.186	.002	.012	24.0 0
0010	E								ZCR-ST-M2	.50 STRIP CHROME OD MED/LRG PART OCC. 2 EA OPERATIONS	.35303		.218	
0020	E								RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0110			UP	01		24		.05		STRIP CHROME MED PART O.D.	.186	.002	.012	24.0 0
0010	E								ZCR-ST-M2	.50 STRIP CHROME OD MED/LRG PART OCC. 2 EA OPERATIONS	.35303		.218	
0020	E								RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0113			UP	01		24		.05		STRIP CHROME MED PART I.D.	.494	.006	.031	24.0 1
0010	E								ZCR-ST-M1	1.00 STRIP CHROME ID MED/LRG PART	.48467		.600	
0020	E								RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0150			UP	01		24		.50		BAKE AFTER ETCH	.171	.021	.106	8.0 3
0010	E								ZPL-BK-M1	1.00 BAKE MED/LRG SIZE PART	.16175		.200	
0020	E								RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0165			UP	01		24		.50		DEGREASE	.097	.012	.060	2
0010	E								RWB-CV-D1	1.00 VAPOR CL (DEGR)HOOK/BASKET	.08709		.107	
0020	E								RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0170			UP	01		24		.50		SHOTPEEN MED PART/MASK	.391	.047	.243	8
0010	E								ZMA-CL-02	1.00 MASK MED CYLINDRICAL PART	.17000		.210	
0020	E								RPL-SP-M1	1.00 SHOT PEEN SMALL/MED PART	.16131		.200	
0030	M								ZUM-CL-02	1.00 UNMASK MEDIUM SIZE CYL PART	.05067		.062	
0040	E								RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0175			UP	01		24		.05		PREP FOR CHROME MED PART O.D	.720	.009	.045	1
0010	M									1.00 PREP FOR CHROME	.71000		.880	
0020	E								RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0178			UP	01		24		.05		GRIT BLAST	.111	.001	.007	0
0010	E								RPL-SB-M2	1.00 SANDBLAST MED PART WALK-IN B	.10180		.126	
0020	E								RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0180			UP	01		24		.05		CHROME PLATE MED PART O.D.	.600	.007	.037	24.0 1
0010	M									1.00 CHROME PLT MED PART O.D.	.59000		.731	
0020	E								RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0185			UP	01		24		.05		BAKE AFTER CHROME PLATE	.171	.002	.011	8.0 0
0010	E								ZPL-BK-M1	1.00 BAKE MED/LRG SIZE PART	.16175		.200	
0020	E								RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0191			UP	01		24		.05		BAKE AFTER GRIND	.171	.002	.011	8.0 0

OUTER CYLINDER

0010 E		ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200		
0020 E		RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC	.01001		.012		
	UP 01	24	.40	GRIT BLAST	.111	.011	.055		2
0010 E		RPL-SB-M2	1.00	SANDBLAST MED PART WALK-IN B	.10180		.126		
0020 E		RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC	.01001		.012		
0194	UP 01	24	.40	PREP FOR CHROME MED PART I.D	.940	.090	.466		15
0010 N			1.00	PREP CHROME I.D.	.93000		1.153		
0020 E		RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC	.01001		.012		
0195	UP 01	24	.40	CHROME PLATE MED PART I.D.	.640	.061	.317	30.0	10
0010 N			1.00	CHROME PLATE MED PART	.63000		.781		
0020 E		RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC	.01001		.012		
0200	UP 01	24	.40	BAKE AFTER CHROME PLATE	.171	.016	.085	8.0	3
0010 E		ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200		
0020 E		RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC	.01001		.012		
0202	UP 01	24	.05	PREP FOR CHROME MED PART O.D	.720	.009	.045		1
0010 N			1.00	PREP FOR CHROME	.71000		.880		
0020 E		RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC	.01001		.012		
0204	UP 01	24	.05	GRIT BLAST	.111	.001	.007		0
0010 E		RPL-SB-M2	1.00	SANDBLAST MED PART WALK-IN B	.10180		.126		
0020 E		RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC	.01001		.012		
0206	UP 01	24	.05	CHROME PLATE MED PART I.D.	.640	.008	.040	30.0	1
0010 N			1.00	CHROME PLATE MED PART	.63000		.781		
0020 E		RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC	.01001		.012		
0207	UP 01	24	.05	BAKE AFTER CHROME PLATE	.171	.002	.011	8.0	0
0010 E		ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200		
0020 E		RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC	.01001		.012		
0225	UP 01	24	.40	BAKE AFTER GRIND	.171	.016	.085	8.0	3
0010 E		ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200		
0020 E		RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC	.01001		.012		
0235	UP 01	24	.40	DEGREASE	.097	.009	.048		2
0010 E		RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET	.08709		.107		
0020 E		RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC	.01001		.012		
0300	UP 01	24	1.00	GRIT BLAST	.111	.027	.139		5
0010 E		RPL-SB-M2	1.00	SANDBLAST MED PART WALK-IN B	.10180		.126		
0020 E		RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC	.01001		.012		
0370	UP 01	24	.45	CAD PLATE	.620	.067	.346		11
0010 E		ZPL-CD-M1	1.00	CADMIUM PLATE MEDIUM PART	.61058		.757		
0020 E		RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC	.01001		.012		
0380	UP 01	24	.45	BAKE AFTER CAD PLATE	.171	.019	.096	38.0	3
0010 E		ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200		
0020 E		RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC	.01001		.012		
0385	UP 01	24	.45	CHROMATE CONVERSION(IRIDITE)	.106	.011	.059		2
0010 E		ZPL-IR-M1	1.00	IRIDITE MEDIUM PART-HOIST	.09635		.119		
0020 E		RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC	.01001		.012		
0390	UP 01	24	.50	VAC CAD MED PART	.080	.010	.050	1.0	2
0010 E		ZPL-VC-S1	1.20	VAC CAD PLATE SMALL PART	.05856		.087		
0020 E		RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC	.01001		.012		
0395	UP 01	24	.50	HOT WATER RINSE	.030	.004	.019		1
0010 N			1.00	HOT WATER RINSE	.02000		.024		
0020 E		RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC	.01001		.012		
0397	UP 01	24	.05	I.V.D. ALUMINUM PLATE	.450	.005	.028	1.0	1
0010 N			1.00	I.V.D. PLATE	.44000		.545		
0020 E		RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC/	.01001		.012		
3	UP 01	24	.05	ALODINE I.V.D. ALUM PLATE	.230	.003	.014		0
0010 N			1.00	ALODINE	.22000		.272		
0020 E		RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC/	.01001		.012		

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LABOR STANDARD HISTORY

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14NOV84 2 YR REVIEW W/OCC CHANGE > OLD STD < 3.38  
18MAR85 DOWN GRADED NOT MARKET BASKET  
21NOV85 CHANGED SUBOPS TO MATCH 958 OLS STD 3.07  
J.CALDWELL TECH MANEAA

TO INTERROGATE LABOR STANDARDS, INPUT

RCC PRD NROP NR

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STEP	D	L	K	C	DC	ELEMENT	FACT	STO	DESCRIPTION	SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A
C002	E	N	UP	EA	B	K 88203	.96	PERCENT	ENGR 45.3	PLATE PISTON ASSY. F-15MLG	12.61		12.11			
0001			UP	01	00		.00			PART NUMBER/STOCK NUMBER	.000	.000	.000			0
0030								68A4107004-1011		1620010803404						
0040								68A410704-1012		1620010803401						
0050								68A410704-1005		1620010803401						
0060								68A410704-1006		1620010818799						
0024			UP	01	24		1.00			DEGREASE	.097	.023	.120			1
0010	E					RWB-CV-D1	1.00	VAPOR	CL (DEGR)HOOK/BASKET		.08709		.107			
0020	E					RJP-PW-R1	1.00	REM	RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0026			UP	01	24		.95			STRIP CAD	.262	.060	.309	.5		2
0010	E					ZCD-ST-M1	1.00	STRIP	CAD ID/OD MED/LRG PART		.25260		.313			
0020	E					RJP-PW-R1	1.00	REM	RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0028			UP	01	24		.05			STRIP RUST	.262	.003	.016	.3		0
0010	E					ZCD-ST-M1	1.00	STRIP	RUST		.25260		.313			
0020	E					RJP-PW-R1	1.00	REM	RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0049			UP	01	24		1.00			DEGREASE	.097	.023	.120			1
0010	E					RWB-CV-D1	1.00	VAPOR	CL (DEGR)HOOK/BASKET		.08709		.107			
0020	E					RJP-PW-R1	1.00	REM	RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0050			UP	01	24		1.00			STRIP CHROME MED PART O.D.	.363	.087	.450	24.0		4
0010	E					ZCR-ST-M2	1.00	STRIP	CHROME OD MED/LRG PART		.35303		.437			
0020	E					RJP-PW-R1	1.00	REM	RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0060			UP	01	24		1.00			STRIP CHROME MED PART I.D.	.494	.119	.613	24.0		5
0010	E					ZCR-ST-M1	1.00	STRIP	CHROME ID MED/LRG PART		.48467		.600			
0020	E					RJP-PW-R1	1.00	REM	RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0062			UP	01	24		1.00			STRIP CHROME MED PART O.D.	.363	.087	.450	24.0		4
0010	E					ZCR-ST-M2	1.00	STRIP	CHROME OD MED/LRG PART		.35303		.437			
0020	E					RJP-PW-R1	1.00	REM	RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0065			UP	01	24		1.00			STRIP CHROME MED PART O.D.	.363	.087	.450	24.0		4
0010	E					ZCR-ST-M2	1.00	STRIP	CHROME OD MED/LRG PART		.35303		.437			
0020	E					RJP-PW-R1	1.00	REM	RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0100			UP	01	24		1.00			BAKE AFTER ETCH	.171	.041	.213	8.0		2
0010	E					ZPL-BK-M1	1.00	BAKE	MED/LRG SIZE PART		.16175		.200			
0020	E					RJP-PW-R1	1.00	REM	RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0115			UP	01	24		1.00			DEGREASE	.097	.023	.120			1
0010	E					RWB-CV-D1	1.00	VAPOR	CL (DEGR)HOOK/BASKET		.08709		.107			
0020	E					RJP-PW-R1	1.00	REM	RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0120			UP	01	24		1.00			SHOTPEEN MED PART/MASK	.391	.094	.486			4
0010	E					ZMA-CL-02	1.00	MASK	MED CYLINDRICAL PART		.17000		.210			
0020	E					RPL-SP-M1	1.00	SHOT	PEEN SMALL/MED PART		.16131		.200			
0030	M					ZUM-CL-02	1.00	UNMASK	MEDIUM SIZE CYL PART		.05067		.062			
0040	E					RJP-PW-R1	1.00	REM	RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0123			UP	01	24		1.00			GRIT BLAST	.111	.027	.139			1
0010	E					RPL-SB-M2	1.00	SANDBLAST	MED PART WALK-IN B		.10180		.126			
0020	E					RJP-PW-R1	1.00	REM	RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0127			UP	01	24		1.00			PREP FOR CHROME MED PART I.D.	.940	.226	1.166			9
0010	M						1.00			PREP CHROME I.D.	.93000		1.153			
0020	E					RJP-PW-R1	1.00	REM	RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0130			UP	01	24		1.00			CHROME PLATE MED PART I.D.	.640	.154	.794	30.0		6
0010	M						1.00			CHROME PLATE MED PART	.63000		.781			

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0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0135	UP 01	24	1.00	BAKE AFTER CHROME PLATE	.171	.041	.213	8.0	2
0010 E		ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0138	UP 01	24	1.00	PREP FOR CHROME MED PART O.D	.720	.173	.893		7
0010 N			1.00	PREP FOR CHROME	.71000		.880		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0139	UP 01	24	1.00	GRIT BLAST	.111	.027	.139		1
0010 E		RPL-SB-M2	1.00	SANDBLAST MED PART WALK-IN B	.10180		.126		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0140	UP 01	24	1.00	CHROME PLATE MED PART O.D.	.600	.144	.744	24.0	6
0010 N			1.00	CHROME PLT MED PART O.D.	.59000		.731		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0150	UP 01	24	1.00	PREP FOR CHROME MED PART O.D	.720	.173	.893		7
0010 N			1.00	PREP FOR CHROME	.71000		.880		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0152	UP 01	24	1.00	PREP FOR CHROME MED PART O.D	.720	.173	.893		7
0010 N			1.00	PREP FOR CHROME	.71000		.880		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0154	UP 01	24	1.00	GRIT BLAST	.111	.027	.139		1
0010 E		RPL-SB-M2	1.00	SANDBLAST MED PART WALK-IN B	.10180		.126		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0156	UP 01	24	1.00	CHROME PLATE MED PART O.D.	.600	.144	.744	24.0	6
0010 N			1.00	CHROME PLT MED PART O.D.	.59000		.731		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0157	UP 01	24	1.00	CHROME PLATE MED PART O.D.	.600	.144	.744	24.0	6
0010 N			1.00	CHROME PLT MED PART O.D.	.59000		.731		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
8	UP 01	24	1.00	BAKE AFTER CHROME PLATE	.171	.041	.213	8.0	2
0010 E		ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0180	UP 01	24	.25	BAKE AFTER GRIND	.171	.010	.053	8.0	0
0010 E		ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0195	UP 01	24	1.00	DEGREASE	.097	.023	.120		1
0010 E		RWB-CU-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET	.08709		.107		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0205	UP 01	24	1.00	GRIT BLAST	.111	.027	.139		1
0010 E		RPL-SB-M2	1.00	SANDBLAST MED PART WALK-IN B	.10180		.126		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0210	UP 01	24	.95	CAD PLATE	.620	.141	.731		6
0010 E		ZPL-CU-M1	1.00	CADMIUM PLATE MEDIUM PART	.61058		.757		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0220	UP 01	24	.95	BAKE AFTER CAD PLATE	.171	.039	.202	38.0	2
0010 E		ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0225	UP 01	24	1.00	VAC CAD MED PART	.080	.019	.100	1.0	1
0010 E		ZPL-VC-S1	1.20	VAC CAD PLATE SMALL PART OCC FOR MED SIZED PART	.05856		.087		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0227	UP 01	24	1.00	HOT WATER RINSE	.030	.007	.037		0
0010 N			1.00	HOT WATER RINSE	.02000		.024		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0230	UP 01	24	1.00	CHROMATE CONVERSION(IRIDITE)	.106	.026	.132		1
0010 E		ZPL-IR-M1	1.00	IRIDITE MEDIUM PART-HOIST	.09635		.119		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0233	UP 01	24	.05	I.V.D. ALUMINUM PLATE	.450	.005	.028	1.0	0

0010	N		1.00	I.V.D. PLATE	.44000		.545	
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/	.01001		.012	
34	UP 01	24	.05	ALODINE I.V.D. ALUM PLATE	.230	.003	.014	0
0010	N		1.00	ALODINE	.22000		.272	
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/	.01001		.012	
9000	UP 01	24	.01	LABOR STANDARD HISTORY	.000	.000	.000	0
0010				14NOV84 2 YR REVIEW W/OCC CHANGE > OLD STD < .60				
0011				18MAR85 DOWN GRADED NOT MARKET BASKET				
0012				21NOV85 CHANGED SUBOPS TO MATCH 958 OLD STD 3.05				
0900				J CALDWELL TECH MANEAA				

TO INTERROGATE LABOR STANDARDS, INPUT

RCC PRD NROP NR  
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OPER	TECH	S	S	M	F	P	F	A/R	REV	OCC	DESCRIPTION	BASE	PFD	STD	A
SUB	T	K	#R	A	FA	SUPPORT	FACT	STORAGE	SUPPLEMENTAL	HOURS	TIME	HOURS	DLY	PCT	C
STEP	D	L	K	C	DC	ELEMENT	FACT	STORAGE	SUPPLEMENTAL	HOURS	TIME	HOURS	DLY	PCT	C
003	S	E	UP	EA	B	J 88187	.61	PERCENT ENGR 99.9	ORIFICE TUBE, F-15 M	1.73		1.05			
0001			UP	01	00		.00		PART NUMBER/MSN	.000	.000	.000			0
	0010					68A410726-1001			1620003486485						
0030		UP	01		24		1.00		STRIP ANODIZE MED PART	.136	.033	.169	.5	10	
	0010	E				ZCD-ST-S1	1.00		STRIP ANODIZE	.12630		.156			
	0020	E				RJP-PW-R1	1.00	REN RPL PAPERWK SIGN OFF DOC		.01001		.012			
0050		UP	01		24		1.00		ANODIZE MED PART	.460	.111	.571	.8	33	
	0010	E				RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
	0020	E				ZPL-AN-M1	1.00	ANODIZE MEDIUM SIZE PART		.36341		.450			
	0030	E				RJP-PW-R1	1.00	REN RPL PAPERWK SIGN OFF DOC		.01001		.012			
0060		UP	01		24		1.00		HARD ANODIZE MED PART .001	.803	.193	.996	.8	57	
	0010	E				RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
	0020	E				RPL-AN-M1	1.00	HARD ANO TO .001 SM-MED PART		.70637		.875			
	0030	E				RJP-PW-R1	1.00	REN RPL PAPERWK SIGN OFF DOC		.01001		.012			
9000		UP	01		24		.01		LABOR STANDARD HISTORY	.000	.000	.000			0
	0010							14NOV84 2 YR REVIEW W/OCC CHANGE > OLD STD < .60							
	0011							18MAR85 DOWN GRADED NOT MARKET BASKET							
	0012							21NOV85 CHANGED SUBOPS TO MATCH 958 OLD STD 3.05							
	0900							J CALDWELL TECH MANEAA							

TO INTERROGATE LABOR STANDARDS. INPUT

OCC PRD NROP NR

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26337A F15 MLG R/H HM				RCC MIPRC			7-22-3		86224				
OPER	TECH	S S	W F PF A/R REV	STEP	DL	K C DC ELEMENT	OCC	DESCRIPTION	BASE HOURS	PFD TIME	STD HOURS	DLY PCT	A C
							←	→					
							FACT	STORED	SUPPLEMENTAL				
004	S	E	UP EA B	J	88187	.13 PERCENT ENGR 86.9		TORQUE ARM F-15 2 EA	.77		.10		
0001			UP 01	00		.00		PART NUMBER/NSN	.000	.000	.000	0	
			0010			68A410646-2005		1620001386306					
0034			UP 01	24		1.00		DEGREASE	.097	.023	.120	16	
0010	E				RWB-CV-D1	1.00		VAPOR CL (DEGR)HOOK/BASKET	.08709		.107		
0020	E				RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC	.01001		.012		
0036			UP 01	24		.95		STRIP CAD	.136	.031	.161	.5 21	
0010	E				ZCD-ST-S1	1.00		STRIP CAD PLATE SMALL PART	.12630		.156		
0020	E				RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC	.01001		.012		
0038			UP 01	24		.05		STRIP RUST	.136	.002	.008	.3 1	
0010	E				ZCD-ST-S1	1.00		STRIP RUST	.12630		.156		
0020	E				RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC	.01001		.012		
0040			UP 01	24		.05		STRIP CHROME SMALL PART O.D.	.054	.001	.003 24.0	0	
0010	E				ZCR-ST-S2	.25		STRIP CHROME O.D. SMALL PART OCC 4 EA OPERATIONS	.17652		.054		
0020	E				RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC	.01001		.012		
0050			UP 01	24		.05		STRIP CHROME SMALL PART I.D.	.070	.001	.004 24.0	1	
0010	E				ZCR-ST-S1	.25		STRIP CHROME I.D. SMALL PART OCC 4 EA OPERATIONS	.24234		.075		
0020	E				RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC	.01001		.012		
0060			UP 01	24		.05		STRIP CHROME SMALL PART O.D.	.054	.001	.003 24.0	0	
0010	E				ZCR-ST-S2	.25		STRIP CHROME O.D. SMALL PART OCC 4 EA OPERATIONS	.17652		.054		
0020	E				RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC	.01001		.012		
0070			UP 01	24		.05		STRIP CHROME SMALL PART I.D.	.070	.001	.004 24.0	1	
0010	E				ZCR-ST-S1	.25		STRIP CHROME I.D. SMALL PART OCC 4 EA OPERATIONS	.24234		.075		
0020	E				RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC	.01001		.012		
0130			UP 01	24		.05		BAKE AFTER ETCH	.090	.001	.006 8.0	1	
0010	E				ZPL-BK-S1	1.00		BAKE SM PART 4HR/24HR BAKE	.08088		.100		
0020	E				RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC	.01001		.012		
0145			UP 01	24		.05		DEGREASE	.097	.001	.006	1	
0010	E				RWB-CV-D1	1.00		VAPOR CL (DEGR)HOOK/BASKET	.08709		.107		
0020	E				RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC	.01001		.012		
0150			UP 01	24		.05		GRIT BLAST	.046	.001	.003	0	
0010	E				RWB-CB-B1	1.00		BLAST SM PT OR BSKT V/SM PTS	.03668		.045		
0020	E				RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC	.01001		.012		
0155			UP 01	24		.05		PREP FOR CHROME SM PART O.D.	.365	.004	.023	3	
0010	N					1.00		PREP FOR CHROME	.35500		.440		
0020	E				RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC	.01001		.012		
0160			UP 01	24		.05		CHROME PLATE SMALL PART O.D.	.155	.002	.010 24.0	1	
0010	N					.50		OCC 2 EA OPERATIONS	.29000		.179		
0020	E				RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC	.01001		.012		
0170			UP 01	24		.05		CHROME PLATE SMALL PART O.D.	.155	.002	.010 24.0	1	
0010	N					.50		OCC 2 EA OPERATIONS	.29000		.179		
0020	E				RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC	.01001		.012		
0173			UP 01	24		.05		BAKE AFTER CHROME PLATE	.090	.001	.006 8.0	1	
0010	E				ZPL-BK-S1	1.00		BAKE SM PART 4HR/24HR BAKE	.08088		.100		
0020	E				RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC	.01001		.012		
0175			UP 01	24		.05		GRIT BLAST	.046	.001	.003	0	
0010	E				RWB-CB-B1	1.00		BLAST SM PT OR BSKT V/SM PTS	.03668		.045		
0020	E				RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC	.01001		.012		
0177			UP 01	24		.05		PREP FOR CHROME SM PART I.D.	.245	.003	.015	2	
0010	N					.50		OCC 2 EA OPERATIONS	.47000		.291		
0020	E				RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC	.01001		.012		
0180			UP 01	24		.05		CHROME PLATE SMALL PART I.D.	.170	.002	.011 30.0	1	
0010	N					.50		OCC 2 EA OPERATIONS	.32000		.198		

30004

Code	Material	Quantity	Description	Unit	Rate	Amount	Other	Total	Notes
0190	RJP-PW-R1	24	1.00 REM RPL PAPRWRK SIGN OFF DOC		.05				
			CHROME PLATE SMALL PART I.B.			.170	.002	.011	30.0 1
			OCZ 2 EA OPERATIONS			.32000		.198	
0200	RJP-PW-R1	24	1.00 REM RPL PAPRWRK SIGN OFF DOC		.05				
			BAKE AFTER CHROME PLATE			.01001		.012	
	ZPL-BK-S1		1.00 BAKE SM PART 4HR/24HR BAKE			.090	.001	.006	8.0 1
						.08088		.100	
0250	RJP-PW-R1	24	1.00 REM RPL PAPRWRK SIGN OFF DOC		.05				
			BAKE AFTER GRIND			.01001		.012	
	ZPL-BK-S1		1.00 BAKE SM PART 4HR/24HR BAKE			.090	.001	.006	8.0 1
						.08088		.100	
0265	RJP-PW-R1	24	1.00 REM RPL PAPRWRK SIGN OFF DOC		.05				
			DEGREASE			.01001		.012	
	RWB-CV-D1		1.00 VAPOR CL (DEGR)HOOK/BASKET			.097	.001	.006	1
						.08709		.107	
0275	RJP-PW-R1	24	1.00 REM RPL PAPRWRK SIGN OFF DOC		.05				
			GRIT BLAST			.01001		.012	
	RWB-CB-B1		1.00 BLAST SM PT OR BSKT V/SM PTS			.046	.011	.058	7
						.03668		.045	
0280	RJP-PW-R1	24	1.00 REM RPL PAPRWRK SIGN OFF DOC		.95				
			CAD PLATE			.01001		.012	
	ZPL-CD-S1		1.00 CADMIUM PLATE SMALL PART			.102	.023	.120	15
						.09212		.114	
0290	RJP-PW-R1	24	1.00 REM RPL PAPRWRK SIGN OFF DOC		.95				
			BAKE AFTER CAD PLATE			.01001		.012	
	ZPL-BK-S1		1.00 BAKE SM PART 4HR/24HR BAKE			.090	.021	.107	38.0 14
						.08088		.100	
0300	RJP-PW-R1	24	1.00 REM RPL PAPRWRK SIGN OFF DOC		.75				
						.033	.008	.040	5
	ZPL-IR-S1		1.00 IRIDITE SMALL PART			.02362		.029	
						.01001		.012	
0313	RJP-PW-R1	24	1.00 REM RPL PAPRWRK SIGN OFF DOC		.05				
			I.V.D. ALUMINUM PLATE			.230	.003	.014	1.0 2
			I.V.D. PLATE			.22000		.272	
	RJP-PW-R1		1.00 REM RPL PAPRWRK SIGN OFF DOC/			.01001		.012	
0317	RJP-PW-R1	24	1.00 REM RPL PAPRWRK SIGN OFF DOC/		.05				
			ALODINE I.V.D. ALUM PLATE			.230	.003	.014	2
			ALODINE			.22000		.272	
9000	RJP-PW-R1	24	1.00 REM RPL PAPRWRK SIGN OFF DOC/		.01				
			LABOR STANDARD HISTORY			.000	.000	.000	0
0010			14NOV84 2 YR REVIEW W/OCC CHANGE > OLD STD <		.07				
0011			18MAR85 DOWN GRADED NOT MARKET BASKET						
0012			22NOV85 CHANGED SUBOPS TO MATCH 958 OLD STD		.10				
0900			J.CALDWELL TECH MANEAM						

TO INTERROGATE LABOR STANDARDS, INPUT

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OPER	TECH	S	S	M	F	P	A/R	REV	SUB	T	K	#R	A	FA	SUPPORT	OCC	←	DESCRIPTION	→	BASE	PFD	STD	A
STEP	D	L	K	C	DC	ELEMENT	FACT	STOR	DESCRIPTION	SUPPLEMENTAL	HOURS	TIME	HOURS	DLY	PCT	C							
006	S	E	UP	EA	B	J 88188	.07	PERCENT ENGR 90.7		APEX PIN-JURY LINK, F15 MAIN	.74		.05										
0001			UP	01	00		.00			PART NUMBER/NSW	.000	.000	.000			0							
		0010						68A410764-2001		5315005546340													
0025		UP	01	24			1.00			DEGREASE	.097	.023	.120		16								
	0010	E				RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET			.08709		.107										
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC			.01001		.012										
0030		UP	01	24			.95			STRIP CAD	.136	.031	.161	.5	22								
	0010	E				ZCD-ST-S1	1.00	STRIP CAD PLATE SMALL PART			.12630		.156										
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC			.01001		.012										
0035		UP	01	24			.05			STRIP RUST	.136	.002	.008	.3	1								
	0010	E				ZCD-ST-S1	1.00	STRIP RUST			.12630		.156										
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC			.01001		.012										
0040		UP	01	24			.05			STRIP CHROME SMALL PART O.D.	.186	.002	.012	24.0	2								
	0010	E				ZCR-ST-S2	1.00	STRIP CHROME O.D. SMALL PART			.17652		.218										
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC			.01001		.012										
0070		UP	01	24			.05			BAKE AFTER ETCH	.090	.001	.006	8.0	1								
	0010	E				ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE			.08088		.100										
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC			.01001		.012										
0085		UP	01	24			.05			DEGREASE	.097	.001	.006		1								
	0010	E				RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET			.08709		.107										
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC			.01001		.012										
0090		UP	01	24			.05			SHOTPEEN SM STEEL PART/MASK	.278	.003	.017		2								
	0010	E				ZMA-CP-S2	1.00	MASK SMALL COMPONENT PART			.08183		.101										
	0020	E				RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART			.16131		.200										
	0030	N				ZUM-CL-02	.50	UNMASK MEDIUM SIZE CYL PART OCC 50Z FOR SMALL PART			.05067		.031										
	0040	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC			.01001		.012										
0093		UP	01	24			.05			PREP FOR CHROME SM PART O.D.	.365	.004	.023		3								
	0010	N					1.00	PREP FOR CHROME			.35500		.440										
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC			.01001		.012										
0097		UP	01	24			.05			GRIT BLAST	.046	.001	.003		0								
	0010	E				RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS			.03668		.045										
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC			.01001		.012										
0100		UP	01	24			.05			CHROME PLATE SMALL PART O.D.	.300	.004	.019	24.0	2								
	0010	N					1.00	CHROME PLATE SMALL PART O.D.			.29000		.359										
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC			.01001		.012										
0110		UP	01	24			.05			BAKE AFTER CHROME PLATE	.090	.001	.006	8.0	1								
	0010	E				ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE			.08088		.100										
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC			.01001		.012										
0130		UP	01	24			.05			BAKE AFTER GRIND	.090	.001	.006	8.0	1								
	0010	E				ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE			.08088		.100										
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC			.01001		.012										
0145		UP	01	24			.05			DEGREASE	.097	.001	.006		1								
	0010	E				RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET			.08709		.107										
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC			.01001		.012										
0155		UP	01	24			1.00			GRIT BLAST	.046	.011	.058		8								
	0010	E				RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS			.03668		.045										
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC			.01001		.012										
0160		UP	01	24			.95			CAD PLATE	.102	.023	.120		16								
	0010	E				ZPL-CD-S1	1.00	CADMIUM PLATE SMALL PART			.09212		.114										
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC			.01001		.012										
0170		UP	01	24			.95			BAKE AFTER CAD PLATE	.090	.021	.107	38.0	14								
	0010	E				ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE			.08088		.100										
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC			.01001		.012										

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Code	UP	01	24	Rate	Description	Rate	Rate	Rate	Rate	Rate
.0175				.95	UNKNOWING CONVERSION					
0010 E				1.00	IRZ SMALL PART	.02362			.029	
0020 E				1.00	REN RPL PAPERWK SIGN OFF DOC	.01001			.012	
0185	UP	01	24	.05	I.V.D. ALUMINUM PLATE	.230	.003		.014	1.0 2
0010 N				1.00	I.V.D. PLATE	.22000			.272	
0020 E				1.00	REN RPL PAPERWK SIGN OFF DOC/	.01001			.012	
0190	UP	01	24	.05	ALODINE I.V.D. ALUM PLATE	.230	.003		.014	2
0010 N				1.00	ALODINE	.22000			.272	
0020 E				1.00	REN RPL PAPERWK SIGN OFF DOC/	.01001			.012	
9000	UP	01	24	.01	LABOR STANDARD HISTORY	.000	.000		.000	0
0010					14NOV84 2 YR REVIEW W/NO CHANGE					
0011					18MAR85 DOWN GRADED NOT MARKET BASKET					
0012					13NOV85 CHANGED SUBOPS TO MATCH 958 OLD STD .20					
0900					J.CALDWELL TECH MANEAA					

TO INTERROGATE LABOR STANDARDS. INPUT

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 OPER TECH S S W F PF A/R REV

OPER	TECH	S	S	W	F	PF	A/R	REV	SUB	T	K	HR	A	FA	SUPPORT	OCC	DESCRIPTION	BASE	PFD	STD	A
STEP	D	L	K	C	DC	ELEMENT	FACT	STORED	SUPPLEMENTAL	HOURS	TIME	HOURS	DLY	PCT	C						
007	S	N	UP	EA	B	J	88190	.33	PERCENT ENGR 79.8	1.25						TRUNNION PIN. F-15 MAIN			.41		
0001			UP	01	15		.00		PART NUMBER/ NSN	.000	.000	.000			0						
	0010							68A410735-2001	1620003386529												
0034			UP	01	24		1.00		DEGREASE	.097	.023	.120		10							
	0010	E				RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107									
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012									
0036			UP	01	24		.95		STRIP CAD	.136	.031	.161	.5	13							
	0010	E				ZCD-ST-S1	1.00	STRIP CAD PLATE SMALL PART		.12630		.156									
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012									
0038			UP	01	24		.05		STRIP RUST	.136	.002	.008	.3	1							
	0010	E				ZCD-ST-S1	1.00	STRIP RUST		.12630		.156									
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012									
0040			UP	01	24		.22		STRIP CHROME SMALL PART O.D.	.098	.005	.027	24.0	2							
	0010	E				ZCR-ST-S2	.50	STRIP CHROME O.D. SMALL PART OCC 2EA OPERATIONS		.17652		.109									
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012									
0050			UP	01	24		.22		STRIP CHROME SMALL PART O.D.	.098	.005	.027	24.0	2							
	0010	E				ZCR-ST-S2	.50	STRIP CHROME O.D. SMALL PART OCC. 2EA OPERATIONS		.17652		.109									
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012									
0090			UP	01	24		.34		BAKE AFTER GRIND	.090	.007	.038	8.0	3							
	0010	E				ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100									
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012									
0105			UP	01	24		.34		DEGREASE	.097	.008	.041		3							
	0010	E				RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107									
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012									
0110			UP	01	24		.34		GRIT BLAST	.278	.023	.117		9							
	0010	E				ZMA-CP-S2	1.00	MASK SMALL COMPONENT PART		.08183		.101									
	0020	E				RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200									
	0030	N				ZUM-CL-02	.50	UNMASK MEDIUM SIZE CYL PART OCC 50% FOR SMALL PART		.05067		.031									
	0040	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012									
0113			UP	01	24		.34		PREP FOR CHROME SM PART O.D.	.365	.030	.154		12							
	0010	N					1.00	PREP FOR CHROME		.35500		.440									
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012									
0117			UP	01	24		.34		GRIT BLAST	.046	.004	.020		2							
	0010	E				RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045									
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012									
0120			UP	01	24		.22		CHROME PLATE SMALL PART O.D.	.155	.008	.042	24.0	3							
	0010	N					.50	CHROME PLATE SMALL PART O.D.		.29000		.179									
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012									
0130			UP	01	24		.22		CHROME PLATE SMALL PART O.D.	.155	.008	.042	24.0	3							
	0010	N					.50	OCC. 2EA OPERATIONS		.29000		.179									
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012									
0135			UP	01	24		.34		BAKE AFTER CHROME PLATE	.090	.007	.038	8.0	3							
	0010	E				ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100									
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012									
0170			UP	01	24		.34		BAKE AFTER GRIND	.090	.007	.038	8.0	3							
	0010	E				ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100									
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012									
0185			UP	01	24		.34		DEGREASE	.097	.008	.041		3							
	0010	E				RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107									
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012									
0191			UP	01	24		1.00		GRIT BLAST	.046	.011	.058		5							
	0010	E				RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045									
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012									

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U172	UP 01	24	1.00						
0010 E		ZPL-CB-S1	1.00	CAD PLATE SMALL PART		.09212		.114	
0020 E		RJP-PW-R1	1.00	REN RPL PAPERWK SIGN OFF DOC		.01001		.012	
0196	UP 01	24	.95	BAKE AFTER CAD PLATE		.070	.021	.107	38.0 9
0010 E		ZPL-BK-S1	1.00	BAKE SH PART 4HR/24HR BAKE		.08088		.100	
0020 E		RJP-PW-R1	1.00	REN RPL PAPERWK SIGN OFF DOC		.01001		.012	
0197	UP 01	24	.95	CHROMATE CONVERSION(IRIDITE)		.033	.008	.040	3
0010 E		ZPL-IR-S1	1.00	IRIDITE SMALL PART		.02362		.029	
0020 E		RJP-PW-R1	1.00	REN RPL PAPERWK SIGN OFF DOC		.01001		.012	
0201	UP 01	24	.05	I.V.D. ALUMINUM PLATE		.230	.003	.014	1.0 1
0010 N			1.00	I.V.D. PLATE		.22000		.272	
0020 E		RJP-PW-R1	1.00	REN RPL PAPERWK SIGN OFF DOC/		.01001		.012	
0203	UP 01	24	.05	LABOR STANDARD HISTORY		.000	.000	.000	0
0010				14NOV84 2 YR REVIEW W/OCC CHANGE > OLD STD <	.14				
0011				18MAR85 DOWN GRADED NOT MARKET BASKET					
0012				20NOV85 CHANGED SUBOPS TO MATCH 958 OLD STD	.43				
0990				J.CALDWELL TECH MANEAA					
9000	UP 01	24	.01	LABOR STANDARD HISTORY		.000	.000	.000	0
0010				14NOV84 2 YR REVIEW W/OCC CHANGE > OLD STD <	.14				
0011				18MAR85 DOWN GRADED NOT MARKET BASKET					
0012				20NOV85 CHANGED SUBOPS TO MATCH 958 OLD STD	.43				
0990				J.CALDWELL TECH MANEAA					

TO INTERROGATE LABOR STANDARDS. INPUT

RCC PRD NR0P NR

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26337A F15 MLG R/H HM  
 OPER TECH S S W F PF A/R REV

SUB	STEP	T K	#R	A	FA	SUPPORT	DCC	←	DESCRIPTION	→	BASE HOURS	PFD TIME	STD HOURS	A DLY PCT C
STEP	D L	K C	DC	ELEMENT	FACT	STORED	SUPPLEMENTAL							
008	S	E	UP	EA	B	J 88189	.26	PERCENT ENGR	92.0	LOWER DRAG BRACE F-15M	.62		.16	
0001			UP	01	00		.00			PART NUMBER/NSM	.000	.000	.000	0
	0010					68A410792-1001			1620003654004					
0030			UP	01	24		1.00			DEGREASE	.097	.023	.120	19
	0010	E				RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET			.08709		.107	
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC			.01001		.012	
0035			UP	01	24		.95			STRIP CAD	.136	.031	.161	.5 26
	0010	E				ZCD-ST-S1	1.00	STRIP CAD PLATE SMALL PART			.12630		.156	
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC			.01001		.012	
0037			UP	01	24		.05			STRIP RUST	.136	.002	.008	.3 1
	0010	E				ZCD-ST-S1	1.00	STRIP RUST			.12630		.156	
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC			.01001		.012	
0050			UP	01	24		1.00			DEGREASE	.097	.023	.120	19
	0010	E				RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET			.08709		.107	
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC			.01001		.012	
0055			UP	01	24		1.00			GRIT BLAST	.046	.011	.058	9
	0010	E				RWB-CB-B1	1.00	BLAST SH PT OR BSKT V/SH PTS			.03668		.045	
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC			.01001		.012	
0060			UP	01	24		.05			CAD PLATE	.102	.001	.006	1
	0010	E				ZPL-CD-S1	1.00	CADMIUM PLATE SMALL PART			.09212		.114	
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC			.01001		.012	
0070			UP	01	24		.05			BAKE AFTER CAD PLATE	.090	.001	.006	38.0 1
	0010	E				ZPL-BK-S1	1.00	BAKE SH PART 4HR/24HR BAKE			.08088		.100	
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC			.01001		.012	
0080			UP	01	24		.05			CHROMATE CONVERSION(IRIDITE)	.033	.000	.002	0
	0010	E				ZPL-IR-S1	1.00	IRIDITE SMALL PART			.02362		.029	
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC			.01001		.012	
0090			UP	01	24		.90			VAC CAD SMALL PART	.068	.015	.077	1.0 12
	0010	E				ZPL-VC-S1	1.00	VAC CAD PLATE SMALL PART			.05856		.072	
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC			.01001		.012	
0092			UP	01	24		.90			HOT WATER RINSE	.030	.006	.033	5
	0010	N					1.00			HOT WATER RINSE	.02000		.024	
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC			.01001		.012	
0094			UP	01	24		.05			I.V.D. ALUMINUM PLATE	.230	.003	.014	1.0 2
	0010	N					1.00			I.V.D. PLATE	.22000		.272	
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC/			.01001		.012	
0096			UP	01	24		.05			MLODINE I.V.D. ALUM PLATE	.230	.003	.014	2
	0010	N					1.00			MLODINE	.22000		.272	
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC/			.01001		.012	
9000			UP	01	24		.01			LABOR STANDARD HISTORY	.000	.000	.000	0
	0010									14NOV84 2 YR REVIEW W/OCC CHANGE > OLD STD <	.03			
	0011									18MAR85 DOWN GRADED NOT MARKET BASKET				
	0012									19NOV85 CHANGED SUBOPS TO MATCH 958 OLD STD	.17			
	0900									J.CALDWELL TECH MANEAA				

TO INTERROGATE LABOR STANDARDS, INPUT

RCC PRD MROP NR

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36008 N



OPER	TECH	S	S	W	F	PF	A/R	REV	SUB	T	K	1R	A	FA	SUPPORT	OCC	←	DESCRIPTION	→	BASE	FPD	STD	
STEP	D	L	K	C	DC	ELEMENT	FACT	STORED	SUPPLEMENTAL	HOURS	TIME	HOURS	DLY	PCT									
0009	S	E	UP	EA	B	J 88194	.07	PERCENT ENGR 90.6	JURY LINK PIN F-15H	.73										.05			
0001			UP	01	00		.00		PART NUMBER/NSN	.000	.000	.000											0
	0010							68A410756-1001	1620003386530														
0024			UP	01	24		1.00		DEGREASE	.097	.023	.120											16
	0010	E				RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107											
	0020	E				RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC		.01001		.012											
0026			UP	01	24		.95		STRIP CAD	.136	.031	.161	.5	22									
	0010	E				ZCD-ST-S1	1.00	STRIP CAD PLATE SMALL PART		.12630		.156											
	0020	E				RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC		.01001		.012											
0028			UP	01	24		.05		STRIP RUST	.136	.002	.008	.3	1									
	0010	E				ZCD-ST-S1	1.00	STRIP RUST		.12630		.156											
	0020	E				RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC		.01001		.012											
0040			UP	01	24		.05		STRIP CHROME SMALL PART O.D.	.186	.002	.012	24.0	2									
	0010	E				ZCR-ST-S2	1.00	STRIP CHROME O.D. SMALL PART		.17652		.218											
	0020	E				RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC		.01001		.012											
0070			UP	01	24		.05		BAKE AFTER ETCH	.090	.001	.006	8.0	1									
	0010	E				ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100											
	0020	E				RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC		.01001		.012											
0085			UP	01	24		.05		DEGREASE	.097	.001	.006		1									
	0010	E				RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107											
	0020	E				RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC		.01001		.012											
0090			UP	01	24		.05		SHOTPEEN SM STEEL PART/MASK	.278	.003	.017		2									
	0010	E				ZMA-CP-S2	1.00	MASK SMALL COMPONENT PART		.08183		.101											
	0020	E				RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200											
	0030	N				ZUM-CL-02	.50	UNMASK MEDIUM SIZE CYL PART	OCC 50% FOR SMALL PART	.05067		.031											
	0040	E				RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC		.01001		.012											
0093			UP	01	24		.05		PREP FOR CHROME SM PART O.D.	.365	.004	.023		3									
	0010	N					1.00		PREP FOR CHROME	.35500		.440											
	0020	E				RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC		.01001		.012											
0097			UP	01	24		.05		GRIT BLAST	.046	.001	.003		0									
	0010	E				RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045											
	0020	E				RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC		.01001		.012											
0100			UP	01	24		.05		CHROME PLATE SMALL PART O.D.	.155	.002	.010	24.0	1									
	0010	N					.50		OCC 2 EA OPERATIONS	.29000		.179											
	0020	E				RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC		.01001		.012											
0111			UP	01	24		.05		CHROME PLATE SMALL PART O.D.	.155	.002	.010	24.0	1									
	0010	N					.50		OCC 2 EA OPERATIONS	.29000		.179											
	0020	E				RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC		.01001		.012											
0115			UP	01	24		.05		BAKE AFTER CHROME PLATE	.090	.001	.006	8.0	1									
	0010	E				ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100											
	0020	E				RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC		.01001		.012											
0130			UP	01	24		.05		BAKE AFTER GRIND	.090	.001	.006	8.0	1									
	0010	E				ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100											
	0020	E				RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC		.01001		.012											
0145			UP	01	24		.05		DEGREASE	.097	.001	.006		1									
	0010	E				RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107											
	0020	E				RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC		.01001		.012											
0153			UP	01	24		1.00		GRIT BLAST	.046	.011	.058		8									
	0010	E				RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045											
	0020	E				RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC		.01001		.012											
0155			UP	01	24		.05		VAC CAD SMALL PART	.068	.001	.004	1.0	1									
	0010	E				ZPL-VC-S1	1.00	VAC CAD PLATE SMALL PART		.05856		.072											
	0020	E				RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC		.01001		.012											

16009

0166	UP 01	24	.90	CAD PLATE	.102	.022	.114	15
0010 E		ZPL-CD-S1	1.00	CAD PLATE SMALL PART	.09212		.114	
0020 E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012	
0170	UP 01	24	.90	BAKE AFTER CAD PLATE	.090	.020	.101	38.0 14
0010 E		ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE	.08088		.100	
0020 E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012	
0175	UP 01	24	.95	CHROMATE CONVERSION(IRIDITE)	.033	.008	.040	5
0010 E		ZPL-IR-S1	1.00	IRIDITE SMALL PART	.02362		.029	
0020 E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012	
0183	UP 01	24	.05	I.V.D. ALUMINUM PLATE	.230	.003	.014	1.0 2
0010 N			1.00	I.V.D. PLATE	.22000		.272	
0020 E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC/	.01001		.012	
0187	UP 01	24	.05	ALODINE I.V.D. ALUM PLATE	.230	.003	.014	2
0010 N			1.00	ALODINE	.22000		.272	
0020 E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC/	.01001		.012	
9000	UP 01	24	.01	LABOR STANDARD HISTORY	.000	.000	.000	0
0010				14NOV84 2 YR REVIEW W/NO CHANGE				
0011				18MAR85 DOWN GRADED NOT MARKET BASKET				
0012				13NOV85 CHANGED SUBOPS TO MATCH 958 OLD STD .20				
0900				J.CALDWELL TECH MANEAA				

TO INTERROGATE LABOR STANDARDS. INPUT

RCC PRD NROP NR

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26337A F15 MLG R/H HW

RCC MNPIC

4-22-3

86224

OPER	TECH	S	S	W	F	PF	A/R	REV	OCC	DESCRIPTION	BASE	PFD	STD	A
SUB	T	K	#R	A	FA	SUPPORT	FACT	STOR	SUPPLEMENTAL	HOURS	TIME	HOURS	DLY	PCT
STEP	D	L	K	C	DC	ELEMENT	FACT	STOR	SUPPLEMENTAL	HOURS	TIME	HOURS	DLY	PCT
010	S	E	UP	EA	B	J	88189	.10	PERCENT EMGR 99.9	F-15 MAIN LOWER JURY LINK	.36		.03	
0001			UP	01	00			.00		PART NUMBER/NSN	.000	.000	.000	0
	0010								68A410795-1003	1620010360263				
0030			UP	01	24			1.00		STRIP ANODIZE MED PART	.136	.033	.169	.5 47
	0010	E			ZCD-ST-S1			1.00		STRIP ANODIZE	.12630		.156	
	0020	E			RJP-PW-R1			1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012	
0050			UP	01	24			1.00		ANODIZE SMALL PART	.156	.037	.193	.8 53
	0010	E			RWB-CV-D1			1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107	
	0020	E			ZPL-WN-S1			1.00	ANODIZE SMALL PART		.05892		.073	
	0030	E			RJP-PW-R1			1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012	
9000			UP	01	24			.01		LABOR STANDARD HISTORY	.000	.000	.000	0
	0010									13SEP83 NEW INPUT-NO OCC FACTOR HISTORY				
	0011									14NOV84 2 YR REVIEW W/NO CHANGE				
	0012									18MAR85 DOWN GRADED NOT MARKET BASKET				
	0013									25NOV85 CHANGED SUBOPS TO MATCH 958 OLD STD .29				
	0900									J.CALDWELL TECH MANEAA				

TO INTERROGATE LABOR STANDARDS. INPUT

RCC PRD MROP NR

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30215

RCC INPRC

m4-22-3

86224

26337A F15 MLG R/H MM

OPER TECH S S W F PF A/R REV

SUB T K #R A FA SUPPORT OCC

STEP D L K C DC ELEMENT FACT

DESCRIPTION  
 ----->-----  
 STORED SUPPLEMENTAL

BASE PFD STD A  
 HOURS TIME HOURS DLY PCT C

STEP	D	L	K	C	DC	ELEMENT	FACT	DESCRIPTION	BASE HOURS	PFD TIME	STD HOURS	A DLY	PCT	C
011	S	E	UP	EA	B	J 88195	.81	PERCENT ENGR 91.5	.81		.65			
0001			UP	01	00		.00	UPPER JURY LINK F-15H PART NUMBER/NSN	.000	.000	.000			0
			0010					68A410794-1006						
			0020					68A410794-1005						
0040			UP	01	24		1.00	DEGREASE	.097	.023	.120			15
			0010	E		RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET	.08709		.107			
			0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012			
0042			UP	01	24		.95	STRIP CAD	.136	.031	.161	.5		20
			0010	E		ZCD-ST-S1	1.00	STRIP CAD PLATE SMALL PART	.12630		.156			
			0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012			
0043			UP	01	24		.05	STRIP RUST	.136	.002	.008	.3		1
			0010	E		ZCD-ST-S1	1.00	STRIP RUST	.12630		.156			
			0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012			
0045			UP	01	24		.05	STRIP CHROME SMALL PART O.D.	.186	.002	.012	24.0		1
			0010	E		ZCR-ST-S2	1.00	STRIP CHROME O.D. SMALL PART	.17652		.218			
			0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012			
0070			UP	01	24		.82	BAKE AFTER ETCH	.090	.018	.092	8.0		11
			0010	E		ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE	.08088		.100			
			0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012			
0085			UP	01	24		.82	DEGREASE	.097	.019	.099			12
			0010	E		RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET	.08709		.107			
			0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012			
0090			UP	01	24		.05	SHOTPEEN SM STEEL PART/MASK	.278	.003	.017			2
			0010	E		ZMA-CP-S2	1.00	MASK SMALL COMPONENT PART	.08183		.101			
			0020	E		RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART	.16131		.200			
			0030	N		ZUM-CL-02	.50	UNMASK MEDIUM SIZE CYL PART OCC 50% FOR SMALL PART	.05067		.031			
			0040	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012			
0093			UP	01	24		.05	PREP FOR CHROME SM PART O.D.	.365	.004	.023			3
			0010	N			1.00	PREP FOR CHROME	.35500		.440			
			0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012			
0097			UP	01	24		.05	GRIT BLAST	.046	.001	.003			0
			0010	E		RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS	.03668		.045			
			0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012			
0100			UP	01	24		.05	CHROME PLATE SMALL PART O.D.	.300	.004	.019	24.0		2
			0010	N			1.00	CHROME PLATE SMALL PART O.D.	.29000		.359			
			0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012			
0110			UP	01	24		.05	BAKE AFTER CHROME PLATE	.090	.001	.006	8.0		1
			0010	E		ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE	.08088		.100			
			0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012			
0130			UP	01	24		.05	BAKE AFTER GRIND	.090	.001	.006	8.0		1
			0010	E		ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE	.08088		.100			
			0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012			
0145			UP	01	24		.05	DEGREASE	.097	.001	.006			1
			0010	E		RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET	.08709		.107			
			0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012			
0155			UP	01	24		1.00	GRIT BLAST	.046	.011	.058			7
			0010	E		RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS	.03668		.045			
			0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012			
0160			UP	01	24		.23	CAD PLATE	.102	.006	.029			4
			0010	E		ZPL-CD-S1	1.00	CADMIUM PLATE SMALL PART	.09212		.114			
			0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012			
0162			UP	01	24		.72	VAC CAD SMALL PART	.068	.012	.061	1.0		8
			0010	E		ZPL-VC-S1	1.00	VAC CAD PLATE SMALL PART	.05856		.072			

36011

Code	Material	QTY	Description	Unit	Price	Ext	Weight	Count
0020 E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC					
0165	UP 01 24	.23	BAKE AFTER CAD PLATE		.090	.005	.026	38.0 3
0010 E	ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100	
0020 E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012	
0170	UP 01 24	.95	CHROMATE CONVERSION(IRIDITE)		.033	.008	.040	5
0010 E	ZPL-IR-S1	1.00	IRIDITE SMALL PART		.02362		.029	
0020 E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012	
0193	UP 01 24	.05	I.V.D. ALUMINUM PLATE		.230	.003	.014	1.0 2
0010 N		1.00	I.V.D. PLATE		.22000		.272	
0020 E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC/		.01001		.012	
0197	UP 01 24	.05	ALODINE I.V.D. ALUM PLATE		.230	.003	.014	2
0010 N		1.00	ALODINE		.22000		.272	
0020 E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC/		.01001		.012	
9000	UP 01 24	.01	LABOR STANDARD HISTORY		.000	.000	.000	0
0010			09MAY84ADD OP 0025 OCC EST <OLD STD>	02840				
0011			14NOV84 2 YR REVIEW W/OCC CHANGE > OLD STD <	2.90				
0012			18MAR85 DOWN GRADED NOT MARKET BASKET					
0013			19NOV85 CHANGED SUBOPS TO MATCH 958 OLD STD	.83				
0900			J.CALDWELL TECH MANEAA					

TO INTERROGATE LABOR STANDARDS. INPUT

RCC PRD NROP NR

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OPER	TECH	S	S	W	F	P	A/R	REV	OCC	DESCRIPTION	BASE	PFD	STD	A		
SUB	T	K	#R	A	FA	SUPPORT	FACT	STORAGE	DESCRIPTION	SUPPLEMENTAL	HOURS	TIME	HOURS	DLY	PCT	C
STEP	D	L	K	C	DC	ELEMENT	FACT	STORAGE	DESCRIPTION	SUPPLEMENTAL	HOURS	TIME	HOURS	DLY	PCT	C
02	S	N	UP	EA	B	J 88190	.05	PERCENT ENGR 67.9	RETRACT BOLT F-15 MAIN		2.68		.13			
0001			UP	01	15		.00		PART NUMBER/ NSM		.000	.000	.000		0	
						68A410768-1001			1620003386550							
0030			UP	01	24		1.00		DEGREASE		.097	.023	.120		4	
						RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET			.08709		.107			
						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012			
0035			UP	01	24		.95		STRIP CAD		.136	.031	.161	.5	6	
						ZCD-ST-S1	1.00	STRIP CAD PLATE SMALL PART			.12630		.156			
						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012			
0040			UP	01	24		.05		STRIP RUST		.136	.002	.008	.3	0	
						ZCD-ST-S1	1.00	STRIP RUST			.12630		.156			
						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012			
0050			UP	01	24		1.00		STRIP CHROME SMALL PART O.D.		.186	.045	.231	24.0	9	
						ZCR-ST-S2	1.00	STRIP CHROME O.D. SMALL PART			.17652		.218			
						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012			
0090			UP	01	24		1.00		BAKE AFTER ETCH		.090	.022	.113	8.0	4	
						ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE			.08088		.100			
						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012			
0105			UP	01	24		1.00		DEGREASE		.097	.023	.120		4	
						RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET			.08709		.107			
						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012			
0110			UP	01	24		1.00		SHOTPEEN SM STEEL PART/MASK		.278	.067	.345		13	
						ZMA-CP-S2	1.00	MASK SMALL COMPONENT PART			.08183		.101			
						RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART			.16131		.200			
						ZUM-CL-02	.50	UNMASK MEDIUM SIZE CYL PART OCC 50% FOR SMALL PART			.05067		.031			
						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012			
0120			UP	01	24		1.00		PREP FOR CHROME SM PART O.D.		.365	.088	.453		17	
							1.00		PREP FOR CHROME		.35500		.440			
						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012			
0125			UP	01	24		1.00		GRIT BLAST		.046	.011	.058		2	
						RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS			.03668		.045			
						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012			
0130			UP	01	24		1.00		CHROME PLATE SMALL PART O.D.		.300	.072	.372	24.0	14	
							1.00		CHROME PLATE SMALL PART O.D.		.29000		.359			
						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012			
0140			UP	01	24		1.00		BAKE AFTER GRIND		.090	.022	.113	8.0	4	
						ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE			.08088		.100			
						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012			
0170			UP	01	24		1.00		BAKE AFTER GRIND		.090	.022	.113	8.0	4	
						ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE			.08088		.100			
						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012			
0185			UP	01	24		1.00		DEGREASE		.097	.023	.120		4	
						RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET			.08709		.107			
						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012			
0195			UP	01	24		1.00		GRIT BLAST		.046	.011	.058		2	
						RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS			.03668		.045			
						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012			
0200			UP	01	24		.95		CAD PLATE		.102	.023	.120		4	
						ZPL-CD-S1	1.00	CADMIUM PLATE SMALL PART			.09212		.114			
						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012			
0210			UP	01	24		.95		BAKE AFTER CAD PLATE		.090	.021	.107	38.0	4	
						ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE			.08088		.100			
						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012			

30512

0215	UP 01	24	.95	GRANITE CONVERSION TABLE				
0010 E		ZPL-IR-S1	1.00	IR TYPE SMALL PART		.02362		.029
0020 E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012
0223	UP 01	24	.05	I.V.D. ALUMINUM PLATE		.230	.003	.014 1.0 1
0010 N			1.00	I.V.D. PLATE		.22000		.272
0020 E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC/		.01001		.012
0227	UP 01	24	.05	ALODINE I.V.D. ALUM PLATE		.230	.003	.014 1
0010 N			1.00	ALODINE		.22000		.272
0020 E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC/		.01001		.012
9000	UP 01	24	.01	LABOR STANDARD HISTORY		.000	.000	.000 0
0010				14NOV84 2 YR REVIEW W/NO CHANGE				
0011				18MAR85 DOWN GRADED NOT MARKET BASKET				
0012				19NOV85 CHANGED SUPCPS TO MATCH 958 OLD STD .14				
0900				J.CALDWELL TECH MANEAM				

TO INTERROGATE LABOR STANDARDS. INPUT

RCC PRD NROP NR  
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26337A F15 MLG R/H HW

RCC MPRC

4-22-3

86224

OPER	TECH	S	S	W	F	PF	A/R	REV	OCC	DESCRIPTION	BASE	FPD	STD	A
SUB	T	K	BR	A	FA	SUPPORT	DC	ELEMENT	FACT	STORED	HOURS	TIME	HOURS	DLY PCT C
STEP	D	L	K	C	DC	ELEMENT	FACT			SUPPLEMENTAL				
13	S	E	UP	EA	B	J	88197		.15	PERCENT ENGR 85.3	.61		.09	
0001			UP	01	00				.00	SPINDLE ASSY F-15M PART NUMBER/NSM	.000	.000	.000	0
										68A410624-1001 1620003337133				
0024			UP	01	24				1.00	DEGREASE	.097	.023	.120	19
	0010	E				RWB-CV-D1			1.00	VAPOR CL (DEGR)HOOK/BASKET	.08709		.107	
	0020	E				RJP-PW-R1			1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012	
0026			UP	01	24				.95	STRIP CAD	.136	.031	.161	.5 26
	0010	E				ZCD-ST-S1			1.00	STRIP CAD PLATE SMALL PART	.12630		.156	
	0020	E				RJP-PW-R1			1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012	
0028			UP	01	24				.05	STRIP RUST	.136	.002	.008	.3 1
	0010	E				ZCD-ST-S1			1.00	STRIP RUST	.12630		.156	
	0020	E				RJP-PW-R1			1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012	
0040			UP	01	24				.05	PREP FOR CHROME SM PART O.D.	.187	.002	.012	2
	0010	N							.50	OCC 2 EA OPERATIONS	.35500		.220	
	0020	E				RJP-PW-R1			1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012	
0050			UP	01	24				.05	PREP FOR CHROME SM PART O.D.	.187	.002	.012	2
	0010	N							.50	OCC 2 EA OPERATIONS	.35500		.220	
	0020	E				RJP-PW-R1			1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012	
0090			UP	01	24				.05	BAKE AFTER ETCH	.090	.001	.006	8.0 1
	0010	E				ZPL-BK-S1			1.00	BAKE SM PART 4HR/24HR BAKE	.08088		.100	
	0020	E				RJP-PW-R1			1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012	
0100			UP	01	24				.05	DEGREASE	.097	.001	.006	1
	0010	E				RWB-CV-D1			1.00	VAPOR CL (DEGR)HOOK/BASKET	.08709		.107	
	0020	E				RJP-PW-R1			1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012	
0110			UP	01	24				.05	SHOTPEEN SM STEEL PART/MASK	.278	.003	.017	3
	0010	E				ZMA-CP-S2			1.00	MASK SMALL COMPONENT PART	.08183		.101	
	0020	E				RPL-SP-M1			1.00	SHOT PEEN SMALL/MED PART	.16131		.200	
	0030	N				ZUM-CL-02			.50	UNMASK MEDIUM SIZE CYL PART OCC 50% FOR SMALL PART	.05067		.031	
	0040	E				RJP-PW-R1			1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012	
0113			UP	01	24				.05	PREP FOR CHROME SM PART O.D.	.365	.004	.023	4
	0010	N							1.00	PREP FOR CHROME	.35500		.440	
	0020	E				RJP-PW-R1			1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012	
0117			UP	01	24				.05	GRIT BLAST	.046	.001	.003	0
	0010	E				RWB-CB-B1			1.00	BLAST SM PT OR BSKT V/SM PTS	.03668		.045	
	0020	E				RJP-PW-R1			1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012	
0120			UP	01	24				.05	CHROME PLATE SMALL PART O.D.	.155	.002	.010 24.0	2
	0010	N							.50	OCC 2 EA OPERATIONS	.29000		.179	
	0020	E				RJP-PW-R1			1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012	
0130			UP	01	24				.05	CHROME PLATE SMALL PART O.D.	.155	.002	.010 24.0	2
	0010	N							.50	OCC 2 EA OPERATIONS	.29000		.179	
	0020	E				RJP-PW-R1			1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012	
0140			UP	01	24				.05	BAKE AFTER CHROME PLATE	.090	.001	.006 8.0	1
	0010	E				ZPL-BK-S1			1.00	BAKE SM PART 4HR/24HR BAKE	.08088		.100	
	0020	E				RJP-PW-R1			1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012	
0170			UP	01	24				.05	BAKE AFTER GRIND	.090	.001	.006 8.0	1
	0010	E				ZPL-BK-S1			1.00	BAKE SM PART 4HR/24HR BAKE	.08088		.100	
	0020	E				RJP-PW-R1			1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012	
0177			UP	01	24				.05	DEGREASE	.097	.001	.006	1
	0010	E				RWB-CV-D1			1.00	VAPOR CL (DEGR)HOOK/BASKET	.08709		.107	
	0020	E				RJP-PW-R1			1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012	
0181			UP	01	24				1.00	GRIT BLAST	.046	.011	.058	9
	0010	E				RWB-CB-B1			1.00	BLAST SM PT OR BSKT V/SM PTS	.03668		.045	
	0020	E				RJP-PW-R1			1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012	

36013



Item	UP	01	24	QTY	DESCRIPTION	UNIT	PRICE	TOTAL	EXT	QTY
0183				.90	VACUUM PLATE SMALL PART					
0010 E				1.00	ZPL-VC-S1 VACUUM PLATE SMALL PART		.05856		.072	
0020 E				1.00	RJP-PW-R1 REM RPL PAPWRK SIGN OFF DOC		.01001		.012	
0185	UP	01	24	.05	CAD PLATE		.102	.001	.006	1
0010 E				1.00	ZPL-CD-S1 CADMIUM PLATE SMALL PART		.09212		.114	
0020 E				1.00	RJP-PW-R1 REM RPL PAPWRK SIGN OFF DOC		.01001		.012	
0187	UP	01	24	.05	BAKE AFTER CAD PLATE		.090	.001	.006	38.0 1
0010 E				1.00	ZPL-BK-S1 BAKE SM PART 4HR/24HR BAKE		.08088		.100	
0020 E				1.00	RJP-PW-R1 REM RPL PAPWRK SIGN OFF DOC		.01001		.012	
0191	UP	01	24	.95	CHROMATE CONVERSION(IRIDITE)		.033	.008	.040	6
0010 E				1.00	ZPL-IR-S1 IRIDITE SMALL PART		.02362		.029	
0020 E				1.00	RJP-PW-R1 REM RPL PAPWRK SIGN OFF DOC		.01001		.012	
0193	UP	01	24	.05	I.V.D. ALUMINUM PLATE		.230	.003	.014	1.0 2
0010 N				1.00	I.V.D. PLATE		.22000		.277	
0020 E				1.00	RJP-PW-R1 REM RPL PAPWRK SIGN OFF DOC/		.01001		.012	
0195	UP	01	24	.05	ALODINE I.V.D. ALUM PLATE		.230	.003	.014	2
0010 N				1.00	ALODINE		.22000		.272	
0020 E				1.00	RJP-PW-R1 REM RPL PAPWRK SIGN OFF DOC/		.01001		.012	
9000	UP	01	00	.00	LAOBR STANDARD HISTORY		.000	.000	.000	0
0001					15 JUL 88 INITIAL INPUT					
0900					KIM VINCENT, MANEL, 73255					

TO INTERROGATE LABOR STANDARDS, INPUT

RCC PRD NROP NR

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26337A F15 MLG R/H MW  
OPER TECH S S W F PF A/R REV  
SUB T K BR A FA SUPPORT  
STEP D L K C DC ELEMENT

OCC ←----- DESCRIPTION ----->  
FACT STORED SUPPLEMENTAL  
BASE PFD STD A  
HOURS TIME HOURS DLY PCT C

OPER	TECH	S	S	W	F	PF	A/R	REV	OCC	DESCRIPTION	BASE HOURS	PFD TIME	STD HOURS	A DLY PCT C
0014	S	E	UP	EA	B	J	88196	.48	PERCENT ENGR 87.7	SWIVEL CRANK DRAG BOLT F-15M	.76		.36	
0001			UP	01	00			.00		PART NUMBER/NSM	.000	.000	.000	0
0010									68A410637-1001	NSL				
0024			UP	01	24			1.00		DEGREASE	.097	.023	.120	16
0010	E					RWB-CV-D1		1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107	
0020	E					RJP-PW-R1		1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012	
0026			UP	01	24			.95		STRIP CAD	.136	.031	.161	.5 21
0010	E					ZCD-ST-S1		1.00	STRIP CAD PLATE SMALL PART		.12630		.156	
0020	E					RJP-PW-R1		1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012	
0028			UP	01	24			.05		STRIP RUST	.136	.002	.008	.3 1
0010	E					ZCD-ST-S1		1.00	STRIP RUST		.12630		.156	
0020	E					RJP-PW-R1		1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012	
0040			UP	01	24			.08		STRIP CHROME SMALL PART O.D.	.186	.004	.019	24.0 2
0010	E					ZCR-ST-S2		1.00	STRIP CHROME O.D. SMALL PART		.17652		.218	
0020	E					RJP-PW-R1		1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012	
0070			UP	01	24			.08		BAKE AFTER ETCH	.090	.002	.009	8.0 1
0010	E					ZPL-BK-S1		1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100	
0020	E					RJP-PW-R1		1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012	
0080			UP	01	24			.08		DEGREASE	.097	.002	.010	1
0010	E					RWB-CV-D1		1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107	
0020	E					RJP-PW-R1		1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012	
0090			UP	01	24			.08		SHOTPEEN SM STEEL PART/MASK	.278	.005	.028	4
0010	E					ZMA-CP-S2		1.00	MASK SMALL COMPONENT PART		.08183		.101	
0020	E					RPL-SP-M1		1.00	SHOT PEEN SMALL/MED PART		.16131		.200	
0030	N					ZUM-CL-02		.50	UNMASK MEDIUM SIZE CYL PART OCC 50Z FOR SMALL PART		.05067		.031	
0040	E					RJP-PW-R1		1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012	
0093			UP	01	24			.08		PREP FOR CHROME SM PART O.D.	.365	.007	.036	5
0010	N							1.00	PREP FOR CHROME		.35500		.440	
0020	E					RJP-PW-R1		1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012	
0097			UP	01	24			.08		GRIT BLAST	.046	.001	.005	1
0010	E					RWB-CB-B1		1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045	
0020	E					RJP-PW-R1		1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012	
0100			UP	01	24			.08		CHROME PLATE SMALL PART O.D.	.300	.006	.030	24.0 4
0010	N							1.00	CHROME PLATE SMALL PART O.D.		.29000		.359	
0020	E					RJP-PW-R1		1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012	
0110			UP	01	24			.08		BAKE AFTER CHROME PLATE	.090	.002	.009	8.0 1
0010	E					ZPL-BK-S1		1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100	
0020	E					RJP-PW-R1		1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012	
0130			UP	01	24			.08		BAKE AFTER GRIND	.090	.002	.009	8.0 1
0010	E					ZPL-BK-S1		1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100	
0020	E					RJP-PW-R1		1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012	
0145			UP	01	24			.08		DEGREASE	.097	.002	.010	1
0010	E					RWB-CV-D1		1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107	
0020	E					RJP-PW-R1		1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012	
0155			UP	01	24			1.00		GRIT BLAST	.046	.011	.058	8
0010	E					RWB-CB-B1		1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045	
0020	E					RJP-PW-R1		1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012	
0160			UP	01	24			.95		CAD PLATE	.102	.023	.120	16
0010	E					ZPL-CD-S1		1.00	CADMIUM PLATE SMALL PART		.09212		.114	
0020	E					RJP-PW-R1		1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012	
0170			UP	01	24			.95		BAKE AFTER CAD PLATE	.090	.021	.107	39.0 14
0010	E					ZPL-BK-S1		1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100	
0020	E					RJP-PW-R1		1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012	

36014

0183	UP 01	24	.05	I.V.D. ALUMINUM PLATE	.230	.003	.014	1.00	2
0010 M			1.00	I.V.D. PLATE	.22000		.272		
0020 E	RJP-PW-R1	1.00	REM RPL PAPERWORK SIGN OFF DOC/		.01001		.012		
0187	UP 01	24	.05	ALODINE I.V.D. ALUM PLATE	.230	.003	.014		2
0010 M			1.00	ALODINE	.22000		.272		
0020 E	RJP-PW-R1	1.00	REM RPL PAPERWORK SIGN OFF DOC/		.01001		.012		
000	UP 01	00	.00	LABOR STANDARD HISTORY	.000	.000	.000		0
0010				14 JUL 88					
0900				KIM VINCENT, MANEL. 73255					

TO INTERROGATE LABOR STANDARDS. INPUT

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26337A F15 MLG R/H HW

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MA-22-3

86224

OPER	TECH	S	S	W	F	PF	A/R	REV	SUB	T	K	#R	A	FA	SUPPORT	OCC	←	DESCRIPTION	→	BASE	PFD	STD	A
STEP	D	L	K	C	DC	ELEMENT	FACT	STORED	SUPPLEMENTAL	HOURS	TIME	HOURS	DLY	PCT	C								
116	S	E	UP	EA	B	J	88196	.63	PERCENT ENGR 94.6									COLLAR ASSY F-15M		.53		.33	
0001			UP	01	00		.00		PART NUMBER/NSN	.000	.000	.000											0
	0010							68A410733-1001	1620003386559														
	0020							68A410733-1002	1620003386559														
0024			UP	01	24		1.00		DEGREASE	.097	.023	.120											22
	0010	E				RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107											
	0020	E				RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012											
0026			UP	01	24		.95		STRIP CAD	.136	.031	.161	.5										30
	0010	E				ZCD-ST-S1	1.00	STRIP CAD PLATE SMALL PART		.12630		.156											
	0020	E				RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012											
0028			UP	01	24		.05		STRIP RUST	.136	.002	.008	.3										2
	0010	E				ZCD-ST-S1	1.00	STRIP RUST		.12630		.156											
	0020	E				RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012											
0080			UP	01	24		.05		BAKE AFTER ETCH	.090	.001	.006	8.0										1
	0010	E				ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100											
	0020	E				RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012											
0095			UP	01	24		.05		DEGREASE	.097	.001	.006											1
	0010	E				RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107											
	0020	E				RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012											
0100			UP	01	24		.05		SHOTPEEN SM STEEL PART/MASK	.278	.003	.017											3
	0010	E				ZMA-CP-S2	1.00	MASK SMALL COMPONENT PART		.08183		.101											
	0020	E				RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200											
	0030	N				ZUM-CL-02	.50	UNMASK MEDIUM SIZE CYL PART OCC 50% FOR SMALL PART		.05067		.031											
	0040	E				RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012											
0105			UP	01	24		1.00		GRIT BLAST	.046	.011	.058											11
	0010	E				RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045											
	0020	E				RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012											
0110			UP	01	24		.12		CAD PLATE	.102	.003	.015											3
	0010	E				ZPL-CD-S1	1.00	CADMIUM PLATE SMALL PART		.09212		.114											
	0020	E				RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012											
0120			UP	01	24		.83		VAC CAD SMALL PART	.068	.014	.071	1.0										13
	0010	E				ZPL-VC-S1	1.00	VAC CAD PLATE SMALL PART		.05856		.072											
	0020	E				RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012											
0130			UP	01	24		.05		BAKE AFTER CAD PLATE	.090	.001	.006	38.0										1
	0010	E				ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100											
	0020	E				RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012											
0135			UP	01	24		.95		CHROMATE CONVERSION(IRIDITE)	.033	.008	.040											7
	0010	E				ZPL-IR-S1	1.00	IRIDITE SMALL PART		.02362		.029											
	0020	E				RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012											
0137			UP	01	24		.05		I.V.D. ALUMINUM PLATE	.230	.003	.014	1.0										3
	0010	N					1.00	I.V.D. PLATE		.22000		.272											
	0020	E				RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC/		.01001		.012											
0138			UP	01	24		.05		MODINE I.V.D. ALUM PLATE	.230	.003	.014											3
	0010	N					1.00	MODINE		.22000		.272											
	0020	E				RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC/		.01001		.012											
9000			UP	01	24		.01		LABOR STANDARD HISTORY	.000	.000	.000											0
	0010							14NOV84 2 YR REVIEW W/OCC CHANGE > OLD STD <		.04													
	0011							18MARG5 DOWN GRADED NOT MARKET BASKET															
	0012							18NOV85 CHANGED SUBOPS TO MATCH 958 OLD STD		.45													
	0013							25AUG85 SUBOP 0080 NEW REQ. OLD STANDARD		.42													
	0900							J.CALDWELL TECH MANEAM															

36016

26337A F15 HLG R/H HW

RCC MNPRC

4-22-3

86224

OPER	TECH	S	S	W	F	PF	A/R	REV	SUB	T	K	#R	A	FA	SUPPORT	OCC	←	DESCRIPTION	→	BASE	PF	STD	A
STEP	D	L	K	C	DC	ELEMENT	FACT	STORED	SUPPLEMENTAL	HOURS	TIME	HOURS	DLY	PCT	C								
0019	S	E	UP	EA	B	J	88190	.07	PERCENT ENGR 88.6									JURY BRACE APEX PIN,F15 MAIN		.60		.04	
0001			UP	01		15	.00		PART NUMBER/NSM	.000	.000	.000			0								
	0010							68A410755-2005	1620003337138														
0024			UP	01		24	1.00		DEGREASE	.097	.023	.120		20									
	0010	E						RWB-CV-D1	1.00	.08709		.107											
	0020	E						RJP-PW-R1	1.00	.01001		.012											
0026			UP	01		24	.95		STRIP CAD	.136	.031	.161	.5	26									
	0010	E						ZCD-ST-S1	1.00	.12630		.156											
	0020	E						RJP-PW-R1	1.00	.01001		.012											
0028			UP	01		24	.05		STRIP RUST	.136	.002	.008	.3	1									
	0010	E						ZCD-ST-S1	1.00	.12630		.156											
	0020	E						RJP-PW-R1	1.00	.01001		.012											
0030			UP	01		24	.05		STRIP CHROME SMALL PART O.D.	.186	.002	.012	24.0	2									
	0010	E						ZCR-ST-S2	1.00	.17652		.218											
	0020	E						RJP-PW-R1	1.00	.01001		.012											
0070			UP	01		24	.05		BAKE AFTER ETCH	.090	.001	.006	8.0	1									
	0010	E						ZPL-BK-S1	1.00	.08088		.100											
	0020	E						RJP-PW-R1	1.00	.01001		.012											
0085			UP	01		24	.05		DEGREASE	.097	.001	.006		1									
	0010	E						RWB-CV-D1	1.00	.08709		.107											
	0020	E						RJP-PW-R1	1.00	.01001		.012											
0090			UP	01		24	.05		SHOTPEEN SM STEEL PART/MASK	.278	.003	.017		3									
	0010	E						ZMA-CP-S2	1.00	.08183		.101											
	0020	E						RPL-SP-M1	1.00	.16131		.200											
	0030	N						ZUM-CL-02	.50	.05067		.031											
	0040	E						RJP-PW-R1	1.00	.01001		.012											
0093			UP	01		24	.05		PREP FOR CHROME SM PART O.D.	.365	.004	.023		4									
	0010	N							1.00	.35500		.440											
	0020	E						RJP-PW-R1	1.00	.01001		.012											
0097			UP	01		24	.05		GRIT BLAST	.046	.001	.003		0									
	0010	E						RWB-CB-B1	1.00	.03668		.045											
	0020	E						RJP-PW-R1	1.00	.01001		.012											
0100			UP	01		24	.05		CHROME PLATE SMALL PART O.D.	.155	.002	.010	24.0	2									
	0010	N							.50	.29000		.179											
	0020	E						RJP-PW-R1	1.00	.01001		.012											
0105			UP	01		24	.05		CHROME PLATE SMALL PART O.D.	.155	.002	.010	24.0	2									
	0010	N							.50	.29000		.179											
	0020	E						RJP-PW-R1	1.00	.01001		.012											
0110			UP	01		24	.05		BAKE AFTER CHROME PLATE	.090	.001	.006	8.0	1									
	0010	E						ZPL-BK-S1	1.00	.08088		.100											
	0020	E						RJP-PW-R1	1.00	.01001		.012											
0130			UP	01		24	.05		BAKE AFTER GRIND	.090	.001	.006	8.0	1									
	0010	E						ZPL-BK-S1	1.00	.08088		.100											
	0020	E						RJP-PW-R1	1.00	.01001		.012											
0145			UP	01		24	.05		DEGREASE	.097	.001	.006		1									
	0010	E						RWB-CV-D1	1.00	.08709		.107											
	0020	E						RJP-PW-R1	1.00	.01001		.012											
0153			UP	01		24	1.00		GRIT BLAST	.046	.011	.058		10									
	0010	E						RWB-CB-B1	1.00	.03668		.045											
	0020	E						RJP-PW-R1	1.00	.01001		.012											
0155			UP	01		24	.90		VAC CAD SMALL PART	.068	.015	.077	1.0	13									
	0010	E						ZPL-VC-S1	1.00	.05856		.072											
	0020	E						RJP-PW-R1	1.00	.01001		.012											

36019

0160	UP 01	24	.05	CAD PLATE	.102	.001	.006	1
0010 E		ZPL-CD-S1	1.00	CAD PLATE SMALL PART	.09212		.114	
0020 E		RJP-PW-R1	1.00	REN RPL PAPERWK SIGN OFF DOC	.01001		.012	
0170	UP 01	24	.05	BAKE AFTER CAD PLATE	.090	.001	.006	38.0 1
0010 E		ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE	.08088		.100	
0020 E		RJP-PW-R1	1.00	REN RPL PAPERWK SIGN OFF DOC	.01001		.012	
0175	UP 01	24	.95	CHROMATE CONVERSION(IRIDITE)	.033	.008	.040	7
0010 E		ZPL-IR-S1	1.00	IRIDITE SMALL PART	.02362		.029	
0020 E		RJP-PW-R1	1.00	REN RPL PAPERWK SIGN OFF DOC	.01001		.012	
0183	UP 01	24	.05	I.V.D. ALUMINUM PLATE	.230	.003	.014	1.0 2
0010 N			1.00	I.V.D. PLATE	.22000		.272	
0020 E		RJP-PW-R1	1.00	REN RPL PAPERWK SIGN OFF DOC/	.01001		.012	
0187	UP 01	24	.05	ALODINE I.V.D. ALUM PLATE	.230	.003	.014	2
0010 N			1.00	ALODINE	.22000		.272	
0020 E		RJP-PW-R1	1.00	REN RPL PAPERWK SIGN OFF DOC/	.01001		.012	
9000	UP 01	24	.01	LABOR STANDARD HISTORY	.000	.000	.000	0
0010				13SEP83 NEW INPUT-NO OCC FACTOR HISTORY				
0011				14NOV84 2 YR REVIEW W/OCC CHANGE > OLD STD < .28				
0012				18MAR85 DOWN GRADED NOT MARKET BASKET				
0013				26NOV85 CHANGED SUBOPS TO MATCH 958 OLD STD .19				
0900				J.CALDWELL TECH MANEAM				

TO INTERROGATE LABOR STANDARDS. INPUT

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26337A F15 NLG R/H HW

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86224

OPER	TECH	S	S	W	F	PF	A/R	REV	SUB	T	K	#R	A	FA	SUPPORT	OCC	DESCRIPTION	BASE	PFD	STD	A
STEP	D	L	K	C	DC	ELEMENT	FACT	STORED	SUPPLEMENTAL	HOURS	TIME	HOURS	DLY	PCT	C						
20	S	E	UP	EA	D	J	89196	.82	PERCENT ENGR 88.9								SPRING F-15M	.92		.75	
0001			UP	01	00		.00		PART NUMBER/MSN	.000	.000	.000			0						
	0010							68A410725-1001	1620001323253												
	0020							68A410725-1002	1620001323209												
0050			UP	01	24		1.00		DEGREASE	.184	.044	.228		25							
	0010	E				RWB-CV-D1	2.00	VAPOR CL (DEGR)HOOK/BASKET	OCC 2 EA PARTS	.08709		.215									
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012									
0060			UP	01	24		.95		STRIP CAD	.262	.060	.309	.5	34							
	0010	E				ZCD-ST-S1	2.00	STRIP CAD PLATE SMALL PART	OCC 2 EA PARTS	.12630		.313									
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012									
0070			UP	01	24		.05		STRIP RUST	.262	.003	.016	.3	2							
	0010	E				ZCD-ST-S1	2.00		OCC 2 EA PARTS	.12630		.313									
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012									
0080			UP	01	24		1.00		GRIT BLAST	.083	.020	.103		11							
	0010	E				RWB-CB-B1	2.00	BLAST SH PT OR BSKT V/SM PTS	OCC 2 EA PARTS	.03668		.090									
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012									
0090			UP	01	24		.95		VAC CAD SMALL PART	.127	.029	.150	1.0	16							
	0010	E				ZPL-VC-S1	2.00	VAC CAD PLATE SMALL PART	OCC 2 EA PARTS	.05856		.145									
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012									
0100			UP	01	24		.95		HOT WATER RINSE	.050	.011	.059		6							
	0010	N					2.00		OCC 2 EA PARTS	.02000		.049									
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012									
0110			UP	01	24		.05		I.V.D. ALUMINUM PLATE	.450	.005	.028	1.0	3							
	0010	N					2.00		OCC 2 EA PARTS	.22000		.545									
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC/		.01001		.012									
0120			UP	01	24		.05		ALODINE I.V.D. ALUM PLATE	.450	.005	.028		3							
	0010	N					2.00		OCC 2 EA PARTS	.22000		.545									
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC/		.01001		.012									
9000			UP	01	24		.01		LABOR STD HISTORY	.000	.000	.000		0							
	0010							13SEP83 NEW INPUT-NO OCC FACTOR HISTORY													
	0011							14NOV84 2 YR REVIEW W/OCC CHANGE > OLD STD < .02													
	0012							18NOV85 CHANGED DROPED DRY FILM NOT REQ OLD STD.18													
	0900							J.CALDWELL TECH MANEAA													

TO INTERROGATE LABOR STANDARDS. INPUT

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LABOR STANDARD OPERATION RESOURCE STANDARD AND METHOD ANALYSIS

05/26/69

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PAGE 0001

26337A F15 MLG R/H MW

RCC MNPC

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86224

PER TECH B S W F RF A/R REV

SUB	TK	HR	FA	SUPPORT	QCC	DESCRIPTION	BASE	PPD	STD	A					
STEP	D	L	K	C	DC	ELEMENT	FACT	STORED	SUPPLEMENTAL	HOURS	TIME	HOURS	DLY	PCT	C
0022	S	E	UP	EA	B	108202	1.00	PERCENT ENGR 92.1	PLATE COLLAR TRUNNION F-15M	.76		.76			
0001			UP	01	00		.00		PART NUMBER/NSN	.000	.000	.000		0	
		0010				68A410638-1010	1.00		1620010753564						
		0020				68A410638-1006	1.00		1620010381837						
0030			UP	01	24		1.00		DEGREASE	.097	.003	.120		16	
		0010	E			RWB-TV-B1	1.00	VAPOR CL (DEGR)HOON/BASKET		.08709		.197			
		0020	E			RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012			
0040			UP	01	24		.05		STRIP CAD	.136	.031	.161	.5	21	
		0010	E			ZCC-ST-S1	1.00	STRIP CAD PLATE SMALL PART		.12630		.156			
		0020	E			RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012			
0050			UP	01	24		.05		STRIP RUST	.136	.002	.006	.3	1	
		0010	E			ZCC-ST-S1	1.00	STRIP RUST		.12630		.156			
		0020	E			RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012			
0120			UP	01	24		.05		BAKE AFTER ETCH	.090	.001	.006	8.0	1	
		0010	E			ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08038		.100			
		0020	E			RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012			
0140			UP	01	24		.05		DEGREASE	.097	.001	.006		1	
		0010	E			RWB-CV-B1	1.00	VAPOR CL (DEGR)HOON/BASKET		.08709		.107			
		0020	E			RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012			
			UP	01	24		.05		SHOTPEEN SM STEEL PART/MASK	.276	.003	.017		2	
		0010	E			ZMA-CP-S2	1.00	MASK SMALL COMPONENT PART		.08183		.101			
		0020	F			RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200			
		0030	N			ZUM-CL-02	.50	UNMASK MEDIUM SIZE CYL PART QCC 50% FOR SMALL PART		.05067		.031			
		0040	E			RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012			
0160			UP	01	24		1.00		SHOTPEEN SM STEEL PART/MASK	.276	.067	.345		45	
		0010	E			ZMA-CP-S2	1.00	MASK SMALL COMPONENT PART		.08183		.101			
		0020	E			RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200			
		0030	N			ZUM-CL-02	.50	UNMASK MEDIUM SIZE CYL PART QCC 50% FOR SMALL PART		.05067		.031			
		0040	E			RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012			
0280			UP	01	24		1.00		GRIT BLAST	.046	.011	.053		9	
		0010	E			RWB-05-B1	1.00	BLAST SM PT OR BSKT WASH PTS		.03668		.045			
		0020	E			RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012			
0290			UP	01	24		.05		CAD PLATE	.102	.001	.006		1	
		0010	E			ZPL-CD-S1	1.00	CADNIUM PLATE SMALL PART		.09212		.114			
		0020	E			RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012			
0290			UP	01	24		.05		BAKE AFTER CAD PLATE	.090	.001	.006	59.0	1	
		0010	E			ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08038		.100			
		0020	E			RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012			
0290			UP	01	24		.05		CHROMATE CONVERSION (IRIDITE)	.033	.000	.002		0	
		0010	E			ZPL-IR-S1	1.00	IRIDITE SMALL PART		.02362		.029			
		0020	E			RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012			
0330			UP	01	24		.05		I.V.D. ALUMINUM PLATE	.230	.003	.014	1.0	2	
		0010	N				1.00		I.V.D. PLATE	.22000		.272			
		0020	E			RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC/		.01001		.012			
40			UP	01	24		.05		ALODINE I.V.D. ALUM PLATE	.230	.003	.014		2	
		0010	N				1.00		ALODINE	.22000		.272			
		0020	E			RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC/		.01001		.012			
9000			UP	01	00		1.00		LABOR STANDARD HISTORY	.000	.000	.000		0	
0001									2 AUGUST 08 INITIAL INPUT/NEW WORKLOAD						

*Handwritten signature or initials*



0010  
0800  
0900

KERRY COOP      MANEL 7-3357  
22 MAR 69    INITIAL INPUT    MRP II  
ALBERT HARWOOD    MANEL 7-3783

TO INTERROGATE LABOR STANDARDS. INPUT

RDC PRD MRP NS

1034567890103456 ELSE PUT IN END

26337A F15 HLG R/H HW  
 OPER TECH S S W F PF A/R REV  
 SUB T K #R A FA SUPPORT  
 STEP D L K C DC ELEMENT

RCC MMPC

14-22-3

86224

OPER	TECH	S	S	W	F	PF	A/R	REV	SUB	T	K	#R	A	FA	SUPPORT	OCC	←	DESCRIPTION	→	BASE	PFD	STD	A
STEP	D	L	K	C	DC	ELEMENT	FACT	STOR	DESCRIPTION	SUPPLEMENTAL	HOURS	TIME	HOURS	DLY	PCT	C							
J26	E	N	UP	EA	B	J 88202	.05	PERCENT ENGR 48.7										HIGH PRESSURE PISTON F15M		5.56		.27	
0001			UP	01	00		.00											PART NUMBER/N.S.N.		.000	.000	.000	0
						0010		68A410790-2001		1620003654003													
0024			UP	01	24		1.00											DEGREASE		.097	.023	.120	2
	0010	E				RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET												.08709		.107	
	0020	E				RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC												.01001		.012	
0026			UP	01	24		.95											DEGREASE		.097	.022	.114	2
	0010	E				RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET												.08709		.107	
	0020	E				RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC												.01001		.012	
0028			UP	01	24		.05											DEGREASE		.097	.001	.006	0
	0010	E				RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET												.08709		.107	
	0020	E				RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC												.01001		.012	
0030			UP	01	24		1.00											STRIP CHROME SMALL PART O.D.		.070	.017	.087	24.0 2
	0010	E				ZCR-ST-S2	.34	STRIP CHROME O.D. SMALL PART OCC. 3EA. OPERATIONS												.17652		.074	
	0020	E				RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC												.01001		.012	
0040			UP	01	24		1.00											STRIP CHROME SMALL PART I.D.		.092	.022	.115	24.0 2
	0010	E				ZCR-ST-S1	.34	STRIP CHROME I.D. SMALL PART OCC. 3EA. OPERATIONS												.24234		.102	
	0020	E				RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC												.01001		.012	
0045			UP	01	24		1.00											STRIP CHROME SMALL PART I.D.		.092	.022	.115	24.0 2
	0010	E				ZCR-ST-S1	.34	STRIP CHROME I.D. SMALL PART OCC. 3EA. OPERATIONS												.24234		.102	
	0020	E				RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC												.01001		.012	
0050			UP	01	24		1.00											STRIP NICKEL SMALL PART		.131	.031	.163	40.0 3
	0010	E				ZCR-ST-S1	.50	OCC. 2EA. OPERATIONS												.24234		.150	
	0020	E				RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC												.01001		.012	
0060			UP	01	24		1.00											STRIP NICKEL SMALL PART		.131	.031	.163	40.0 3
	0010	E				ZCR-ST-S1	.50	OCC. 2EA. OPERATIONS												.24234		.150	
	0020	E				RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC												.01001		.012	
0120			UP	01	24		1.00											BAKE AFTER ETCH		.090	.022	.113	8.0 2
	0010	E				ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE												.08088		.100	
	0020	E				RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC												.01001		.012	
0135			UP	01	24		1.00											DEGREASE		.097	.023	.120	2
	0010	E				RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET												.08709		.107	
	0020	E				RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC												.01001		.012	
0140			UP	01	24		1.00											SHOTPEEN SM STEEL PART/MASK		.278	.067	.345	6
	0010	E				ZMA-CP-S2	1.00	MASK SMALL COMPONENT PART												.08183		.101	
	0020	E				RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART												.16131		.200	
	0030	N				ZUM-CL-02	.50	UNMASK MEDIUM SIZE CYL PART OCC 50% FOR SMALL PART												.05067		.031	
	0040	E				RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC												.01001		.012	
0143			UP	01	24		1.00											PREP FOR CHROME SM PART O.D.		.365	.088	.453	8
	0010	N					1.00	PREP FOR CHROME												.35500		.440	
	0020	E				RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC												.01001		.012	
0147			UP	01	24		1.00											GRIT BLAST		.046	.011	.058	1
	0010	E				RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS												.03668		.045	
	0020	E				RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC												.01001		.012	
0150			UP	01	24		1.00											CHROME PLATE SMALL PART O.D.		.300	.072	.372	24.0 7
	0010	N					1.00	CHROME PLATE SMALL PART O.D.												.29000		.359	
	0020	E				RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC												.01001		.012	
0155			UP	01	24		1.00											BAKE AFTER CHROME PLATE		.090	.022	.113	8.0 2
	0010	E				ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE												.08088		.100	
	0020	E				RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC												.01001		.012	
0157			UP	01	24		1.00											PREP FOR CHROME SM PART I.D.		.480	.115	.595	11
	0010	N					1.00	PREP CHROME I.D.												.47000		.582	
	0020	E				RJP-PW-R1	1.00	REN RPL PAPWRK SIGN OFF DOC												.01001		.012	

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0158	UP 01	24	1.00	GRIT BLAST	.046	.011	.058	1
0010 E		RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS	.03668		.045	
0020 E		RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0160	UP 01	24	1.00	CHROME PLATE SMALL PART I.D.	.330	.079	.409	30.0 7
0010 N			1.00	CHROME PLATE SMALL PART	.32000		.396	
0020 E		RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0170	UP 01	24	1.00	BAKE AFTER CHROME PLATE	.090	.022	.113	8.0 2
0010 E		ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE	.08088		.100	
0020 E		RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0200	UP 01	24	.25	BAKE AFTER GRIND	.090	.005	.028	8.0 1
0010 E		ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE	.08088		.100	
0020 E		RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0203	UP 01	24	1.00	PREP FOR NICKEL	.160	.038	.198	4
0010 N			1.00	PREP FOR NICKEL SMALL PART	.15000		.186	
0020 E		RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0207	UP 01	24	1.00	GRIT BLAST	.046	.011	.058	1
0010 E		RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS	.03668		.045	
0020 E		RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0210	UP 01	24	1.00	NICKEL	.270	.065	.335	24.0 6
0010 N			1.00	NICKEL PLATE SMALL PART	.26000		.322	
0020 E		RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0214	UP 01	24	1.00	BAKE AFTER NICKEL	.090	.022	.113	38.0 2
0010 E		ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE	.08088		.100	
0020 E		RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0216	UP 01	24	1.00	PREP FOR NICKEL	.160	.038	.198	4
0010 N			1.00	PREP FOR NICKEL SMALL PART	.15000		.186	
0020 E		RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0218	UP 01	24	1.00	GRIT BLAST	.046	.011	.058	1
0010 E		RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS	.03668		.045	
0020 E		RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0220	UP 01	24	1.00	NICKEL	.270	.065	.335	24.0 6
0010 N			1.00	NICKEL PLATE SMALL PART	.26000		.322	
0020 E		RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0230	UP 01	24	1.00	BAKE AFTER NICKEL	.090	.022	.113	38.0 2
0010 E		ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE	.08088		.100	
0020 E		RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0255	UP 01	24	.25	BAKE AFTER GRIND	.090	.005	.028	8.0 1
0010 E		ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE	.08088		.100	
0020 E		RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0265	UP 01	24	1.00	DEGREASE	.097	.023	.120	2
0010 E		RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET	.08709		.107	
0020 E		RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0275	UP 01	24	1.00	GRIT BLAST	.046	.011	.058	1
0010 E		RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS	.03668		.045	
0020 E		RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0280	UP 01	24	.95	CAD PLATE	.102	.023	.120	2
0010 E		ZPL-CD-S1	1.00	CADMIUM PLATE SMALL PART	.09212		.114	
0020 E		RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0290	UP 01	24	.95	BAKE AFTER CAD PLATE	.090	.021	.107	38.0 2
0010 E		ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE	.08088		.100	
0020 E		RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0295	UP 01	24	.95	CHROMATE CONVERSION(IRIDITE)	.033	.008	.040	1
0010 E		ZPL-IR-S1	1.00	IRIDITE SMALL PART	.02362		.029	
0020 E		RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0303	UP 01	24	.05	I.V.D. ALUMINUM PLATE	.230	.003	.014	1.0 0
0010 N			1.00	I.V.D. PLATE	.22000		.272	
0020 E		RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC/	.01001		.012	
0307	UP 01	24	.05	ALODINE I.V.D. ALUM PLATE	.230	.003	.014	0
0010 N			1.00	ALODINE	.22000		.272	
0020 E		RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC/	.01001		.012	

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LABOR STANDARD HISTORY

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28W INITIAL INPUT ESTAMATE TIME NEW WORK REQUI  
J.CALDWELL TECH MANEL

INTERROGATE LABOR STANDARDS. INPUT

RCC PRD NR0P NR

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1234567890123456 ELSE PUT IN END

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SUB	STEP	D	L	T	K	#R	A	FA	SUPPORT	OCC	DESCRIPTION		BASE HOURS	PFD TIME	STD HOURS	A DLY PCT
											STOR	SUPPLEMENTAL				
XNPRC	S	X	UP	EA	B	J	84194	1.00	PERCENT ENGR 99.9		PLATE MISC STRUT PARTS	407	.64		.64	
0001			UP	01	00			.00			PART NUMBER/NSN		.000	.000	.000	0
	0010								3660005-141		1620001877445					
0010			UP	01	24			1.00			ALL PLATING PROCESSES		.519	.125	.644	100
	0010	E						1.00	ZPL-MS-S1		PLATE MISC PARTS AVGE STRUT		.51947		.644	
	0900								<							
9000			UP	01	24			.01			LABOR STANDARD HISTORY		.000	.000	.000	0
	0010										PRIOR HISTORY ON 00-ALC 494 FORM					
	0020										27JUN83 UPDATE OPERATION	<OLD STD>	.60			
	0021										27DEC84 2 YR REVIEW W/ NO CHANGE					
	0900										JENSEN	MAMEL	73255			

TO INTERROGATE LABOR STANDARDS, INPUT

RCC PRD NROP NR  
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LABOR STANDARD OPERATION RESOURCE STANDARD AND METHOD ANALYSIS

02/01/88

A-E046B-HM1-DY-M45 PAGE 0001

74521A STRUT ASSY C-141 NLG

RCC NNPRC

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SUB	TECH	S	M	UP	EA	B	J	84194	OCC	←-----	DESCRIPTION	-----	BASE	PFB	STD	A	
																	STEP
RC501	S	N	UP	EA	B	J	84194	1.00	PERCENT	ENGR	67.9	PLATE OUTER CYL C141 NLG 407	3.58		3.58		
0001			UP	00	00			.00				PART NUMBER/NSN	.000	.000	.000	0	
0010										3G61090-119	162004419763						
0055			UP	01	24			1.00				DEGREASE	.115	.028	.143	4	
0010	E					RPL-DE-L1		.75	DEGREASE	LARGE PART OR BASKT	PRORATED FOR SMALL PART		.14095		.131		
0020	E					RJP-PW-R1		1.00	REN	RPL PAPERWK	SIGN OFF DOC		.01001		.012		
0060			UP	01	24			.95				STRIP CAD	.136	.031	.161	.5	4
0010	E					ZCD-ST-S1		1.00	STRIP	CAD PLATE	SMALL PART		.12630		.156		
0020	E					RJP-PW-R1		1.00	REN	RPL PAPERWK	SIGN OFF DOC		.01001		.012		
0065			UP	01	24			.05				STRIP RUST	.136	.002	.008	.3	0
0010	E					ZCD-ST-S1		1.00	STRIP	RUST			.12630		.156		
0020	E					RJP-PW-R1		1.00	REN	RPL PAPERWK	SIGN OFF DOC		.01001		.012		
0071			UP	01	24			.05				REMOVE METAL SPRAY	.326	.004	.020	1	
0010	E					RPL-SB-L2		1.00	SANDBLAST	LARGE PART -	HOIST		.31693		.392		
0020	E					RJP-PW-R1		1.00	REN	RPL PAPERWK	SIGN OFF DOC,		.01001		.012		
0072			UP	01	24			.05				BAKE 4 HRS	.171	.002	.011	8.0	0
0010	E					ZPL-BK-M1		1.00	BAKE	MED/LRG	SIZE PART	,	.16175		.200		
0020	E					RJP-PW-R1		1.00	REN	RPL PAPERWK	SIGN OFF DOC,		.01001		.012		
0076			UP	01	24			.05				DEGREASE	.115	.001	.007	0	
0010	E					RPL-DE-L1		.75	DEGREASE	LARGE PART OR BASKT	PRORATED FOR SMALL PART		.14095		.131		
0020	E					RJP-PW-R1		1.00	REN	RPL PAPERWK	SIGN OFF DOC		.01001		.012		
0078			UP	01	24			.39				STRIP CHROME FROM TRUNNION	.098	.009	.048	24.0	1
0010	E					ZCR-ST-M2		.25	STRIP	CHROME OD	MED/LRG PART4	EA AREAS AT A TIME	.35303		.109		
0900	E					RJP-PW-R1		1.00	REN	RPL PAPERWK	SIGN OFF DOC,		.01001		.012		
0080			UP	01	24			.50				STRIP CHROME FROM COLLAR	.098	.012	.061	24.0	2
0010	E					ZCR-ST-M2		.25	STRIP	CHROME OD	MED/LRG PART4	EA AREAS AT A TIME	.35303		.109		
0900	E					RJP-PW-R1		1.00	REN	RPL PAPERWK	SIGN OFF DOC,		.01001		.012		
0090			UP	01	24			.05				STRIP CHROME UPPER BORE	.098	.001	.006	24.0	0
0010	E					ZCR-ST-M2		.25	STRIP	CHROME OD	MED/LRG PART4	EA AREAS AT A TIME	.35303		.109		
0900	E					RJP-PW-R1		1.00	REN	RPL PAPERWK	SIGN OFF DOC,		.01001		.012		
0100			UP	01	24			.11				STRIP CHROME LOWER BORE	.098	.003	.013	0	
0010	E					ZCR-ST-M2		.25	STRIP	CHROME OD	MED/LRG PART4	EA AREAS AT A TIME	.35303		.109		
0900	E					RJP-PW-R1		1.00	REN	RPL PAPERWK	SIGN OFF DOC,		.01001		.012		
0290			UP	01	24			.89				BAKE AFTER ETCH	.171	.037	.190	8.0	5
0010	E					ZPL-BK-M1		1.00	BAKE	MED/LRG	SIZE PART	,	.16175		.200		
0020	E					RJP-PW-R1		1.00	REN	RPL PAPERWK	SIGN OFF DOC,		.01001		.012		
0305			UP	01	24			.05				DEGREASE	.115	.001	.007	0	
0010	E					RPL-DE-L1		.75	DEGREASE	LARGE PART OR BASKT	PRORATED FOR SMALL PART		.14095		.131		
0020	E					RJP-PW-R1		1.00	REN	RPL PAPERWK	SIGN OFF DOC		.01001		.012		
0310			UP	01	24			.39				SHOTPEEN ALL SURFACES	.035	.003	.017	0	
0010	E					RPL-SP-M1		.16	SHOT	PEEN	SMALL/MED PART	7 EA AREAS AT A TIME	.16131		.032		
0020	E					RJP-PW-R1		1.00	REN	RPL PAPERWK	SIGN OFF DOC,		.01001		.012		
0315			UP	01	24			.22				SHOTPEEN FILLER PLUG HOLE	.032	.002	.009	0	
0010	E					RPL-SP-M1		.14	SHOT	PEEN	SMALL/MED PART	7 EA AREAS AT A TIME	.16131		.028		
0020	E					RJP-PW-R1		1.00	REN	RPL PAPERWK	SIGN OFF DOC,		.01001		.012		
0320			UP	01	24			.44				SHOTPEEN TRUNION JOURNALS	.032	.003	.018	0	
0010	E					RPL-SP-M1		.14	SHOT	PEEN	SMALL/MED PART	7 EA AREAS AT A TIME	.16131		.028		
0020	E					RJP-PW-R1		1.00	REN	RPL PAPERWK	SIGN OFF DOC,		.01001		.012		
0330			UP	01	24			.50				SHOTPEEN FLANGE RADIUS	.032	.004	.020	1	
0010	E					RPL-SP-M1		.14	SHOT	PEEN	SMALL/MED PART	7 EA AREAS AT A TIME	.16131		.028		
0020	E					RJP-PW-R1		1.00	REN	RPL PAPERWK	SIGN OFF DOC,		.01001		.012		
0335			UP	01	24			.44				SHOTPEEN STEERING FLANGE	.032	.003	.018	0	
0010	E					RPL-SP-M1		.14	SHOT	PEEN	SMALL/MED PART	7 EA AREAS AT A TIME	.16131		.028		

0020 E	RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0340 UP 01	24	.56	SHOTPEEN COLLAR JOURNAL	.032	.004	.023		1
0010 E	RPL-SP-M1	.14	SHOT PEEN SMALL/MED PART	.16131		.028		
0020 E	RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0350 UP 01	24	.39	SHOTPEEN UPPER BORE	.032	.003	.016		0
0010 E	RPL-SP-M1	.14	SHOT PEEN SMALL/MED PART	.16131		.028		
0020 E	RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0360 UP 01	24	.11	SHOTPEEN LOWER BORE	.032	.001	.004		0
0010 E	RPL-SP-M1	.14	SHOT PEEN SMALL/MED PART	.16131		.028		
0020 E	RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0370 UP 01	24	.17	SHOTPEEN UPPER CHAMBER	.032	.001	.007		0
0010 E	RPL-SP-M1	.14	SHOT PEEN SMALL/MED PART	.16131		.028		
0020 E	RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0373 UP 01	24	.33	PREP FOR CHROME	.370	.029	.151		4
0010 N		1.00	PRORATED OVER 2 PREPS	.36000		.446		
0020 E	RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0377 UP 01	24	.33	GRIT BLAST FOR CHROME	.060	.005	.025		1
0010 E	RPL-SB-M2	.50	SANDBLAST MED PART WALK-IN	.10180		.063		
0020 E	RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0380 UP 01	24	.33	CHROME PLATE TRUN JRNLS	.305	.024	.125	24.0	3
0010			..					
0030 N		.50	CHROME PLATE	.59000		.365		
0040 E	RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0383 UP 01	25	.28	PREP FOR CHROME	.720	.050	.252		7
0010 N		1.00	PREP FOR CHROME	.71000		.887		
0020 E	RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0387 UP 01	24	.28	GRIT BLAST FOR CHROME	.060	.004	.021		1
0010 E	RPL-SB-M2	.50	SANDBLAST MED PART WALK-IN B	.10180		.063		
0020 E	RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0390 UP 01	24	.28	CHROME PLATE COLLAR JOURNAL	.600	.040	.208	24.0	6
0030 N		1.00	CHROME PLATE	.59000		.731		
0040 E	RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0395 UP 01	24	.33	BAKE AFTER CHROME	.090	.007	.037	8.0	1
0010 E	ZPL-BK-M1	.50	BAKE MED/LRG SIZE PART	.16175		.100		
0020 E	RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0397 UP 01	24	.33	PREP FOR CHROME	.365	.029	.149		4
0010 N		.50	PREP FOR CHROME	.71000		.440		
0020 E	RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0398 UP 01	24	.33	GRIT BLAST FOR CHROME	.060	.005	.025		1
0010 E	RPL-SB-M2	.50	SANDBLAST MED PART WALK-IN B	.10180		.063		
0020 E	RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0400 UP 01	24	.33	CHROME PLATE UPPER BORE	.305	.024	.125	30.0	3
0030 N		.50	CHROME PLATE	.59000		.365		
0040 E	RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0403 UP 01	24	.17	PREP FORM CHROME	.365	.015	.077		2
0010 N		.50	PREP FOR CHROME	.71000		.440		
0020 E	RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0407 UP 01	24	.17	GRIT BLAST FOR CHROME	.060	.002	.013		0
0010 E	RPL-SB-M2	.50	SANDBLAST MED PART WALK-IN B	.10180		.063		
0020 E	RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0410 UP 01	24	.17	CHROME PLATE LOWER BORE	.305	.012	.064	30.0	2
0030 N		.50	CHROME PLATE	.59000		.365		
0040 E	RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0420 UP 01	24	.33	BAKE AFTER CHROME	.090	.007	.037	8.0	1
0010 E	ZPL-BK-M1	.50	BAKE MED/LRG SIZE PART	.16175		.100		
0020 E	RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0540 UP 01	24	.78	BAKE AFTER GRIND	.171	.032	.166	8.0	5
0010 E	ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200		
0020 E	RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0555 UP 01	24	.05	DEGREASE	.115	.001	.007		0

0010 E	RPL-DE-L1	.75	DEGREASE LARGE PART OR BASKY	PRORATED FOR SMALL PART	.14095		.131		
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
566	UP 01	24	.05	BRUSH TEMPER ETCH	.105	.001	.007		0
0010 E	RLG-RS-B1	1.00	BRUSH PLATE SPOT OR HOLE	,	.09546		.118		
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0568	UP 01	24	.94	GRIT BLAST PRIOR TO CAD	.086	.019	.101		3
0010 E	RPL-SB-M2	.75	SANDBLAST MED PART WALK-IN	BPRORATED SMALL PART	.10180		.094		
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0570	UP 01	24	.94	CAD PLATE	.620	.140	.723		20
0030 E	ZPL-CD-M1	1.00	CADMIUM PLATE MEDIUM PART	,	.61058		.757		
0040 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0580	UP 01	24	.94	BAKE AFTER CAD	.171	.039	.200	38.0	6
0010 E	ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	,	.16175		.200		
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0585	UP 01	24	.94	IRIDITE	.106	.024	.124		3
0010 E	ZPL-IR-M1	1.00	IRIDITE MEDIUM PART-HOIST	,	.09635		.119		
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0590	UP 01	24	1.00	BLAST TO REMOVE CORROSION	.092	.022	.115		3
0010 E	ZLG-BC-03	1.00	BLAST CLEAN MED STRUT PART	,	.08290		.102		
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0603	UP 01	24	.05	I.V.D. ALUMINUM PLATE	.230	.003	.014	1.0	0
0010 N			1.00	I.V.D. PLATE	.22000		.272		
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/		.01001		.012		
0607	UP 01	24	.05	ALODINE I.V.D. ALUM PLATE	.230	.003	.014		0
0010 N			1.00	ALODINE	.22000		.272		
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/		.01001		.012		
9000	UP 01	24	.01	LABOR STANDARD HISTORY	.000	.000	.000		0
0010				PRIOR HISTORY ON 00-ALC 494 FORM					
0020				27JUN83 NEW OCC. FACTOR STUDY <OLD STD>	3.51				
0021				27DEC84 2 YR REVIEW W/OCC CHANGE > OLD STD <	3.96				
0022				8 OCT85 CHANGED SUBOPS TO MATCH 958 OLD STD	4.25				
0023				27JAN88 STD CUT ORDER N.M.					
0900				JENSEN					
				MANEL					
					73255				

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LABOR STANDARD OPERATION RESOURCE STANDARD AND METHOD ANALYSIS  
 RCC MNPRC

02/01/88  
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 81174

74521A STRUT ASSY C-141 NLG

TECH S S W F PF A/R REV

SUB	T K	#R A	FA	SUPPORT	OC	DESCRIPTION	BASE HOURS	PFD TIME	STD HOURS	A DLY	PCT	C
STEP	D L	K C	DC	ELEMENT	FACT	STORED	SUPPLEMENTAL					
RC502	S	E	UP	EA B	J 84194	.62 PERCENT ENGR 91.5	PLATE INNER CYL C141 NLG 407	3.21		1.99		
0001			UP	01	00	.00	PART NUMBER/NSN	.000	.000	.000		0
							3661089-111 1620004983226					
0035			UP	01	00	1.00	DEGREASE BEARING	.150	.000	.151		5
							RPL-DE-L1	.14095		.140		
0050						1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.010		
							RJP-PW-R1					
0037			UP	01	24	.95	STRIP CAD	.136	.031	.161	.5	5
							ZCD-ST-S1	.12630		.156		
0010						1.00	STRIP CAD PLATE SMALL PART	.01001		.012		
							RJP-PW-R1					
0020						1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012		
							RJP-PW-R1					
0040			UP	01	24	.05	STRIP RUST	.136	.002	.008	.3	0
							ZCD-ST-S1	.12630		.156		
0010						1.00	STRIP RUST	.01001		.012		
							RJP-PW-R1					
0020						1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012		
							RJP-PW-R1					
0095			UP	01	24	.31	DEGREASE	.115	.009	.044		1
							RPL-DE-L1	.14095		.131		
0010						.75	DEGREASE LARGE PART OR BASKT PRORATED FOR SMALL PART	.01001		.012		
							RJP-PW-R1					
0020						1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012		
							RJP-PW-R1					
0100			UP	01	24	.31	STRIP CHROME	.363	.027	.140	24.0	4
							ZCR-ST-M2	.35303		.437		
0010						1.00	STRIP CHROME OD MED/LRG PART,	.01001		.012		
							RJP-PW-R1					
0900						1.00	REM RPL PAPWRK SIGN OFF DOC,	.01001		.012		
							RJP-PW-R1					
0104			UP	01	24	.05	STRIP CHROME	.363	.004	.023	24.0	1
							ZCR-ST-M2	.35303		.437		
0010						1.00	STRIP CHROME OD MED/LRG PART,	.01001		.012		
							RJP-PW-R1					
0020						1.00	REM RPL PAPWRK SIGN OFF DOC,	.01001		.012		
							RJP-PW-R1					
0108			UP	01	24	.05	STRIP CHROME	.363	.004	.023	24.0	1
							ZCR-ST-M2	.35303		.437		
0010						1.00	STRIP CHROME OD MED/LRG PART,	.01001		.012		
							RJP-PW-R1					
0020						1.00	REM RPL PAPWRK SIGN OFF DOC,	.01001		.012		
							RJP-PW-R1					
0150			UP	01	24	.62	BAKE AFTER ETCH	.171	.026	.132	8.0	4
							ZPL-BK-M1	.16175		.200		
0010						1.00	BAKE MED/LRG SIZE PART	.01001		.012		
							RJP-PW-R1					
0020						1.00	REM RPL PAPWRK SIGN OFF DOC,	.01001		.012		
							RJP-PW-R1					
0163			UP	01	24	.56	DEGREASE	.115	.016	.080		2
							RPL-DE-L1	.14095		.131		
0010						.75	DEGREASE LARGE PART OR BASKT PRORATED FOR SMALL PART	.01001		.012		
							RJP-PW-R1					
0020						1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012		
							RJP-PW-R1					
0165			UP	01	24	.15	GLASS BLAST PISTON SEAL	.092	.003	.017		1
							ZLG-BC-03	.08290		.102		
0010						1.00	BLAST CLEAN MED STRUT PART	.01001		.012		
							RJP-PW-R1					
0020						1.00	REM RPL PAPWRK SIGN OFF DOC,	.01001		.012		
							RJP-PW-R1					
0170			UP	01	24	.31	SHOTPEEN O.D.	.042	.003	.016		1
							RPL-SP-M1	.16131		.040		
0010						.20	SHOT PEEN SMALL/MED PART 5 EA AREAS AT A TIME	.01001		.012		
							RJP-PW-R1					
0020						1.00	REM RPL PAPWRK SIGN OFF DOC,	.01001		.012		
							RJP-PW-R1					
0180			UP	01	24	.05	SHOTPEEN PISTON UPPER END OD	.042	.001	.003		0
							RPL-SP-M1	.16131		.040		
0010						.20	SHOT PEEN SMALL/MED PART 5 EA AREAS AT A TIME	.01001		.012		
							RJP-PW-R1					
0020						1.00	REM RPL PAPWRK SIGN OFF DOC,	.01001		.012		
							RJP-PW-R1					
0190			UP	01	24	.20	SHOTPEEN METER, PIN HOLE I.D	.042	.002	.010		0
							RPL-SP-M1	.16131		.040		
0010						.20	SHOT PEEN SMALL/MED PART 5 EA AREAS AT A TIME	.01001		.012		
							RJP-PW-R1					
0020						1.00	REM RPL PAPWRK SIGN OFF DOC,	.01001		.012		
							RJP-PW-R1					
0200			UP	01	24	.33	SHOTPEEN AXLE ATT. LUG	.042	.003	.017		1
							RPL-SP-M1	.16131		.040		
0010						.20	SHOT PEEN SMALL/MED PART 5 EA AREAS AT A TIME	.01001		.012		
							RJP-PW-R1					
0020						1.00	REM RPL PAPWRK SIGN OFF DOC,	.01001		.012		
							RJP-PW-R1					
0215			UP	01	24	.15	SHOTPEEN ALL SURFACES	.042	.002	.008		0
							RPL-SP-M1	.16131		.040		
0010						.20	SHOT PEEN SMALL/MED PART 5 EA AREAS AT A TIME	.01001		.012		
							RJP-PW-R1					
0020						1.00	REM RPL PAPWRK SIGN OFF DOC,	.01001		.012		
							RJP-PW-R1					
0218			UP	01	24	.31	PREP CHROME PISTON OD.	.360	.027	.138		4
							PREP 2EA FACE SAME TIME	.35000		.434		
0010						1.00	PREP CHROME PISTON OD.	.01001		.012		
							RJP-PW-R1					
0020						1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012		
							RJP-PW-R1					
0220			UP	01	24	.31	CHROME PLATE PISTON O.D.	1.314	.098	.505	24.0	16
							ZPL-CH-M2	1.30401		1.616		
0030						1.00	CHROME PLATE MED/LRG PART-OD,					

0040 E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC,	.01001		.012			
0225 UP 01	24	.31	BAKE AFTER CHROME	.171	.013	.066	8.0	2	
0010 E	ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200			
0020 E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC,	.01001		.012			
0228 UP 01	24	.05	PREP PISTON O.D FOR CHROME	.360	.004	.022		1	
0010 N		1.00	PREP 2EA FACE SAME TIME	.35000		.434			
0020 E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012			
0230 UP 01	24	.05	CHROME PLATE PISTON O.D. UPP	.310	.004	.019	24.0	1	
0030 N		1.00	CHROME PRORATED 2 CHROME OPS	.30000		.372			
0040 E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC,	.01001		.012			
0235 UP 01	24	.05	BAKE AFTER CHROME	.171	.002	.011	8.0	0	
0010 E	ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200			
0020 E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC,	.01001		.012			
0238 UP 01	24	.08	PREP METERING PIN FOR CHROME	.360	.007	.036		1	
0010 N		1.00	PREP 2EA FACE SAME TIME	.35000		.434			
0020 E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012			
0240 UP 01	24	.08	CHROME PLATE METR PIN I.D.	.410	.008	.041	30.0	1	
0030 N		1.00	CHROME ID	.40000		.496			
0040 E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC,	.01001		.012			
0250 UP 01	24	.08	BAKE AFTER CHROME	.171	.003	.017	8.0	1	
0010 E	ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200			
0020 E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC,	.01001		.012			
0290 UP 01	24	.31	BAKE AFTER GRIND	.171	.013	.066	8.0	2	
0010 E	ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200			
0020 E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC,	.01001		.012			
0305 UP 01	24	.05	DEGREASE	.115	.001	.007		0	
0010 E	RPL-DE-L1	.75	DEGREASE LARGE PART OR BASKT PRORATED FOR SMALL PART	.14095		.131			
0020 E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012			
030 UP 01	24	.95	DEGREASE	.115	.026	.136		4	
0010 E	RPL-DE-L1	.75	DEGREASE LARGE PART OR BASKT PRORATED FOR SMALL PART	.14095		.131			
0020 E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012			
0363 UP 01	24	.95	GRIT BLAST PRIOR TO CAD	.086	.020	.102		3	
0010 E	RPL-SB-M2	.75	SANDBLAST MED PART WALK-IN BPRORATED SMALL PART	.10180		.094			
0020 E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012			
0365 UP 01	24	.95	CAD PLATE	.620	.141	.731		23	
0010 E	ZPL-CD-M1	1.00	CADMIUM PLATE MEDIUM PART CAD PLATE INNER CYL	.61058		.757			
0040 E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC,	.01001		.012			
0370 UP 01	24	.95	BAKE AFTER CAD	.171	.039	.202	38.0	6	
0010 E	ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200			
0020 E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC,	.01001		.012			
0375 UP 01	24	.95	IRIDITE	.106	.024	.125		4	
0010 E	ZPL-IR-M1	1.00	IRIDITE MEDIUM PART-HOIST	.09635		.119			
0020 E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC,	.01001		.012			
0383 UP 01	24	.05	I.V.D. ALUMINUM PLATE	.230	.003	.014	1.0	0	
0010 N		1.00	I.V.D. PLATE	.22000		.272			
0020 E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC/	.01001		.012			
0387 UP 01	24	.05	ALODINE I.V.D. ALUM PLATE	.230	.003	.014		0	
0010 N		1.00	ALODINE	.22000		.272			
0020 E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC/	.01001		.012			
0432 UP 01	24	.05	DEGREASE	.115	.001	.007		0	
0010 E	RPL-DE-L1	.75	DEGREASE LARGE PART OR BASKT PRORATED FOR SMALL PART	.14095		.131			
0020 E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012			
0435 UP 01	24	.05	BRUSH PLATE REPAIR	.105	.001	.007		0	
0010 E	RLG-RS-B1	1.00	BRUSH PLATE SPOT OR HOLE	.09546		.118			
0020 E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC,	.01001		.012			
0438 UP 01	24	.05	IRIDITE	.106	.001	.007		0	
0010 E	ZPL-IR-M1	1.00	IRIDITE MEDIUM PART-HOIST	.09635		.119			
0020 E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC,	.01001		.012			
0440 UP 01	24	.85	BRUSH NICKEL PLATE	.105	.022	.111		3	
0010 E	RLG-RS-B1	1.00	BRUSH PLATE SPOT OR HOLE	.09546		.118			

0020 E	RJP-PW-R1	1.00	REN RPL PAPERWK SIGN OFF DOC,	.01001	.012	
9000	UP 01 24	.01	LABOR STANDARD HISTORY	.000	.000	0
0010			PRIOR HISTORY ON OO-ALC 494 FORM			
0020			27JUN83 NEW OCC. FACTOR STUDY <OLD STD>	2.67		
0030			26JUL83 NEW SUB OP.0025-OCC. EST <OLD STD>	2.92		
0031			27DEC84 2 YR REVIEW W/OCC CHANGE > OLD STD <	2.96		
0032			7 OCT85 CHANGED SUBOPS TO MATCH 958 OLD STD	2.09		
0900			JENSEN	MANEL	73255	

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TECH S S		W F PF A/R REV												
JOB	T K	#R	A	FA	SUPPORT	OCC	←-----	DESCRIPTION	-----→	BASE	PF	STD	A	
STEP	D L	K	C	DC	ELEMENT	FACT	STOR	SUPPLEMENTAL		HOURS	TIME	HOURS	DLY PCT C	
RC503	S	E	UP	EA	B	J 84194	.93	PERCENT ENGR 81.9	PLATE AXLE C141 NLG	407	2.41		2.24	
0001			UP	01	00		.00		PART NUMBER/NSN		.000	.000	.000	0
0010								3661032-107	1620009272599					
0035			UP	01	24		1.00		DEGREASE		.115	.028	.143	6
0010	E				RPL-DE-L1		.75	DEGREASE LARGE PART OR BASKET PRORATED FOR SMALL PART			.14095		.131	
0020	E				RJP-PW-R1		1.00	REN RPL PAPERWORK SIGN OFF DOC			.01001		.012	
0040			UP	01	24		.95		STRIP CAD		.136	.031	.161	.5 7
0010	E				ZCD-ST-S1		1.00	STRIP CAD PLATE SMALL PART			.12630		.156	
0020	E				RJP-PW-R1		1.00	REN RPL PAPERWORK SIGN OFF DOC			.01001		.012	
0045			UP	01	24		.05		STRIP RUST		.136	.002	.008	.3 0
0010	E				ZCD-ST-S1		1.00	STRIP RUST			.12630		.156	
0020	E				RJP-PW-R1		1.00	REN RPL PAPERWORK SIGN OFF DOC			.01001		.012	
0080			UP	01	24		.36		STRIP CHM CNTR. JRNL. 3 EA		.130	.011	.058	24.0 2
0010	E				ZCR-ST-M2		.34	STRIP CHROME OD MED/LRG PARTS EA AREAS AT A TIME			.35303		.148	
0900	E				RJP-PW-R1		1.00	REN RPL PAPERWORK SIGN OFF DOC,			.01001		.012	
0090			UP	01	24		.07		STRIP CHROME LRG. JRNL 2 EA		.126	.002	.011	24.0 0
0010	E				ZCR-ST-M2		.33	STRIP CHROME OD MED/LRG PARTS EA AREAS AT A TIME			.35303		.144	
0900	E				RJP-PW-R1		1.00	REN RPL PAPERWORK SIGN OFF DOC,			.01001		.012	
0100			UP	01	24		.07		STRIP CHROME SML JRNL 2 EA		.126	.002	.011	24.0 0
0010	E				ZCR-ST-M2		.33	STRIP CHROME OD MED/LRG PARTS EA AREAS AT A TIME			.35303		.144	
0900	E				RJP-PW-R1		1.00	REN RPL PAPERWORK SIGN OFF DOC,			.01001		.012	
160			UP	01	24		.50		BAKE AFTER ETCH		.171	.021	.106	8.0 4
0010	E				ZPL-BK-M1		1.00	BAKE MED/LRG SIZE PART			.16175		.200	
0020	E				RJP-PW-R1		1.00	REN RPL PAPERWORK SIGN OFF DOC,			.01001		.012	
0175			UP	01	24		.05		DEGREASE		.115	.001	.007	0
0010	E				RPL-DE-L1		.75	DEGREASE LARGE PART OR BASKET PRORATED FOR SMALL PART			.14095		.131	
0020	E				RJP-PW-R1		1.00	REN RPL PAPERWORK SIGN OFF DOC			.01001		.012	
0180			UP	01	24		.36		SHOTPEEN CENTER JRNL 3 EA		.042	.004	.019	1
0010	E				RPL-SP-M1		.20	SHOT PEEN SMALL/MED PART 5 EA AREAS AT A TIME			.16131		.040	
0020	E				RJP-PW-R1		1.00	REN RPL PAPERWORK SIGN OFF DOC,			.01001		.012	
0190			UP	01	24		.07		SHOTPEEN LARGE JRNL 2 EA		.042	.001	.004	0
0010	E				RPL-SP-M1		.20	SHOT PEEN SMALL/MED PART 5 EA AREAS AT A TIME			.16131		.040	
0020	E				RJP-PW-R1		1.00	REN RPL PAPERWORK SIGN OFF DOC,			.01001		.012	
0200			UP	01	24		.07		SHOTPEEN SMALL JOURNALS 2 EA		.042	.001	.004	0
0010	E				RPL-SP-M1		.20	SHOT PEEN SMALL/MED PART 5 EA AREAS AT A TIME			.16131		.040	
0020	E				RJP-PW-R1		1.00	REN RPL PAPERWORK SIGN OFF DOC,			.01001		.012	
0210			UP	01	24		.36		SHOTPEEN OUTER REMARK AREAS		.042	.004	.019	1
0010	E				RPL-SP-M1		.20	SHOT PEEN SMALL/MED PART 5 EA AREAS AT A TIME			.16131		.040	
0020	E				RJP-PW-R1		1.00	REN RPL PAPERWORK SIGN OFF DOC,			.01001		.012	
0212			UP	01	24		.29		SHOTPEEN CROSS BOLT HOLES		.042	.003	.015	1
0010	E				RPL-SP-M1		.20	SHOT PEEN SMALL/MED PART 5 EA AREAS AT A TIME			.16131		.040	
0020	E				RJP-PW-R1		1.00	REN RPL PAPERWORK SIGN OFF DOC,			.01001		.012	
0215			UP	01	24		.05		PREP FOR CHROME		.720	.009	.045	2
0010	N						1.00	PREP FOR CHROME			.71000		.880	
0020	E				RJP-PW-R1		1.00	REN RPL PAPERWORK SIGN OFF DOC			.01001		.012	
0220			UP	01	24		.36		CHROME PLATE CENTER JRNL 3EA		.600	.052	.268	24.0 11
0030	N						1.00	CHROME PLATE			.59000		.731	
0040	E				RJP-PW-R1		1.00	REN RPL PAPERWORK SIGN OFF DOC,			.01001		.012	
0230			UP	01	24		.07		CHROME LARGE JOURNALS 2 EA		.600	.010	.052	24.0 2
0030	N						1.00	CHROME PLATE			.59000		.731	
0040	E				RJP-PW-R1		1.00	REN RPL PAPERWORK SIGN OFF DOC,			.01001		.012	
0240			UP	01	24		.07		CHROME SMALL JOURNALS 2 EA		.600	.010	.052	24.0 2
0030	N						1.00	CHROME PLATE			.59000		.731	

0040 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012			
0250	UP 01	24	.43	BAKE AFTER CHROME	.171	.018	.092	8.0	4
0010 E	ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200			
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012			
0296	UP 01	24	.43	BAKE AFTER GRIND	.171	.018	.092	8.0	4
0010 E	ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200			
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012			
0305	UP 01	24	.05	DEGREASE	.115	.001	.007		0
0010 E	RPL-DE-L1	.75	DEGREASE LARGE PART OR BASKT PRORATED FOR SMALL PART	.14095		.131			
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012			
0315	UP 01	24	.96	GRIT BLAST PRIOR TO CAD	.086	.020	.103		4
0010 E	RPL-SB-M2	.75	SANDBLAST MED PART WALK-IN BPRORATED SMALL PART	.10180		.094			
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012			
0320	UP 01	24	1.00	CAD PLATE	.620	.149	.770		32
0030 E	ZPL-CD-M1	1.00	CADMIUM PLATE MEDIUM PART	.61058		.757			
0040 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012			
0330	UP 01	24	1.00	BAKE AFTER CAD	.171	.041	.213	38.0	9
0010 E	ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200			
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012			
0335	UP 01	24	1.00	IRIDITE	.106	.026	.132		5
0010 E	ZPL-IR-M1	1.00	IRIDITE MEDIUM PART-HOIST	.09635		.119			
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012			
0343	UP 01	24	.05	I.V.D. ALUMINUM PLATE	.230	.003	.014	1.0	1
0010 H		1.00	I.V.D. PLATE	.22000		.272			
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/	.01001		.012			
0347	UP 01	24	.05	ALODINE I.V.D. ALUM PLATE	.230	.003	.014		1
0010 H		1.00	ALODINE	.22000		.272			
0020 E	RJP PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/	.01001		.012			
00	UP 01	24	.01	LABOR STANDARD HISTORY	.000	.000	.000		0
0010			PRIOR HISTORY ON 00-ALC 494 FORM						
0020			27JUN83 NEW OCC FACTOR STUDY <OLD STD>	1.31					
0021			27DEC84 2 YR REVIEW W/OCC CHANGE > OLD STD <	1.33					
0022			8 OCT85 CHANGED SUBOPS TO MATCH 958 OLD STD	.89					
0900			JENSEN	MANEL	73255				

TO INTERROGATE LABOR STANDARDS, INPUT

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 1234567890123456 ELSE PUT IN END

74521A STRUT ASSY C-141 NL6

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JOB	TECH S S	W F PF A/R REV	STEP D L	K R A FA SUPPORT	OCC	DESCRIPTION	BASE HOURS	PFD TIME	STB HOURS	A DLY PCT C
STEP D L	K C DC ELEMENT	FACT	STORED	SUPPLEMENTAL						
RCS04	S E UP EA B	J 84194	.05	PERCENT ENGR 99.9		PLATE TRUNNION ASSY	407	1.13	.05	
0001	UP 01 00		.00			PART NUMBER/NSM	.000	.000	.000	0
0010				8340783-10		1620001947597				
0020				8340783-30		NSL				
0180	UP 01 24		1.00	DEGREASE TRUNNION			.150	.036	.187	16
0005 E	RPL-DE-L1		1.00	DEGREASE LARGE PART OR BASKT<			.14095		.174	
0020 E	RJP-PW-R1		1.00	REN RPL PAPERWK SIGN OFF DOC<			.01001		.012	
0200	UP 01 24		1.00	SHOTPEEN TRUNION			.050	.012	.062	5
0010 E	RPL-SP-M1		.25	SHOT PEEN SMALL/MED PART OCC FOR 4 EA OPPERATIONS			.16131		.050	
0020 E	RJP-PW-R1		1.00	REN RPL PAPERWK SIGN OFF DOC<			.01001		.012	
0202	UP 01 24		1.00	SHOTPEEN CENTER ATT HOLE			.050	.012	.062	5
0010 E	RPL-SP-M1		.25	SHOT PEEN SMALL/MED PART OCC FOR 4 EA OPPERATIONS			.16131		.050	
0020 E	RJP-PW-R1		1.00	REN RPL PAPERWK SIGN OFF DOC<			.01001		.012	
0204	UP 01 24		.05	SHOTPEEN END TRUN SOCT RT.			.050	.001	.003	0
0010 E	RPL-SP-M1		.25	SHOT PEEN SMALL/MED PART OCC FOR 4 EA OPPERATIONS			.16131		.050	
0020 E	RJP-PW-R1		1.00	REN RPL PAPERWK SIGN OFF DOC<			.01001		.012	
0206	UP 01 24		.05	SHOTPEEN END TRUN SOCT RT.			.050	.001	.003	0
0010 E	RPL-SP-M1		.25	SHOT PEEN SMALL/MED PART OCC FOR 4 EA OPPERATIONS			.16131		.050	
0020 E	RJP-PW-R1		1.00	REN RPL PAPERWK SIGN OFF DOC<			.01001		.012	
0210	UP 01 24		1.00	HONE LARGE CENTER LUG			.104	.025	.129	11
0010 E	RBW-SU-G1		.33	S/U FOR BENCH WORK GENERAL PRO RATE 3 OPERATIONS			.27525		.112	
0020 E	RBW-BU-P1		1.00	BUTTERFLY POLISH BUSHING I DPOLISH/BUTTERFLY CENTER HOLE			.00333		.004	
0030 E	RJP-PW-R1		1.00	REN RPL PAPERWK SIGN OFF DOC			.01001		.012	
0220	UP 01 24		.05	HONE TRUN END SOCKET <RIGHT>			.104	.001	.006	1
0010 E	RBW-SU-G1		.33	S/U FOR BENCH WORK GENERAL PRO RATE 3 OPERATIONS			.27525		.112	
0020 E	RBW-BU-P1		1.00	BUTTERFLY POLISH BUSHING I DPOL/BUTTERFLY TRUN END<RIGHT>			.00333		.004	
0030 E	RJP-PW-R1		1.00	REN RPL PAPERWK SIGN OFF DOC			.01001		.012	
0230	UP 01 24		.05	HONE TRUN END SOCKET <LEFT>			.104	.001	.006	1
0010 E	RBW-SU-G1		.33	S/U FOR BENCH WORK GENERAL PRO RATE 3 OPERATIONS			.27525		.112	
0020 E	RBW-BU-P1		1.00	BUTTERFLY POLISH BUSHING I DPOL/BUTTERFLY TRUN END<LEFT>			.00333		.004	
0030 E	RJP-PW-R1		1.00	REN RPL PAPERWK SIGN OFF DOC			.01001		.012	
0260	UP 01 24		1.00	DEGREASE TRUNNION			.150	.036	.187	16
0005 E	RPL-DE-L1		1.00	DEGREASE LARGE PART OR BASKT<			.14095		.174	
0020 E	RJP-PW-R1		1.00	REN RPL PAPERWK SIGN OFF DOC<			.01001		.012	
0270	UP 01 24		1.00	ANODIZE TYPE II			.373	.090	.463	.8 41
0010 E	ZPL-AM-M1		1.00	ANODIZE MEDIUM SIZE PART <			.36341		.450	
0020 E	RJP-PW-R1		1.00	REN RPL PAPERWK SIGN OFF DOC<			.01001		.012	
0395	UP 01 24		.05	ALODINE CENTER LUG HOLES			.450	.005	.028	2
0005 E	RPL-DE-L1		1.00	DEGREASE LARGE PART OR BASKT<			.14095		.174	
0010 E	RPL-AL-L1		1.00	ALODINE LARGE PART - MOIST <			.29943		.371	
0020 E	RJP-PW-R1		1.00	REN RPL PAPERWK SIGN OFF DOC<			.01001		.012	
9000	UP 01 24		.01	LABOR STANDARD HISTORY			.000	.000	.000	0
0010				PRIOR HISTORY ON DD ALC 494 FORM						
0020				27JUN83 UPDATE OPERATION <OLD STD>		1.66				
0021				27DEC84 2 YR REVIEW W/OCC CHANGE > OLD STD <		1.66				
0022				7 OCT85 CHANGED SUBOPS TO MATCH 958 OLD STD		.35				
0900				JENSEN		MAMEL			73255	

TO INTERROGATE LABOR STANDARDS, INPUT

RCC PRD NROP NR

LABOR STANDARD OPERATION RESOURCE STANDARD AND METHOD ANALYSIS

02/01/88

A-E046B-MH1-BY-M45

PAGE 0001

74521A

STRUT ASSY C-141 NLG

RCC MNPRC

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TECH S S		W F PF A/R REV		SUB T K		R A FA SUPPORT		OCC <----->		DESCRIPTION		BASE	PFD	STD	A	
STEP	D L	K	C	DC	ELEMENT	FACT	STOR	STOR	SUPPLEMENTAL	HOURS	TIME	HOURS	DLY	PCT	C	
RC505	S	N	UP	EA	B	J 85268	.38	PERCENT ENGR 69.8	PLATE TRUNNION PIN OCC X 2	1.77		.67				
0001			UP	00	00		.00		PART NUMBER/NSM	.000	.000	.000			0	
			0010					3G61014-101	162000271196							
0032			UP	01	24		1.00		DEGREASE	.115	.028	.143			8	
	0010	E			RPL-DE-L1	.75		DEGREASE LARGE PART OR BASKT PRORATED FOR SMALL PART		.14095		.131				
	0020	E			RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC		.01001		.012				
0034			UP	01	24		.95		STRIP CAD	.136	.031	.161	.5		9	
	0010	E			ZCD-ST-S1	1.00		STRIP CAD PLATE SMALL PART		.12630		.156				
	0020	E			RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC		.01001		.012				
0036			UP	01	24		.05		STRIP RUST	.136	.002	.008	.3		0	
	0010	E			ZCD-ST-S1	1.00		STRIP RUST		.12630		.156				
	0020	E			RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC		.01001		.012				
0040			UP	01	24		.57		STRIP CHROME LARGE DIA.	.186	.026	.132	24.0		7	
	0010	E			ZCR-ST-S2	1.00		STRIP CHROME O.D. SMALL PART/		.17652		.218				
	0020	E			RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC/		.01001		.012				
0050			UP	01	24		.07		STRIP CHROME SMALL DIA.	.098	.002	.009	24.0		0	
	0010	E			ZCR-ST-S2	.50		STRIP CHROME O.D. SMALL PARTOCC FOR 2 EA AREAS AT A TIME		.17652		.109				
	0020	E			RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC\		.01001		.012				
0100			UP	01	24		.50		BAKE AFTER ETCH	.171	.021	.106	8.0		6	
	0010	E			ZPL-BK-M1	1.00		BAKE MED/LRG SIZE PART		.16175		.200				
	0020	E			RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC,		.01001		.012				
115			UP	01	24		.05		DEGREASE	.115	.001	.007			0	
	0010	E			RPL-DE-L1	.75		DEGREASE LARGE PART OR BASKT PRORATED FOR SMALL PART		.14095		.131				
	0020	E			RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC		.01001		.012				
0120			UP	01	24		.57		SHOTPEEN LARGE DIAMETER	.090	.012	.064			4	
	0010	E			RPL-SP-M1	.50		SHOT PEEN SMALL/MED PART		.16131		.100				
	0020	E			RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC\		.01001		.012				
0122			UP	01	24		.07		SHOTPEEN SMALL DIAMETER	.090	.002	.008			0	
	0010	E			RPL-SP-M1	.50		SHOT PEEN SMALL/MED PART		.16131		.100				
	0020	E			RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC\		.01001		.012				
0125			UP	01	24		.57		PREP FOR CHROME	.360	.049	.254			14	
	0010	N				1.00		PREP FOR CHROME		.35000		.434				
	0020	E			RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC		.01001		.012				
0130			UP	01	24		.57		CHROME PLATE LARGE DIAMETER	.300	.041	.212	24.0		12	
	0010	N				1.00		CHROME PLATE		.29000		.359				
	0030	E			RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC\		.01001		.012				
0135			UP	01	24		.07		PREP FOR CHROME	.360	.006	.031			2	
	0010	N				1.00		PREP FOR CHROME		.35000		.434				
	0020	E			RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC		.01001		.012				
0140			UP	01	24		.07		CHROME PLATE SMALL DIAMETER	.300	.005	.026	24.0		1	
	0010	N				1.00		CHROME PLATE		.29000		.359				
	0030	E			RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC\		.01001		.012				
0150			UP	01	24		.43		BAKE AFTER CHROME PLATE	.090	.009	.048	8.0		3	
	0010	E			ZPL-BK-S1	1.00		BAKE SM PART 4HR/24HR BAKE /		.08088		.100				
	0020	E			RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC'		.01001		.012				
0180			UP	01	24		.57		BAKE AFTER GRIND	.090	.012	.064	8.0		4	
	0010	E			ZPL-BK-S1	1.00		BAKE SM PART 4HR/24HR BAKE /		.08088		.100				
	0020	E			RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC'		.01001		.012				
0195			UP	01	24		.05		DEGREASE	.115	.001	.007			0	
	0010	E			RPL-DE-L1	.75		DEGREASE LARGE PART OR BASKT PRORATED FOR SMALL PART		.14095		.131				
	0020	E			RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC		.01001		.012				
0205			UP	01	24		.96		GRIT BLAST PRIOR TO CAD	.086	.020	.103			6	
	0010	E			RPL-SB-M2	.75		SANDBLAST MED PART WALK-IN BPRORATED SMALL PART		.10180		.094				

0020 E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012		
0210	UP 01 24	.95	CAD PLT	.102	.023	.120		7
0010 E	ZPL-CD-S1	1.00	CADMIUM PLATE SMALL PART	.09212		.114		
0060 E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC,	.01001		.012		
0220	UP 01 24	1.00	BAKE AFTER CAD PLATE	.090	.022	.113	38.0	6
0010 E	ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE /	.08088		.100		
0020 E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC'	.01001		.012		
0221	UP 01 24	.95	IRIDITE	.106	.024	.125		7
0010 E	ZPL-IR-M1	1.00	IRIDITE MEDIUM PART-HOIST ,	.09635		.119		
0020 E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC,	.01001		.012		
0224	UP 01 24	.05	I.V.D. ALUMINUM PLATE	.230	.003	.014	1.0	1
0010 N		1.00	I.V.D. PLATE	.22000		.272		
0020 E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC/	.01001		.012		
0225	UP 01 24	.05	MODINE I.V.D. ALUM PLATE	.230	.003	.014		1
0010 N		1.00	MODINE	.22000		.272		
0020 E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC/	.01001		.012		
9000	UP 01 24	.00	LABOR STANDARD HISTORY	.000	.000	.000		0
0010			PRIOR HISTORY ON OO-ALC 494 FORM					
0020			27JUN83 NEW OCC FACTOR STUDY <OLD STD>	.63				
0021			27DEC84 2 YR REVIEW W/OCC CHANGE > OLD STD <	.88				
0022			25SEPT85 CHANGED SUBOPS TO MATCH 958 OLD STD	.93				
0023			17 APRIL 87 ADDED SUBOPS 0221, 0224, 0225					
0024			<OLD STD 1.31>					
0900			KERRY COOP MANEL TECHN 73357					

TO INTERROGATE LABOR STANDARDS, INPUT

PRD NROP NR

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RC	STEP	S	E	UP	EA	B	J	87341	1.00	PERCENT ENGR 99.9	DESCRIPTION	BASE HOURS	PFD TIME	STD HOURS	DLY PCT	A
	D	L	K	C	DC	ELEMENT	FACT		STORED		SUPPLEMENTAL					C
0001				UP	01	00			.00		PLT BEARING PART NUMBER/NSM	.34 .000		.34 .000		0
0020									3661226-101		1620001257860					
0030									115689A		NSN					
0040				UP	01	24			1.00		STRIP OLD ANODIZE	.206	.050	.256	.5	75
0005	E					RPL-DE-L1			.50	DEGREASE LARGE PART OR BASKT	OCC FOR SMALL PART	.14095		.087		
0010	E					ZCD-ST-S1			1.00		STRIP ANODIZE	.12630		.156		
0020	E					RJP-PW-R1			1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012		
0050				UP	01	25			1.00		ANODIZE BEARING	.068	.017	.086	.7	25
0010	E					ZPL-AN-S1			1.00	ANODIZE SMALL PART		.05892		.073		
0020	E					RJP-PW-R1			1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012		
9000				UP	01	00			1.00		LABOR STANDARD HISTORY	.000	.000	.000		0
0010										07DEC87 INITIAL INPUT BUILT TO MATCH 958						
0020										J						
0900										JENSEN	MANEL					73255

TO INTERROGATE LABOR STANDARDS, INPUT

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LABOR STANDARD OPERATION RESOURCE STANDARD AND METHOD ANALYSIS

02/01/88

A-E046B-MH1-DY-M45

PAGE 0001

74521A STRUT ASSY C-141 ML6

RCC MNPCC

4S2-59-3

81174

TECH S S W F PF A/R REV

SUB	STEP	D L	K C DC	ELEMENT	FACT	DESCRIPTION	STORAGE	SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A C
RC511	S	N	UP	EA B	J 84194	.90 PERCENT ENGR 74.7		PLATE STEERING COLLAR	407	2.04		1.84		
	0001		UP	00	00	.00		PART NUMBER/NSN		.000	.000	.000		0
	0010						3G61092-111	162009294672						
	0032		UP	01	24	1.00		DEGREASE		.115	.028	.143		7
	0010 E				RPL-DE-L1	.75	DEGREASE LARGE PART OR BASKT	PRORATED FOR SMALL PART		.14095		.131		
	0020 E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012		
	0035		UP	01	24	.95		STRIP CAD		.136	.031	.161	.5	8
	0010 E				ZCD-ST-S1	1.00	STRIP CAD PLATE SMALL PART			.12630		.156		
	0020 E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012		
	0040		UP	01	24	.05		STRIP RUST		.136	.002	.008	.3	0
	0010 E				ZCD-ST-S1	1.00	STRIP RUST			.12630		.156		
	0020 E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012		
	0055		UP	01	24	.05		STRIP CHROME I.D.		.252	.003	.016	24.0	1
	0010 E				ZCR-ST-S1	1.00	STRIP CHROME I.D. SMALL PART			.24234		.300		
	0020 E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012		
	0060		UP	01	24	.10		STRIP CHROME FACES		.186	.004	.023	24.0	1
	0010 E				ZCR-ST-S2	1.00	STRIP CHROME O.D. SMALL PART			.17652		.218		
	0900 E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012		
	0100		UP	01	24	.30		BAKE AFTER ETCH		.090	.007	.034	8.0	2
	0010 E				ZPL-BK-S1	1.00	BAKE SH PART 4HR/24HR BAKE			.08088		.100		
	0020 E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012		
	0115		UP	01	24	.05		DEGREASE		.115	.001	.007		0
	0010 E				RPL-DE-L1	.75	DEGREASE LARGE PART OR BASKT	PRORATED FOR SMALL PART		.14095		.131		
	0020 E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012		
	0120		UP	01	24	.05		SHOTPEEN I.D.		.171	.002	.011		1
	0010 E				RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART			.16131		.200		
	0020 E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012		
	0125		UP	01	24	.15		SHOT PEEN 2 EA FACES		.171	.006	.032		2
	0010 E				RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART			.16131		.200		
	0020 E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012		
	0128		UP	01	24	.10		PREP FOR CHROME		.480	.012	.060		3
	0010 N					1.00	PREP FOR CHROME			.47000		.582		
	0020 E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012		
	0130		UP	01	24	.10		CHROME PLATE I.D.		.330	.008	.041	30.0	2
	0030 N					1.00	CHROME PLATE			.32000		.396		
	0040 E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012		
	0150		UP	01	24	.10		BAKE AFTER CHROME		.090	.002	.011	8.0	1
	0010 E				ZPL-BK-S1	1.00	BAKE SH PART 4HR/24HR BAKE			.08088		.100		
	0020 E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012		
	0153		UP	01	24	.25		PREP FOR CHROME		.480	.029	.149		7
	0010 N					1.00	PREP FOR CHROME			.47000		.582		
	0020 E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012		
	0155		UP	01	24	.25		CHROME PLATE COLLAR #1		.330	.020	.102	24.0	5
	0030 N					1.00	CHROME PLATE			.32000		.396		
	0040 E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012		
	0157		UP	01	24	.25		BAKE AFTER CHROME		.090	.005	.028	8.0	1
	0010 E				ZPL-BK-S1	1.00	BAKE SH PART 4HR/24HR BAKE			.08088		.100		
	0020 E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012		
	0180		UP	01	24	.20		BAKE AFTER GRIND		.090	.004	.023	8.0	1
	0010 E				ZPL-BK-S1	1.00	BAKE SH PART 4HR/24HR BAKE			.08088		.100		
	0020 E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC			.01001		.012		
	0200		UP	01	24	.15		PREP FOR CHROME		.480	.017	.089		4
	0010 N					1.00	PREP FOR CHROME			.47000		.582		

0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0210 UP 01	24	.15	CHROME FACE #2	.330	.012	.061	24.0	3
0030 N		1.00	CHROME PLATE	.32000		.396		
0040 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0220 UP 01	24	.15	BAKE AFTER CHROME	.090	.003	.017	8.0	1
0010 E	ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE ,	.08088		.100		
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0250 UP 01	24	.25	BAKE AFTER GRIND FACE	.090	.005	.028	8.0	1
0010 E	ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE ,	.08088		.100		
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0265 UP 01	24	.05	DEGREASE	.115	.001	.007		0
0010 E	RPL-DE-L1	.75	DEGREASE LARGE PART OR BASKT PRORATED FOR SMALL PART	.14095		.131		
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0275 UP 01	24	.96	GRIT BLAST PRIOR TO CAD	.086	.020	.103		5
0010 E	RPL-SB-M2	.75	SANDBLAST MED PART WALK-IN BPRORATED SMALL PART	.10180		.094		
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0280 UP 01	24	1.00	CAD PLATE	.102	.025	.127		6
0030 E	ZPL-CD-S1	1.00	CADMIUM PLATE SMALL PART ,	.09212		.114		
0040 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0290 UP 01	24	1.00	BAKE AFTER CAD	.090	.022	.113	38.0	5
0010 E	ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE ,	.08088		.100		
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0304 UP 01	24	.05	DEGREASE	.115	.001	.007		0
0010 E	RPL-DE-L1	.75	DEGREASE LARGE PART OR BASKT PRORATED FOR SMALL PART	.14095		.131		
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0307 UP 01	24	.05	I.V.D. ALUMINUM PLATE	.230	.003	.014	1.0	1
0010 N		1.00	I.V.D. PLATE	.22000		.272		
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/	.01001		.012		
0310 UP 01	24	1.00	DRY FILM LUBE	.222	.053	.276		13
0010 E	RPL-DF-S1	1.00	DRYFILM LUBE 1ST SM/MED PART,	.21250		.263		
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0315 UP 01	24	1.00	BAKE AFTER DRY LUB	.171	.041	.213	2.0	10
0010 E	ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART ,	.16175		.200		
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0318 UP 01	24	1.00	IRIDITE	.106	.026	.132		6
0010 E	ZPL-IR-M1	1.00	IRIDITE MEDIUM PART-HOIST ,	.09635		.119		
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0319 UP 01	24	.05	ALODINE I.V.D. ALUM PLATE	.230	.003	.014		1
0010 N		1.00	ALODINE	.22000		.272		
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/	.01001		.012		
9000 UP 01	24	.01	LABOR STANDARD HISTORY	.000	.000	.000		0
0010			PRIOR HISTORY ON OO-ALC 494 FORM					
0020			27JUN83 NEW OCC FACTOR STUDY <OLD STD>			2.77		
0021			27DEC84 2 YR REVIEW W/OCC CHANGE > OLD STD <			2.71		
0022			4 OCT85 CHANGED SUBOPS TO MATCH 958 OLD STD			2.33		
0900			JENSEN MANEL 73255					

TO INTERROGATE LABOR STANDARDS, INPUT

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LABOR STANDARD OPERATION RESOURCE STANDARD AND METHOD ANALYSIS

02/01/88

A-E046B-MM1-DY-M45

PAGE 0001

74521A

STRUT ASSY C-141 NLG

RCC MNPRC

452-59-3

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SUB	TECH	T	K	#R	A	FA	SUPPORT	OCC	DESCRIPTION	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A
STEP	B	L	K	C	DC	ELEMENT	FACT	STO	SUPPLEMENTAL						C
RC512	S	N	UP	EA	B	J 84194	.89	PERCENT ENGR 64.4	PLATE STEERING PLATE	407	1.43	1.27			
0001			UP	01	00		.00		PART NUMBER/NSN		.000	.000	.000		0
0010								3G61027-101	1620000110320						
0030			UP	01	24		1.00		DEGREASE		.115	.028	.143		10
0010	E					RPL-DE-L1	.75	DEGREASE LARGE PART OR BASKT	PRORATED FOR SMALL PART		.14095		.131		
0020	E					RJP-PW-R1	1.00	REN RPL PAPERWK SIGN OFF DOC			.01001		.012		
0035			UP	01	24		.88		STRIP NICKEL PLATE		.252	.053	.275	40.0	19
0010	E					ZCR-ST-S1	1.00	STRIP CHROME I.D.SMALL PART ,			.24234		.300		
0020	E					RJP-PW-R1	1.00	REN RPL PAPERWK SIGN OFF DOC,			.01001		.012		
0085			UP	01	24		1.00		DEGREASE		.115	.028	.143		10
0010	E					RPL-DE-L1	.75	DEGREASE LARGE PART OR BASKT	PRORATED FOR SMALL PART		.14095		.131		
0020	E					RJP-PW-R1	1.00	REN RPL PAPERWK SIGN OFF DOC			.01001		.012		
0095			UP	01	24		.71		SHOTPEEN I.D.		.171	.029	.151		11
0020	E					RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART ,			.16131		.200		
0030	E					RJP-PW-R1	1.00	REN RPL PAPERWK SIGN OFF DOC,			.01001		.012		
0150			UP	01	24		1.00		PREP FOR NICKEL		.210	.050	.260		18
0010	N						1.00		PREP FOR NICKLE		.20000		.248		
0020	E					RJP-PW-R1	1.00	REN RPL PAPERWK SIGN OFF DOC			.01001		.012		
0160			UP	01	24		1.00		SUFIMATE NICKEL PLATE		.220	.053	.273	24.0	19
0010	N						1.00		NICKLE PLATE SMALL PART		.21020		.260		
0020	E					RJP-PW-R1	1.00	REN RPL PAPERWK SIGN OFF DOC,			.01001		.012		
165			UP	01	24		.88		BAKE AFTER PLATE		.090	.019	.099	38.0	7
0010	E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE ,			.08088		.100		
0020	E					RJP-PW-R1	1.00	REN RPL PAPERWK SIGN OFF DOC,			.01001		.012		
0168			UP	01	24		.76		BAKE AFTER GRIND		.090	.017	.086	8.0	6
0010	E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE ,			.08088		.100		
0020	E					RJP-PW-R1	1.00	REN RPL PAPERWK SIGN OFF DOC,			.01001		.012		
9000			UP	01	24		.01		LABOR STANDARD HISTORY		.000	.000	.000		0
0010									PRIOR HISTORY ON OO-ALC 494 FORM						
0020									27JUN83 NEW OCC FACTOR STUDY <OLD STD>		.32				
0030									14OCT83 UPGRADE TO 'E' STD <OLD STD>		.08				
0031									27DEC84 2 YR REVIEW W/OCC CHANGE > OLD STD <		.09				
0032									4 OCT85 CHANGED TO MATCH 958 STEPS OLD STD		.78				
0900									JENSEN MANEL 73255						

TO INTERROGATE LABOR STANDARDS, INPUT

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LABOR STANDARD OPERATION RESOURCE STANDARD AND METHOD ANALYSIS  
RCC MNPCC

12/19/88  
452-59-3

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81174

74521A STRUT ASSY C-141 NLG

KNPRC	S	E	UP	EA	B	J	88349	1.00	PERCENT ENGR 99.9	C-141 NOSE MISC CAT. S-1	1.24	1.24	A	
														TECH S S W F PF A/R REV
0001			UP	01	00			.00		PART NUMBER/NSN STEEL S-1	.000	.000	.000	0
										STORED				
										SUPPLEMENTAL	HOURS	TIME	HOURS	DLY PCT C
0010								.13		3661227-101 5305000587840	.291	.009	.047	4
0020								.13		3661042-101 5305007069361	.08709		.323	
0030								.13		7127998-01 5365000073413	.01901		.037	
0010	UP	01			24			.13		DEGREASE	2.556	.080	.412	.5 33
0010	E							3.00		VAPOR CL (DEGR)HOOK/BASKET	.12630		3.132	
0020	E							3.00		REM RPL PAPRWRK SIGN OFF DOC	.01001		.037	
0011	UP	01			24			.13		STRIP CAD	.12630		3.132	
0010	E							20.00		STRIP CAD PLATE SMALL PART	.01001		.037	
0020	E							3.00		REM RPL PAPRWRK SIGN OFF DOC	.535	.017	.086	.3 7
0012	UP	01			24			.13		STRIP RUST	.12630		.626	
0010	E							4.00		STRIP RUST	.01001		.037	
0020	E							3.00		REM RPL PAPRWRK SIGN OFF DOC	.140	.004	.023	2
0013	UP	01			24			.13		GRIT BLAST	.03668		.136	
0010	E							3.00		BLAST SM PT OR BSKT V/SM PTS	.01001		.037	
0020	E							3.00		REM RPL PAPRWRK SIGN OFF DOC	1.872	.058	.302	24
0014	UP	01			24			.13		CAD PLATE	.09212		2.284	
0010	E							20.00		CADMIUM PLATE SMALL PART	.01001		.037	
0020	E							3.00		REM RPL PAPRWRK SIGN OFF DOC	.272	.009	.044	38.0 4
0015	UP	01			24			.13		BAKE AFTER CAD PLATE	.08088		.300	
0010	E							3.00		BAKE SM PART 4HR/24HR BAKE	.01001		.037	
0020	E							3.00		REM RPL PAPRWRK SIGN OFF DOC	.502	.016	.081	7
16	UP	01			24			.13		CHROMATE CONVERSION(IRIDITE)	.02362		.585	
0010	E							20.00		IRIDITE SMALL PART	.01001		.037	
0020	E							3.00		REM RPL PAPRWRK SIGN OFF DOC	.000	.000	.000	0
0120	UP	01			00			.00		PART NUMBER /NSN STEEL S-7				
0010										3G61160-101 5310000511078				
0020										3G61088-101 5310000224942				
0129	UP	01			00			.13		BRUSH PLATE D.D.	1.547	.000	.201	16
0010	E							16.00		BRUSH PLATE SPOT DR HOLE	.09546		1.527	
0020	E							2.00		REM RPL PAPRWRK SIGN OFF DOC	.01001		.020	
0400	UP	01			00			.00		PART NUMBER/NSN ALUM. A-1	.000	.000	.000	0
0010										3G61030-103 5310009740834				
0409	UP	01			24			.13		STRIP ANODIZE MED PART	.136	.004	.022	.5 2
0010	E							1.00		STRIP ANODIZE	.12630		.156	
0020	E							1.00		REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0412	UP	01			24			.13		ANODIZE SMALL PART	.156	.005	.025	.8 2
0010	E							1.00		VAPOR CL (DEGR)HOOK/BASKET	.08709		.107	
0020	E							1.00		ANODIZE SMALL PART	.05892		.073	
0030	E							1.00		REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
9000	UP	01			00			.00		LABOR STANDARD HISTORY	.000	.000	.000	0
0010										NOV 21 1988 INITIAL INPUT				
0900										BOB ROSS MANEL 73255				

INTERROGATE LABOR STANDARDS, INPUT

69657A STRUT KC135 MLG L/H

RCC MNRPC

451-56-3 038-9102 83086

FR	TECH	S	S	W	F	P	A/R	REV													
SUB	T	K	#R	A	FA	SUPPORT	OCC		DESCRIPTION		BASE	PFD	STD						A		
STEP	D	L	K	C	DC	ELEMENT	FACT		STORED	SUPPLEMENTAL	HOURS	TIME	HOURS						DLY	PCT	C
RC015	S	E	UP	EA	B	J	88167	.35	PERCENT ENGR 94.9	BEARING LOWER	.53		.18								
0001			UP	00	00			.00		PART NO/NSN	.000	.000	.000								0
	0010								7653528-01	3120010403938											
0033			UP	01	24			1.00		DEGREASE	.097	.023	.120								22
	0010	E				RWB-CV-D1		1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107								
	0020	E				RJP-PW-R1		1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012								
0037			UP	01	24			1.00		STRIP CAD	.136	.033	.169	.5							32
	0010	E				ZCD-ST-S1		1.00	STRIP CAD PLATE SMALL PART		.12630		.156								
	0020	E				RJP-PW-R1		1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012								
0038			UP	01	24			1.00		GRIT BLAST	.046	.011	.058								11
	0010	E				RWB-CB-B1		1.00	BLAST SH PT OR BSKT V/SH PTS		.03668		.045								
	0020	E				RJP-PW-R1		1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012								
0040			UP	01	24			.95		CAD PLATE	.102	.023	.120								22
	0010	E				ZPL-CD-S1		1.00	CADMIUM PLATE SMALL PART		.09212		.114								
	0020	E				RJP-PW-R1		1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012								
0042			UP	01	24			.95		CHROMATE CONVERSION(IRIDITE)	.033	.008	.040								7
	0010	E				ZPL-IR-S1		1.00	IRIDITE SMALL PART		.02362		.029								
	0020	E				RJP-PW-R1		1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012								
0044			UP	01	24			.05		I.V.D. ALUMINUM PLATE	.230	.003	.014	1.0							3
	0010	N						1.00	I.V.D. PLATE		.22000		.272								
	0020	E				RJP-PW-R1		1.00	REM RPL PAPWRK SIGN OFF DOC/		.01001		.012								
0046			UP	01	24			.05		ALODINE I.V.D. ALUM PLATE	.230	.003	.014								3
	0010	N						1.00	ALODINE		.22000		.272								
	0020	E				RJP-PW-R1		1.00	REM RPL PAPWRK SIGN OFF DOC/		.01001		.012								
9000			UP	01	24			.01		LABOR STD HISTORY	.000	.000	.000								0
	0010								INITIAL INPUT MARCH 1983												
	0020								20APR85 DOWNGRADE TO N STD - WAS 0.12 HRS												
	0990								K W SHIPLEY MANEAA 63357												

TO INTERROGATE LABOR STANDARDS. INPUT

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RC	TECH	S	W	F	PF	A/R	REV	OC	DESCRIPTION	BASE	PF	STD	
STEP	D	L	K	C	DC	ELEMENT	FACT	STO	SUPPLEMENTAL	HOURS	TIME	HOURS	DLY PCT
RC016	S	E	UP	EA	B	J 88173	.35	PERCENT ENGR 99.9	PIN.METERING	.36		.12	
0001			UP	00	00		.00		PART NO/NSW	.000	.000	.000	0
								65-5735	1620007390166				
0030			UP	01	24		1.00		STRIP ANODIZE SMALL PART	.136	.033	.169	.5 47
						ZCD-ST-S1	1.00		STRIP ANODIZE	.12630		.156	
0020						RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012	
0040			UP	01	24		1.00		ANODIZE SMALL PART	.156	.037	.193	.8 53
						RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107	
						ZPL-AN-S1	1.00	ANODIZE SMALL PART		.05892		.073	
						RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012	
9000			UP	01	24		.01		LABOR STANDARD HISTORY	.000	.000	.000	0
									INITIAL INPUT MARCH 1983				
									20APR85 DOWNGRADE TO N STD - WAS 0.08 HRS				
									K W SHIPLEY MANEAA 63357				

TO INTERROGATE LABOR STANDARDS. INPUT

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69657A STRUT KC135 MLG L/H

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OSCP		TECH S S		W F PF A/R REV		T K #R A FA SUPPORT		OCC		DESCRIPTION		BASE	PFJ	STD	A	
STEP	D L	K C	DC	ELEMENT	FACT	STORED	SUPPLEMENTAL		HOURS	TIME	HOURS	DLY	PCT	C		
XNPRC	S	X	UP	EA B	J 88189	1.00	PERCENT ENGR	89.8		PLATE MISC. PARTS KC-135 MLG	2.09		2.09			
0001			UP	01 00		.00				PART NUMBER/NSN STEEL S-1	.000	.000	.000		0	
0010			UP	01 24		.13				DEGREASE	.097	.003	.016		1	
0010	E				RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET				.08709		.107			
0020	E				RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC				.01001		.012			
0011			UP	01 24		.13				STRIP CAD	1.020	.032	.164	.5	8	
0010	E				ZCD-ST-S1	8.00	STRIP CAD PLATE SMALL PART				.12630		1.252			
0020	E				RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC				.01001		.012			
0012			UP	01 24		.13				STRIP RUST	.136	.004	.022	.3	1	
0010	E				ZCD-ST-S1	1.00	STRIP RUST				.12630		.156			
0020	E				RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC				.01001		.012			
0013			UP	01 24		.13				GRIT BLAST	.046	.001	.008		0	
0010	E				RWB-CB-R1	1.00	BLAST SM PT OR BSKT V/SM PTS				.03668		.045			
0020	E				RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC				.01001		.012			
0014			UP	01 24		.13				CAD PLATE	.746	.023	.120		6	
0010	E				ZPL-CD-S1	8.00	CADMIUM PLATE SMALL PART				.09212		.913			
0020	E				RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC				.01001		.012			
0015			UP	01 24		.13				BAKE AFTER CAD PLATE	.657	.020	.106	38.0	5	
0010	E				ZPL-BK-S1	8.00	BAKE SM PART 4HR/24HR BAKE				.08088		.802			
0020	E				RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC				.01001		.012			
0016			UP	01 24		.13				CHROMATE CONVERSION(IRIDITE)	.198	.006	.032		2	
0010	E				ZPL-IR-S1	8.00	IRIDITE SMALL PART				.02362		.234			
0020	E				RJP-PW-R1	1.00	REN RPL PAPRWRK SIGN OFF DOC				.01001		.012			
0060			UP	01 00		.00				PART NUMBER/NSN STEEL S-4	.000	.000	.000		0	
0010																
0020																
0030																
0040																
0050																
0010																
0020																
0030																
0040																
0050																
0067			UP	01 24		.13				DEGREASE	.291	.009	.047		2	
0010	E				RWB-CV-D1	3.00	VAPOR CL (DEGR)HOOK/BASKET				.08709		.323			
0020	E				RJP-PW-R1	3.00	REN RPL PAPRWRK SIGN OFF DOC				.01001		.037			
0068			UP	01 24		.13				STRIP CAD	3.061	.096	.493	.5	24	
0010	E				ZCD-ST-S1	24.00	STRIP CAD PLATE SMALL PART				.12630		3.758			
0020	E				RJP-PW-R1	3.00	REN RPL PAPRWRK SIGN OFF DOC				.01001		.037			
0069			UP	01 24		.13				STRIP RUST	.408	.013	.066	.3	3	
0010	E				ZCD-ST-S1	3.00	STRIP RUST				.12630		.469			
0020	E				RJP-PW-R1	3.00	REN RPL PAPRWRK SIGN OFF DOC				.01001		.037			
0070			UP	01 24		.13				GRIT BLAST	.140	.004	.023		1	
0010	E				RWB-CB-B1	3.00	BLAST SM PT OR BSKT V/SM PTS				.03668		.136			
0020	E				RJP-PW-R1	3.00	REN RPL PAPRWRK SIGN OFF DOC				.01001		.037			
0071			UP	01 24		.13				I.V.D. ALUMINUM PLATE	.690	.022	.111	1.0	5	
0010	N					3.00	I.V.D. PLATE				.22000		.818			
0020	E				RJP-PW-R1	3.00	REN RPL PAPRWRK SIGN OFF DOC/				.01001		.037			
0072			UP	01 24		.13				ALODINE I.V.D. ALUM PLATE	.690	.022	.111		5	
0010	N					3.00	ALODINE				.22000		.818			
0020	E				RJP-PW-R1	3.00	REN RPL PAPRWRK SIGN OFF DOC/				.01001		.037			



0400	UP 01	00	.00	PART NUMBER/NSN ALUM. . . 1	.000	.000	.000	0
0010			69-1173-1	1620006020297				
0020			69-1173-2	1620006020298				
0030			90-8654	1620005725325				
9	UP 01	24	.13	STRIP ANODIZE MED PART	2.040	.064	.329	.5 16
0010 E		ZCD-ST-S1	16.00	STRIP ANODIZE	.12630		2.505	
0020 E		RJP-PW-R1	2.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.024	
0412	UP 01	24	.13	ALODINE SMALL PART	1.612	.050	.260	12
0010 E		RPL-AL-S1	16.00	ALODINE 1ST SMALL ALUM PART	.09953		1.974	
0020 E		RJP-PW-R1	2.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.024	
0480	UP 01	00	.00	PART NUMBER/ NSN ALUM. A-5	.000	.000	.000	0
0010			65-5754-1	1620007651370				
0020			65-5754	N.S.L.				
0030			69-1176	N.S.L.				
0486	UP 01	24	.13	ANODIZE SMALL PART	1.136	.035	.183	.8 9
0010 E		RWB-CV-D1	2.00	VAPOR CL (DEGR)HOOK/BASKET	.08709		.215	
0020 E		ZPL-AN-S1	16.00	ANODIZE SMALL PART	.05892		1.168	
0030 E		RJP-PW-R1	2.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.024	

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0230	UP 01	24	.01	NICKEL	.420	.001	.005	24.0	0
0010	N		1.00	NICKEL PLT LARGE PART	.41000		.508		
0020	E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012		
0235	UP 01	24	.01	NICKEL	.420	.001	.005	24.0	0
0010	N		1.00	NICKEL PLT LARGE PART	.41000		.508		
0020	E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012		
0245	UP 01	24	.50	BAKE AFTER NICKEL	.171	.021	.106	8.0	2
0010	E	ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200		
0020	E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012		
0280	UP 01	24	.65	BAKE AFTER GRIND	.171	.027	.138	8.0	2
0010	E	ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200		
0020	E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012		
0305	UP 01	24	.95	GRIT BLAST PRIOR TO CAD/IVD	.326	.075	.385		7
0010	E	RPL-SB-L2	1.00	SANDBLAST LARGE PART - HOIST	.31693		.392		
0020	E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012		
0310	UP 01	24	.95	CAD PLATE	.824	.188	.971		17
0010	E	ZPL-CD-L1	1.00	CADMIUM PLATE LRG PART-HOIST	.81410		1.009		
0020	E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012		
0330	UP 01	24	.95	BAKE AFTER CAD PLATE	.171	.039	.202	38.0	4
0010	E	ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200		
0020	E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012		
0332	UP 01	24	.95	CHROMATE CONVERSION(IRIDITE)	.117	.027	.138		2
0010	E	ZPL-IR-L1	1.00	IRIDITE LARGE PART-HOIST	.10705		.132		
0020	E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012		
0337	UP 01	24	.05	I.V.D. ALUMINUM PLATE	.824	.010	.051	1.0	1
0010	N		1.00	I.V.D. PLATE	.81400		1.009		
0020	E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC/	.01001		.012		
0338	UP 01	24	.05	ALODINE I.V.D. ALUM PLATE	.425	.005	.026		0
0010	N		1.00	ALODINE	.41500		.514		
0020	E	RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC/	.01001		.012		
9000	UP 01	24	.01	LABOR STANDARD HISTORY	.000	.000	.000		0
0010				INITIAL INPUT MARCH 1983					
0020				20APR85 DOWNGRADE TO N STD - WAS 5.33 HRS					
0990				K W SHIPLEY MANEAA 63357					

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R	SUB	TECH	S	S	W	F	PF	A/R	REV	STEP	D	L	#R	A	FA	SUPPORT	OCC	DESCRIPTION		BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A
																		STORED	SUPPLEMENTAL						
	RC014	S	N	UP	EA	B	J	88167	1.00	PERCENT ENGR	65.9								INNER CYLINDER	5.55		5.55			
	0001			UP	00	00			.00										PART NO/NSN	.000	.000	.000			0
	0010									65-1265-8									1620000842104						
	0035			UP	01	24			1.00										DEGREASE	.150	.036	.187			3
	0010	E							1.00	DEGREASE	LARGE PART OR BASKT									.14095		.174			
	0020	E							1.00	REM RPL	PAPRWRK SIGN OFF DOC									.01001		.012			
	0040			UP	01	24			.95										STRIP CAD	.262	.060	.309	.5		6
	0010	E							1.00	STRIP	CAD ID/OD MED/LRG PART									.25260		.313			
	0020	E							1.00	REM RPL	PAPRWRK SIGN OFF DOC									.01001		.012			
	0045			UP	01	24			.05										STRIP RUST	.262	.003	.016	.3		0
	0010	E							1.00	STRIP	RUST									.25260		.313			
	0020	E							1.00	REM RPL	PAPRWRK SIGN OFF DOC									.01001		.012			
	0050			UP	01	24			.25										STRIP CHROME LARGE PART O.D.	.363	.022	.113	24.0		2
	0010	E							1.00	STRIP	CHROME OD MED/LRG PART									.35303		.437			
	0020	E							1.00	REM RPL	PAPRWRK SIGN OFF DOC									.01001		.012			
	0060			UP	01	24			.25										STRIP CHROME LARGE PART I.D.	.494	.030	.153	24.0		3
	0010	E							1.00	STRIP	CHROME ID MED/LRG PART									.48467		.600			
	0020	E							1.00	REM RPL	PAPRWRK SIGN OFF DOC									.01001		.012			
	0070			UP	01	24			.10										GRIT BLAST PRIOR TO CAD/IVD	.326	.008	.041			1
	0010	E							1.00	SANDBLAST	LARGE PART - HOIST									.31693		.392			
	0020	E							1.00	REM RPL	PAPRWRK SIGN OFF DOC									.01001		.012			
	0180			UP	01	24			.75										BAKE AFTER ETCH	.171	.031	.160	8.0		3
	0010	E							1.00	BAKE	MED/LRG SIZE PART									.16175		.200			
	0020	E							1.00	REM RPL	PAPRWRK SIGN OFF DOC									.01001		.012			
	0195			UP	01	24			.75										DEGREASE	.150	.027	.140			3
	0010	E							1.00	DEGREASE	LARGE PART OR BASKT									.14095		.174			
	0020	E							1.00	REM RPL	PAPRWRK SIGN OFF DOC									.01001		.012			
	0200			UP	01	24			.75										SHOTPEEN LARGE PART/MASK	.548	.099	.510			9
	0010	E							1.00	MASK	V/LRG CYL TYPE PART									.32667		.405			
	0020	E							1.00	SHOT PEEN	SMALL/MED PART									.16131		.200			
	0030	N							1.00	UNMASK	MEDIUM SIZE CYL PART									.05067		.062			
	0040	E							1.00	REM RPL	PAPRWRK SIGN OFF DOC									.01001		.012			
	0205			UP	01	24			.50										PREP CHROME LARGE PART O.D.	.720	.086	.446			8
	0010	N							1.00	PREP	FOR CHRMOE									.71000		.880			
	0020	E							1.00	REM RPL	PAPRWRK SIGN OFF DOC									.01001		.012			
	0210			UP	01	24			.50										CHROME PLATE LARGE PART O.D.	.600	.072	.372	24.0		7
	0010	N							1.00	CHROME	PLATE LARGE PART									.59000		.731			
	0020	E							1.00	REM RPL	PAPRWRK SIGN OFF DOC									.01001		.012			
	0220			UP	01	24			.50										BAKE AFTER CHROME PLATE	.171	.021	.106	8.0		2
	0010	E							1.00	BAKE	MED/LRG SIZE PART									.16175		.200			
	0020	E							1.00	REM RPL	PAPRWRK SIGN OFF DOC									.01001		.012			
	0223			UP	01	24			.49										PREP CHROME I.D. LARGE PART	.940	.111	.571			10
	0010	N							1.00	PREP	CHROME I.D.									.93000		1.153			
	0020	E							1.00	REM RPL	PAPRWRK SIGN OFF DOC									.01001		.012			
	0225			UP	01	24			.49										CHROME LARGE PART I.D.	.640	.075	.389	30.0		7
	0010	N							1.00	CHROME	PLT LARGE PART									.63000		.781			
	0020	E							1.00	REM RPL	PAPRWRK SIGN OFF DOC									.01001		.012			
	0226			UP	01	24			.01										PREP FOR NICKEL	.260	.001	.003			0
	0010	N							1.00	PREP	FOR NICKEL LARGE PART									.25000		.310			
	0020	E							1.00	REM RPL	PAPRWRK SIGN OFF DOC									.01001		.012			
	0228			UP	01	24			.01										GRIT BLAST FOR NICKEL	.326	.001	.004			0
	0010	E							1.00	SANDBLAST	LARGE PART - HOIST									.31693		.392			
	0020	E							1.00	REM RPL	PAPRWRK SIGN OFF DOC									.01001		.012			

0010 E	ZPL-BK-M1	.34	BAKE MED/LRG SIZE . . . T	.16175		.068		
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0500	UP 01	24	.75	BAKE AFTER GRIND	.171	.031	.160	8.0 3
0010 E	ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200		
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0515	UP 01	24	.75	DEGREASE	.150	.027	.140	3
0010 E	RPL-DE-L1	1.00	DEGREASE LARGE PART OR BASKT	.14095		.174		
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0525	UP 01	24	1.00	GRIT BLAST PRIOR TO CAD/IVD	.326	.078	.405	8
0010 E	RPL-SB-L2	1.00	SANDBLAST LARGE PART - HOIST	.31693		.392		
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0530	UP 01	24	.95	CAD PLATE	.824	.188	.971	19
0010 E	ZPL-CD-L1	1.00	CADMIUM PLATE LRG PART-HOIST	.81410		1.009		
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0550	UP 01	24	.95	BAKE AFTER CAD PLATE	.171	.039	.202	38.0 4
0010 E	ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200		
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0555	UP 01	24	.95	CHROMATE CONVERSION(IRIDITE)	.117	.027	.138	3
0010 E	ZPL-IR-L1	1.00	IRIDITE LARGE PART-HOIST	.10705		.132		
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0563	UP 01	24	.05	I.V.D. ALUMINUM PLATE	.824	.010	.051	1.0 1
0010 N		1.00	I.V.D. PLATE	.81400		1.009		
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/	.01001		.012		
0567	UP 01	24	.05	ALODINE I.V.D. ALUM PLATE	.425	.005	.026	1
0010 N		1.00	ALODINE	.41500		.514		
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/	.01001		.012		
9000	UP 01	24	.01	LABOR STANDARD HISTORY	.000	.000	.000	0
0010			INITIAL INPUT MARCH 1983					
0020			20APR85 DOWNGRADE TO N STD - WAS 6.10 HRS					
0990			K W SHIPLEY MANEAA 63357					

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0010	E	ZPL-BK-M1	.50	BAKE MED/LRG SIZE PART	.16175		.100	
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0333	UP 01	24	.28	GRIT BLAST FOR CHROME	.168	.011	.058	1
0010	E	RPL-SB-L2	.50	SANDBLAST LARGE PART - HOIST	.31693		.196	
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0335	UP 01	24	.28	PREP CHROME I.D. LARGE PART	.475	.032	.165	3
0010	N		.50	PREP CHROME I.D.	.93000		.576	
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0340	UP 01	24	.28	CHROME LARGE PART I.D.	.325	.022	.113	30.0 2
0010	N		.50	CHROME PLT LARGE PART	.63000		.390	
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0350	UP 01	24	.28	BAKE AFTER CHROME PLATE	.090	.006	.032	8.0 1
0010	E	ZPL-BK-M1	.50	BAKE MED/LRG SIZE PART	.16175		.100	
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0353	UP 01	24	.10	PREP FOR NICKEL	.260	.006	.032	1
0010	N		1.00	PREP FOR NICKEL LARGE PART	.25000		.310	
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0357	UP 01	24	.10	GRIT BLAST FOR NICKEL	.326	.008	.041	1
0010	E	RPL-SB-L2	1.00	SANDBLAST LARGE PART - HOIST	.31693		.392	
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0360	UP 01	24	.10	NICKEL	.420	.010	.052	24.0 1
0010	N		1.00	NICKEL PLT LARGE PART	.41000		.508	
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0370	UP 01	24	.10	BAKE AFTER NICKEL	.171	.004	.021	8.0 0
0010	E	ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200	
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0373	UP 01	24	.10	PREP FOR NICKEL	.095	.002	.012	0
0010	N		.34	PREP FOR NICKEL LARGE PART	.25000		.105	
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
.77	UP 01	24	.10	GRIT BLAST FOR NICKEL	.117	.003	.015	0
0010	E	RPL-SB-L2	.34	SANDBLAST LARGE PART - HOIST	.31693		.133	
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0380	UP 01	24	.10	NICKEL	.149	.004	.019	24.0 0
0010	N		.34	NICKEL PLT LARGE PART	.41000		.172	
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0390	UP 01	24	.10	BAKE AFTER NICKEL	.065	.002	.008	8.0 0
0010	E	ZPL-BK-M1	.34	BAKE MED/LRG SIZE PART	.16175		.068	
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0393	UP 01	24	.10	PREP FOR NICKEL	.095	.002	.012	0
0010	N		.34	PREP FOR NICKEL LARGE PART	.25000		.105	
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0397	UP 01	24	.10	GRIT BLAST FOR NICKEL	.117	.003	.015	0
0010	E	RPL-SB-L2	.34	SANDBLAST LARGE PART - HOIST	.31693		.133	
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0400	UP 01	24	.10	NICKEL	.149	.004	.019	24.0 0
0010	N		.34	NICKEL PLT LARGE PART	.41000		.172	
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0410	UP 01	24	.10	BAKE AFTER NICKEL	.065	.002	.008	8.0 0
0010	E	ZPL-BK-M1	.34	BAKE MED/LRG SIZE PART	.16175		.068	
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0413	UP 01	24	.10	PREP FOR NICKEL	.095	.002	.012	0
0010	N		.34	PREP FOR NICKEL LARGE PART	.25000		.105	
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0417	UP 01	24	.10	GRIT BLAST FOR NICKEL	.117	.003	.015	0
0010	E	RPL-SB-L2	.34	SANDBLAST LARGE PART - HOIST	.31693		.133	
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0420	UP 01	24	.10	NICKEL	.149	.004	.019	24.0 0
0010	N		.34	NICKEL PLT LARGE PART	.41000		.172	
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0430	UP 01	24	.10	BAKE AFTER NICKEL	.065	.002	.008	8.0 0

69657A STRUT KC135 ML6 L/H

TECH 5 S W F PF A/R REV

JOB	STEP	D L	K C	DC	ELEMENT	OCC	FACT	STOR	DESCRIPTION	SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A C
RC013	S	E	UP	EA	B	J	88174	1.00	PERCENT ENGR 81.9	OUTER CYLINDER	5.18		5.18			
	0001		UP	01	00		.00		PART NUMBER/NSN		.000	.000	.000		0	
									65-5763-17	1620009274739						
									65-5763-18	1620009592078						
									50-9712-32	1620007871750						
									50-9712-31	1620007871749						
	0010		UP	00	00		.00		PART NO/NSN		.000	.000	.000		0	
									65-5763-17	1620009274739						
	0036		UP	01	24		1.00		DEGREASE		.150	.036	.187		4	
		0010	E		RPL-DE-L1		1.00		DEGREASE LARGE PART OR BASKT		.14095		.174			
		0020	E		RJP-PW-R1		1.00		REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
	0037		UP	01	24		.95		STRIP CAD		.262	.060	.309	.5	6	
		0010	E		ZCD-ST-M1		1.00		STRIP CAD ID/OD MED/LRG PART		.25260		.313			
		0020	E		RJP-PW-R1		1.00		REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
	0038		UP	01	24		.05		STRIP RUST		.262	.003	.016	.3	0	
		0010	E		ZCD-ST-M1		1.00		STRIP RUST		.25260		.313			
		0020	E		RJP-PW-R1		1.00		REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
	0080		UP	01	24		.30		STRIP CHROME LARGE PART I.D.		.252	.018	.094	24.0	2	
		0010	E		ZCR-ST-M1		.50		STRIP CHROME ID MED/LRG PART		.48467		.300			
		0020	E		RJP-PW-R1		1.00		REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
	0090		UP	01	24		.30		STRIP CHROME LARGE PART I.D.		.252	.018	.094	24.0	2	
		0010	E		ZCR-ST-M1		.50		STRIP CHROME ID MED/LRG PART		.48467		.300			
		0020	E		RJP-PW-R1		1.00		REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
	0100		UP	01	24		.80		GRIT BLAST CORROSION		.117	.023	.117		2	
		0010	E		RPL-SB-L2		.34		SANDBLAST LARGE PART - HOIST		.31693		.133			
		0020	E		RJP-PW-R1		1.00		REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
	0110		UP	01	24		.70		GRIT BLAST CORROSION		.117	.020	.102		2	
		0010	E		RPL-SB-L2		.34		SANDBLAST LARGE PART - HOIST		.31693		.133			
		0020	E		RJP-PW-R1		1.00		REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
	0120		UP	01	24		.60		GRIT BLAST CORROSION		.117	.017	.088		2	
		0010	E		RPL-SB-L2		.34		SANDBLAST LARGE PART - HOIST		.31693		.133			
		0020	E		RJP-PW-R1		1.00		REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
	0290		UP	01	24		.75		BAKE AFTER ETCH		.171	.031	.160	8.0	3	
		0010	E		ZPL-BK-M1		1.00		BAKE MED/LRG SIZE PART		.16175		.200			
		0020	E		RJP-PW-R1		1.00		REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
	0305		UP	01	24		.75		DEGREASE		.150	.027	.140		3	
		0010	E		RPL-DE-L1		1.00		DEGREASE LARGE PART OR BASKT		.14095		.174			
		0020	E		RJP-PW-R1		1.00		REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
	0310		UP	01	24		.90		SHOTPEEN LARGE PART/MASK		.548	.119	.612		12	
		0010	E		ZMA-CL-04		1.00		MASK V/LRG CYL TYPE PART		.32667		.405			
		0020	E		RPL-SP-M1		1.00		SHOT PEEN SMALL/MED PART		.16131		.200			
		0030	N		ZUM-CL-02		1.00		UNMASK MEDIUM SIZE CYL PART		.05067		.062			
		0040	E		RJP-PW-R1		1.00		REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
	0313		UP	01	24		.38		GRIT BLAST FOR CHROME		.168	.015	.079		2	
		0010	E		RPL-SB-L2		.50		SANDBLAST LARGE PART - HOIST		.31693		.196			
		0020	E		RJP-PW-R1		1.00		REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
	0315		UP	01	24		.38		PREP CHROME I.D. LARGE PART		.475	.043	.224		4	
		0010	N				.50		PREP CHROME I.D.		.93000		.576			
		0020	E		RJP-PW-R1		1.00		REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
	0320		UP	01	24		.38		CHROME LARGE PART I.D.		.325	.030	.153	30.0	3	
		0010	N				.50		CHROME PLT LARGE PART		.63000		.390			
		0020	E		RJP-PW-R1		1.00		REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
	0330		UP	01	24		.38		BAKE AFTER CHROME PLATE		.090	.008	.043	8.0	1	



0020	E	RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART	.16131		.200	
0030	N	ZUM-CL-02	1.00	UNMASK MEDIUM SIZE CYL PART	.05067		.062	
0040	E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012	
0265	UP 01	24	.05	PREP CHROME LARGE PART O.D.	.720	.009	.045	1
0010	N		1.00	PREP FOR CHROME	.71000		.620	
0020	E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012	
0267	UP 01	24	.05	PREP CHROME LARGE PART O.D.	.720	.009	.045	1
0010	N		1.00	PREP FOR CHROME	.71000		.620	
0020	E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012	
0270	UP 01	24	.05	CHROME PLATE LARGE PART O.D.	.600	.007	.037	24.0 1
0010	N		1.00	CHROME PLATE LARGE PART	.59000		.731	
0020	E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012	
0275	UP 01	24	.05	CHROME PLATE LARGE PART O.D.	.600	.007	.037	24.0 1
0010	N		1.00	CHROME PLATE LARGE PART	.59000		.731	
0020	E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012	
0280	UP 01	24	.05	BAKE AFTER CHROME PLATE	.171	.002	.011	8.0 0
0010	E	ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200	
0020	E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012	
0285	UP 01	24	.29	PREP CHROME LARGE PART O.D.	.720	.050	.259	6
0010	N		1.00	PREP FOR CHROME	.71000		.880	
0020	E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012	
0290	UP 01	24	.21	CHROME PLATE LARGE PART O.D.	.600	.030	.156	24.0 4
0010	N		1.00	CHROME PLATE LARGE PART	.59000		.731	
0020	E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012	
0300	UP 01	24	.14	CHROME PLATE LARGE PART O.D.	.600	.020	.104	24.0 2
0010	N		1.00	CHROME PLATE LARGE PART	.59000		.731	
0020	E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012	
0320	UP 01	24	.14	CHROME PLATE LARGE PART O.D.	.600	.020	.104	24.0 2
0010	N		1.00	CHROME PLATE LARGE PART	.59000		.731	
0020	E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012	
0342	UP 01	24	.29	CHROME PLATE LARGE PART O.D.	.600	.042	.216	24.0 5
0010	N		1.00	CHROME PLATE LARGE PART	.59000		.731	
0020	E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012	
0345	UP 01	24	.29	BAKE AFTER CHROME PLATE	.171	.012	.062	8.0 1
0010	E	ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200	
0020	E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012	
0430	UP 01	24	.14	BAKE AFTER GRIND	.171	.006	.030	8.0 1
0010	E	ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200	
0020	E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012	
0440	UP 01	24	.50	DEGREASE	.150	.018	.094	0
0010	E	RPL-DE-L1	1.00	DEGREASE LARGE PART OR BASKT	.14095		.174	
0020	E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012	
0454	UP 01	24	1.00	GRIT BLAST PRIOR TO CAD/IVD	.326	.078	.405	10
0010	E	RPL-SS-L2	1.00	SANDBLAST LARGE PART - HOIST	.31693		.392	
0020	E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012	
0455	UP 01	24	1.00	GRIT BLAST PRIOR TO CAD/IVD	.326	.078	.405	10
0010	E	RPL-SS-L2	1.00	SANDBLAST LARGE PART - HOIST	.31693		.392	
0020	E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012	
0460	UP 01	24	.95	CAD PLATE	.824	.188	.971	23
0010	E	ZPL-CD-L1	1.00	CADMIUM PLATE LRG PART-HOIST	.81410		1.009	
0020	E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012	
0470	UP 01	24	.95	BAKE AFTER CAD PLATE	.171	.039	.292	38.0 5
0010	E	ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200	
0020	E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012	
0480	UP 01	24	.95	CHROMATE CONVERSION(IRIDITE)	.117	.027	.138	3
0010	E	ZPL-IR-L1	1.00	IRIDITE LARGE PART-HOIST	.10705		.132	
0020	E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012	
0486	UP 01	24	.05	I.V.D. ALUMINUM PLATE	.824	.010	.051	1.0 1
0010	N		1.00	I.V.D. PLATE	.81400		1.009	
0020	E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC/	.01001		.012	



0487	UP 01	24	.05	ALODINE I.V.D. ALUM PLATE	.425	.005	.026	1
0010 N			1.00	ALODINE	.41500		.514	
0020 E	RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC/		.01001		.012	
9000	UP 01	00	.01	LABOR STANDARD HISTORY	.000	.000	.000	0
0001			16 MAY 88					
0010			KIN VINCENT. MANEL. 73952					

TO INTERROGATE LABOR STANDARDS. INPUT

RCC PRD NRCP NR

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OPER	TECH	S	S	W	F	PF	A/R	REV													
SUB	T	K	#	A	FA	SUPPORT	OCC	←-----	DESCRIPTION	----->	BASE	PFD	STD						A		
STEP	D	L	K	C	DC	ELEMENT	FACT	STORED		SUPPLEMENTAL	HOURS	TIME	HOURS						DLY	PCT	C
EC503	S	E	UP	EA	8	J 88154	.38	PERCENT ENGR 89.6		SHOT PEEN NUT KC-135 NLG	.60		.23								
0001			UP	01	00		.00			PART NUMBER/NSN	.000	.000	.000								0
			0010					60-6681		N.S.L.											
			0020					60-6681-1		5310010206440											
			0030					60-6681-2		5310010206440											
0045			UP	01	24		1.00			DEGREASE	.097	.023	.120								20
			0010	E		RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET			.08709		.107								
			0020	E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC			.01001		.012								
0050			UP	01	24		1.00			SHOTPEEN MED PART/MASK	.391	.094	.486								80
			0010	E		ZMA-CL-02	1.00	MASK MED CYLINDRICAL PART			.17000		.210								
			0020	E		RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART			.16131		.200								
			0030	N		ZUM-CL-02	1.00	UNMASK MEDIUM SIZE CYL PART			.05067		.062								
			0040	E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC			.01001		.012								
9000			UP	01	24		.01			LABOR STANDARD HISTORY	.000	.000	.000								0
			0010							PRIOR HISTORY ON OO-ALC FORM 494											
			0020							SEP 84-DELETED SUB OPS 0052,0054,0056-OCC FACTOR											
			0021							UPDATE & REVIEW - TIME WAS 0.12 HRS											
			0030							12MAR86 OCC FACTOR UPDATE/REVIEW (TIME WAS .00)											
			0900							D. PARKER TECHN MANEAA 73357											

TO INTERROGATE LABOR STANDARDS, INPUT

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69354A STRUT ASSY KC135 NLG

RCC MNPRC

4S2-30-3 038-1912 82259

TECH S S	W F PF A/R REV	OCC	DESCRIPTION	BASE HOURS	PFD TIME	STD HOURS	A DLY PCT C
SUB	T K #R A FA SUPPORT	FACT	STORED	SUPPLEMENTAL			
STEP D L	K C DC ELEMENT						
50504	S E UP EA B J 88134	.46	PERCENT ENGR 99.9	ACTUATOR BRACKET KC-135	.68	.31	
0001	UP 01 00	1.00		PART NUMBER/NSN	.000	.000	0
0010			5-72349	1620003069935			
0080	UP 01 24	1.00		STRIP ANODIZE MED PART	.136	.033	.169 .5 25
0010	E ZCD-ST-S1	1.00		STRIP ANODIZE	.12330	.156	
0020	E RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC		.01001	.012	
0090	UP 01 24	.91		ANODIZE MED PART	.460	.101	.520 .8 75
0010	E RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709	.107	
0020	E ZPL-AN-M1	1.00	ANODIZE MEDIUM SIZE PART		.36341	.450	
0030	E RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC		.01001	.012	
9000	UP 01 24	.01		LABOR STANDARD HISTORY	.000	.000	.000 0
0010				PRIOR HISTORY ON OO-ALC FORM 494			
0020				SEP 84-OCC FACT UPDATE/REVIEW-TIME WAS 0.64 HRS			
0030				12MAR86 OCC FACTOR UPDATE/REVIEW (TIME WAS .76)			
0900				D. PARKER TECHN MANEAA 73357			

TO INTERROGATE LABOR STANDARDS, INPUT

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LABOR STANDARD OPERATION RESOURCE STANDARD AND METHOD ANALYSIS  
 69354A STRUT ASSY KC135 NLG  
 RCC MNPFC

06/14/88 A-E046B-MM1-DY-M45 PAGE 0001  
 452-30-3 036-1912 82259

STEP	D L	K C DC	ELEMENT	FACT	STOR	DESCRIPTION	SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY PCT	A C
RC510	S	E	UP EA B	J 88154	.63	PERCENT ENGR 99.9	OLED CAM UP & LOWER	.63		.40		
0001		JB	01 00		.00		PART NUMBER/ NSN	.000	.000	.000		0
0010						158662	1620007871753					
0020						5-83012-1	1620005934049					
0073		UP	01 24		1.00		DEGREASE	.097	.023	.120		19
0010	E		RWB-CV-D1		1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107		
0020	E		RJP-PW-R1		1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012		
0077		UP	01 24		1.00		GRIT BLAST	.111	.027	.139		22
0010	E		RPL-SB-M2		1.00	SANDBLAST MED PART WALK-IN B		.10180		.126		
0020	E		RJP-PW-R1		1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012		
0080		UP	01 24		1.00		PHOSPHATE COAT MED PART	.132	.032	.164	.3	26
0010	E		RPL-PK-B1		1.00	PARKERIZE SMALL/MED PART		.12217		.151		
0020	E		RJP-PW-R1		1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012		
0090		UP	01 24		1.00		BAKE PHOSPHATE MED PART	.171	.041	.213	9.0	33
0010	E		ZPL-BK-M1		1.00	BAKE MED/LRG SIZE PART		.16175		.200		
0020	E		RJP-PW-R1		1.00	REM RPL PAPWRK SIGN OFF DOC		.01001		.012		
9000		UP	01 24		.01		LABOR STANDARD HISTORY	.000	.000	.000		0
0010						PRIOR HISTORY ON OO-ALC FORM 494						
0020						SEP 84-DELETED SUB OF 0040 - OCC FACTOR						
0021						UPDATE & REVIEW - TIME WAS 0.19 HRS						
0030						12MAR86 OCC FACTOR UPDATE/REVIEW (TIME WAS .09)						
0900						D. PARKER TECHN MANEAA 73357						

TO INTERROGATE LABOR STANDARDS, INPUT

RCC PRD NROP NR

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69354A STRUT ASSY KC135 NLG

RCC MNPRC

4S2-30-3

038-1912

82259

RC512	TECH S S	W F PF A/R REV	J	88161	.71	PERCENT ENGR 98.0	PLATE OUTER CYL KC135 NLG	1.93		1.37				
0001	UP 01	00			.00		PART NUMBER/NSN	.000	.000	.000			0	
0010						7327022-30	1620001954810							
0060	UP 01	24			.71		STRIP ANODIZE LARGE PART	.073	.012	.064	.5	3		
0010 E			ZCD-ST-S1		.50		STRIP ANODIZE	.12630		.078				
0020 E			RJP-PW-R1		1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012				
0064	UP 01	24			.59		STRIP ANODIZE LARGE PART	.073	.010	.054	.5	3		
0010 E			ZCD-ST-S1		.50		STRIP ANODIZE	.12630		.078				
0020 E			RJP-PW-R1		1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012				
0170	UP 01	24			.94		DEGREASE	.150	.034	.176		9		
0010 E			RPL-DE-L1		1.00	DEGREASE LARGE PART OR BASKT		.14095		.174				
0020 E			RJP-PW-R1		1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012				
0180	UP 01	24			.94		SHOTPEEN LARGE PART/MASK	.193	.044	.225		12		
0010 E			ZMA-CL-04		.34	MASK V/LRG CYL TYPE PART		.32667		.137				
0020 E			RPL-SP-M1		.34	SHOT PEEN SMALL/MED PART		.16131		.068				
0030 N			ZUM-CL-02		.34	UNMASK MEDIUM SIZE CYL PART		.05067		.021				
0040 E			RJP-PW-R1		1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012				
0183	UP 01	24			.76		SHOTPEEN LARGE PART/MASK	.193	.035	.182		9		
0010 E			ZMA-CL-04		.34	MASK V/LRG CYL TYPE PART		.32667		.137				
0020 E			RPL-SP-M1		.34	SHOT PEEN SMALL/MED PART		.16131		.068				
0030 N			ZUM-CL-02		.34	UNMASK MEDIUM SIZE CYL PART		.05067		.021				
0040 E			RJP-PW-R1		1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012				
0185	UP 01	24			.05		SHOTPEEN LARGE PART/MASK	.193	.002	.012		1		
0010 E			ZMA-CL-04		.34	MASK V/LRG CYL TYPE PART		.32667		.137				
0020 E			RPL-SP-M1		.34	SHOT PEEN SMALL/MED PART		.16131		.068				
0030 N			ZUM-CL-02		.34	UNMASK MEDIUM SIZE CYL PART		.05067		.021				
0040 E			RJP-PW-R1		1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012				
0190	UP 01	24			.59		CLEAN SHOT PEEN	.115	.016	.084		4		
0010 E			RLG-CS-02		1.00	CLEAN ANY NONFERROUS PART		.11535		.143				
0200	UP 01	24			.29		POLISH STEER COLLAR AREA	.093	.006	.034		2		
0010 E			RLG-RS-P5		1.00	POLISH PLATED SURF OUTER CYL		.08737		.108				
0020 E			RJP-PW-F1		1.00	SIGN OFF WORK CONTROL DOC		.00601		.007				
0210	UP 01	24			.21		POLISH TOW LUG AREA	.093	.005	.024		1		
0010 E			RLG-RS-P5		1.00	POLISH PLATED SURF OUTER CYL		.08737		.108				
0020 E			RJP-PW-F1		1.00	SIGN OFF WORK CONTROL DOC		.00601		.007				
0230	UP 01	24			.88		ANODIZE LARGE PART	.307	.065	.335	.8	17		
0010 E			RWB-CV-D1		.50	VAPOR CL (DEGR)HOOK/BASKET		.08709		.053				
0020 E			ZPL-AN-L1		.50	ANODIZE LARGE SIZE PART		.50714		.314				
0030 E			RJP-PW-R1		1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012				
0232	UP 01	24			.05		ANODIZE LARGE PART	.307	.004	.019	.8	1		
0010 E			RWB-CV-D1		.50	VAPOR CL (DEGR)HOOK/BASKET		.08709		.053				
0020 E			ZPL-AN-L1		.50	ANODIZE LARGE SIZE PART		.50714		.314				
0030 E			RJP-PW-R1		1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012				
0245	UP 01	24			.38		HARD ANODIZE LARGE PART	1.446	.132	.682	.8	35		
0010 E			RWB-CV-D1		1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107				
0020 E			RPL-AN-H4		1.00	HARD ANODIZE LARGE PART		1.34921		1.673				
0030 E			RJP-PW-R1		1.00	REM RPL PAPERWK SIGN OFF DOC		.01001		.012				
0265	UP 01	24			.12		ALODINE LARGE PART	.309	.009	.046		2		
0010 E			RPL-AL-L1		1.00	ALODINE LARGE PART - HOIST		.29943		.371				

0020 E	RJF-PW-R1	1.00	REN RPL PAPERWK SIGN OFF DOC	.01001		.012	
0000	UP 01 24	.01		.000	.000	.000	0
0010			LABOR STANDARD HISTORY				
0020			PRIOR HISTORY ON OO-ALC FORM 494				
0021			SEP 84-ADDED SUB OP 0055, OCC FACTOR UPDATE				
0030			AND REVIEW - TIME WAS 3.00 HRS				
0900			12MAR86 OCC FACTOR UPDATE/REVIEW (TIME WAS 2.68)				
			D. PARKER TECHN MANEAA 73357				

TO INTERROGATE LABOR STANDARDS, INPUT

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69354A STRUT ASSY KC135 NLG

RCC MNPRC

452-30-3

038-1912

82259

TECH S S W F PF A/R REV

TR A FA SUPPORT OCC

DESCRIPTION

BASE PFD STD A

STEP D L K C DC ELEMENT FACT STORED

SUPPLEMENTAL

HOURS TIME HOURS DLY PCT C

RC528	S	E	UP	EA	B	J	86160	2.00	PERCENT	ENGR	97.5	PLATE TRUNNION PIN KC-135 N	1.69		3.38			
0001			UP	01		00		.00				PART NUMBER/NSN	.000	.000	.000		0	
0010									6-68001			1620003069946						
0020									6-68002			1620003069947						
0030									7729421-01			1620010544789						
0040									7729421-03			1620010544789						
0022			UP	01		24		1.00				DEGREASE	.097	.023	.120		7	
0010	E							1.00	VAPOR	CL (DEGR)	HOCK/BASKET		.08709		.107			
0020	E							1.00	REM	RPL	PAPRWRK	SIGN	.01001		.012			
0024			UP	01		24		.95				STRIP	.262	.060	.309	.5	18	
0010	E							1.00	STRIP	CAD	ID/OD	MED/LRG	.25260		.313			
0020	E							1.00	REM	RPL	PAPRWRK	SIGN	.01001		.012			
0026			UP	01		24		.05				STRIP	.262	.003	.016	.3	1	
0010	E							1.00	STRIP	RUST			.25260		.313			
0020	E							1.00	REM	RPL	PAPRWRK	SIGN	.01001		.012			
0028			UP	01		24		1.00				GRIT	.111	.027	.139		8	
0010	E							1.00	SANDBLAST	MED	PART	WALK-IN	.10180		.126			
0020	E							1.00	REM	RPL	PAPRWRK	SIGN	.01001		.012			
0030			UP	01		24		.95				CAD	.620	.141	.731		43	
0010	E							1.00	CADMIUM	PLATE	MEDIUM	PART	.61058		.757			
0020	E							1.00	REM	RPL	PAPRWRK	SIGN	.01001		.012			
0040			UP	01		24		.95				BAKE	.171	.039	.202	38.0	12	
0010	E							1.00	BAKE	MED/LRG	SIZE	PART	.16175		.200			
0020	E							1.00	REM	RPL	PAPRWRK	SIGN	.01001		.012			
0050			UP	01		24		1.00				CHROMATE	.106	.026	.132		8	
0010	E							1.00	IRIDITE	MEDIUM	PART-HOIST		.09635		.119			
0020	E							1.00	REM	RPL	PAPRWRK	SIGN	.01001		.012			
0063			UP	01		24		.05				I.V.D.	.450	.005	.023	1.0	2	
0010	N							1.00	I.V.D.	PLATE			.44000		.545			
0020	E							1.00	REM	RPL	PAPRWRK	SIGN	.01001		.012			
0067			UP	01		24		.05				ALODINE	.230	.003	.014		1	
0010	N							1.00	ALODINE				.22000		.272			
0020	E							1.00	REM	RPL	PAPRWRK	SIGN	.01001		.012			
9000			UP	01		24		.01				LABOR	.000	.000	.000		0	
0010									12MAR86 UPDATE WITHOUT CHANGE (TIME WAS .38)									
0900									D. PARKER TECHN MANEAA 73357									

TO INTERROGATE LABOR STANDARDS, INPUT

RCC PRD NRCP NR

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0024  
0900

18 FEB 87 NEW OCC FACTORS & REVIEW OLD STD 2.31  
CLINTON BENTLEY TECH MANEL 3357

INTERROGATE LABOR STANDARDS. INPUT

CC PRD NROP NR

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171432- STRUT B-52 MLG

ER	TECH	S	W	F	PF	A/R	REV	SUB	T	K	#R	A	FA	SUPPORT	OCC	DESCRIPTION	BASE	PFD	STD	A
	STEP	D	L	K	C	DC	ELEMENT	FACT	STOR	SUPPLEMENTAL	HOURS	TIME	HOURS	DLY	PCT	C				
	S	E	UP	EA	B	J	88230	.92	PERCENT ENGR 80.0	INNER CYL. B52M	6.89		6.34							
0001			UP	01	00			.00		PART NUMBER/NSN	.000	.000	.000		0					
	0010								25-4204	1620006525469										
	0020								5-85123-6	1620006582588										
0278			UP	01	24			1.00		DEGREASE	.150	.036	.187		3					
	0010	E					RPL-DE-L1	1.00		DEGREASE LARGE PART OR BASKT	.14095		.174							
	0020	E					RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC	.01001		.012							
0279			UP	01	24			.95		STRIP CAD	.262	.060	.309	.5	4					
	0010	E					ZCD-ST-M1	1.00		STRIP CAD ID/OD MED/LRG PART	.25260		.313							
	0020	E					RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC	.01001		.012							
0282			UP	01	24			.05		STRIP RUST	.262	.003	.016	.3	0					
	0010	E					ZCD-ST-M1	1.00		STRIP RUST	.25260		.313							
	0020	E					RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC	.01001		.012							
0285			UP	01	24			.34		STRIP CHROME LARGE PART O.D.	.363	.030	.153	24.0	2					
	0010	E					ZCR-ST-M2	1.00		STRIP CHROME OD MED/LRG PART	.35303		.437							
	0020	E					RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC	.01001		.012							
0300			UP	01	24			.25		STRIP CHROME LARGE PART O.D.	.363	.022	.113	24.0	2					
	0010	E					ZCR-ST-M2	1.00		STRIP CHROME OD MED/LRG PART	.35303		.437							
	0020	E					RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC	.01001		.012							
0320			UP	01	24			.17		STRIP CHROME MED PART O.D.	.000	.003	.017	24.0	0					
	0010	E					ZCR-ST-M2	.20		STRIP CHROME OD MED/LRG PART OCC. 5 EA OPERATIONS	.35303		.087							
	0020	E					RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC	.01001		.012							
0340			UP	01	24			.25		STRIP CHROME MED PART O.D.	.000	.005	.025	24.0	0					
	0010	E					ZCR-ST-M2	.20		STRIP CHROME OD MED/LRG PART OCC. 5 EA OPERATIONS	.35303		.087							
	0020	E					RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC	.01001		.012							
0360			UP	01	24			.42		STRIP CHROME LARGE PART O.D.	.363	.037	.189	24.0	3					
	0010	E					ZCR-ST-M2	1.00		STRIP CHROME OD MED/LRG PART	.35303		.437							
	0020	E					RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC	.01001		.012							
0520			UP	01	24			.46		BAKE AFTER ETCH	.171	.019	.098	8.0	1					
	0010	E					ZPL-BK-M1	1.00		BAKE MED/LRG SIZE PART	.16175		.200							
	0020	E					RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC	.01001		.012							
0550			UP	01	24			.50		DEGREASE	.150	.018	.094		1					
	0010	E					RPL-DE-L1	1.00		DEGREASE LARGE PART OR BASKT	.14095		.174							
	0020	E					RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC	.01001		.012							
0560			UP	01	24			1.00		SHOTPEEN LARGE PART/MASK	.548	.132	.680		10					
	0010	E					ZMA-CL-04	1.00		MASK V/LRG CYL TYPE PART	.32667		.405							
	0020	E					RPL-SP-M1	1.00		SHOT PEEN SMALL/MED PART	.16131		.200							
	0030	N					ZUM-CL-02	1.00		UNMASK MEDIUM SIZE CYL PART	.05067		.062							
	0040	E					RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC	.01001		.012							
0570			UP	01	24			1.00		SHOTPEEN LARGE PART/MASK	.548	.132	.680		10					
	0010	E					ZMA-CL-04	1.00		MASK V/LRG CYL TYPE PART	.32667		.405							
	0020	E					RPL-SP-M1	1.00		SHOT PEEN SMALL/MED PART	.16131		.200							
	0030	N					ZUM-CL-02	1.00		UNMASK MEDIUM SIZE CYL PART	.05067		.062							
	0040	E					RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC	.01001		.012							
0580			UP	01	24			1.00		SHOTPEEN LARGE PART/MASK	.548	.132	.680		10					
	0010	E					ZMA-CL-04	1.00		MASK V/LRG CYL TYPE PART	.32667		.405							
	0020	E					RPL-SP-M1	1.00		SHOT PEEN SMALL/MED PART	.16131		.200							
	0030	N					ZUM-CL-02	1.00		UNMASK MEDIUM SIZE CYL PART	.05067		.062							
	0040	E					RJP-PW-R1	1.00		REM RPL PAPERWK SIGN OFF DOC	.01001		.012							
			UP	01	24			.42		SHOTPEEN LARGE PART/MASK	.264	.027	.138		2					
	0010	E					ZMA-CL-04	.13		MASK V/LRG CYL TYPE PART PRORATED OVER 8 EA OPER	.32667		.052							
	0020	E					RPL-SP-M1	1.00		SHOT PEEN SMALL/MED PART	.16131		.200							
	0030	N					ZUM-CL-02	1.00		UNMASK MEDIUM SIZE CYL PART	.05067		.062							

0040 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001	.012		
0600 UP 01	24	.25	SHOTPEEN LARGE PART/MASK	.264	.016	.082	1
0010 E	ZMA-CL-04	.13	MASK V/LRG CYL TYPE PART	.32667		.052	
0020 E	RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART	.16131		.200	
0030 N	ZUM-CL-02	1.00	UNMASK MEDIUM SIZE CYL PART	.05067		.062	
0040 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
UP 01	24	.34	SHOTPEEN LARGE PART/MASK	.264	.022	.111	2
010 E	ZMA-CL-04	.13	MASK V/LRG CYL TYPE PART	.32667		.052	
0020 E	RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART	.16131		.200	
0030 N	ZUM-CL-02	1.00	UNMASK MEDIUM SIZE CYL PART	.05067		.062	
0040 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0620 UP 01	24	.25	SHOTPEEN LARGE PART/MASK	.264	.016	.082	1
0010 E	ZMA-CL-04	.13	MASK V/LRG CYL TYPE PART	.32667		.052	
0020 E	RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART	.16131		.200	
0030 N	ZUM-CL-02	1.00	UNMASK MEDIUM SIZE CYL PART	.05067		.062	
0040 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0530 UP 01	24	.09	SHOTPEEN LARGE PART/MASK	.264	.006	.030	0
0010 E	ZMA-CL-04	.13	MASK V/LRG CYL TYPE PART	.32667		.052	
0020 E	RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART	.16131		.200	
0030 N	ZUM-CL-02	1.00	UNMASK MEDIUM SIZE CYL PART	.05067		.062	
0040 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0635 UP 01	24	.25	PREP CHROME I.D. LARGE PART	.940	.056	.291	4
0010 N		1.00	PREP CHROME I.D.	.93000		1.153	
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0640 UP 01	24	.25	CHROME LARGE PART I.D.	.640	.038	.198	30.0 3
0010 N		1.00	CHROME PLATE LARGE PART	.63000		.781	
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC....	.01001		.012	
0650 UP 01	24	.25	BAKE AFTER CHROME PLATE	.171	.010	.053	8.0 1
0010 E	ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200	
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0655 UP 01	24	.34	PREP CHROME LARGE PART O.D.	.152	.012	.064	1
0010 N		.20	PRORATE PREP TIME SEA OPER	.71000		.176	
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0600 UP 01	24	.34	CHROME PLATE LARGE PART O.D.	.128	.010	.054	24.0 1
0010 N		.20	PRORATE PERP TIME SEA OPER	.59000		.146	
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0675 UP 01	24	.25	PREP CHROME LARGE PART O.D.	.152	.009	.047	1
0010 N		.20	PRORATE PREP OVER SEA OPER	.71000		.176	
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0680 UP 01	24	.25	CHROME PLATE LARGE PART O.D.	.128	.008	.040	24.0 1
0010 N		.20	PRORATE CHROME SEA OPER	.59000		.146	
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0690 UP 01	24	.34	PREP CHROME LARGE PART O.D.	.152	.012	.064	1
0010 N		.20	PRORATE PREP OVER SEA OPER	.71000		.176	
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0700 UP 01	24	.34	CHROME PLATE LARGE PART O.D.	.128	.010	.054	24.0 1
0010 N		.20	PRORATE CHROME OVER SEA OPER	.59000		.146	
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0720 UP 01	24	.34	PREP CHROME LARGE PART O.D.	.152	.012	.064	1
0010 N		.20	PRORATED PREP OVER SEA OPER	.71000		.176	
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0740 UP 01	24	.34	CHROME PLATE LARGE PART O.D.	.128	.010	.054	24.0 1
0010 N		.20	PRORATE CHROME OVER SEA OPER	.59000		.146	
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0750 UP 01	24	.42	PREP CHROME LARGE PART O.D.	.152	.015	.079	1
0010 N		.20	PRORATE PREP OVER SEA OPER	.71000		.176	
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
UP 01	24	.42	CHROME PLATE LARGE PART O.D.	.128	.013	.067	24.0 1
010 N		.20	PRORATE CHROME OVER SEA OPER	.59000		.146	
0020 E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	

	UP 01	24	.59	BAKE AFTER CHROME PLATE	.171	.024	.126	8.0	2
0010 E		ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200		
0020 E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012		
0880	UP 01	24	.59	BAKE AFTER GRIND	.171	.024	.126	8.0	2
0010 E		ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200		
0020 E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012		
	UP 01	24	.59	DEGREASE	.150	.021	.110		2
0010 E		RPL-DE-L1	1.00	DEGREASE LARGE PART OR BASKET	.14095		.174		
0020 E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012		
0902	UP 01	24	.59	GRIT BLAST PRIOR TO CAD/IVD	.117	.017	.086		1
0010 E		RPL-SB-L2	.34	SANDBLAST LARGE PART - HOIST PRORATED OVER SEA OPER	.31693		.133		
0020 E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012		
0905	UP 01	24	.67	GRIT BLAST PRIOR TO CAD/IVD	.117	.019	.098		1
0010 E		RPL-SB-L2	.34	SANDBLAST LARGE PART - HOIST PRORATED OVER SEA OPERATION	.31693		.133		
0020 E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012		
0907	UP 01	24	1.00	GRIT BLAST PRIOR TO CAD/IVD	.117	.020	.146		2
0010 E		RPL-SB-L2	.34	SANDBLAST LARGE PART - HOIST PRORATED OVER SEA OPER	.31693		.133		
0020 E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012		
0910	UP 01	24	.95	CAD PLATE	.824	.160	.971		14
0010 E		ZPL-CD-L1	1.00	CADMIUM PLATE LRG PART-HOIST	.81410		1.009		
0020 E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012		
0920	UP 01	24	.95	BAKE AFTER CAD PLATE	.171	.039	.202	38.0	3
0010 E		ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200		
0020 E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012		
0930	UP 01	24	.95	CHROMATE CONVERSION(IRIDITE)	.117	.027	.138		2
0010 E		ZPL-IR-L1	1.00	IRIDITE LARGE PART-HOIST	.10705		.132		
0020 E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC	.01001		.012		
0937	UP 01	24	.05	I.V.D. ALUMINUM PLATE	.824	.010	.051	1.0	1
0010 N			1.00	I.V.D. PLATE	.81400		1.009		
0020 E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC/	.01001		.012		
0939	UP 01	24	.05	ALODINE I.V.D. ALUM PLATE	.425	.005	.026		0
0010 N			1.00	ALODINE	.41500		.514		
0020 E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC/	.01001		.012		
9000	UP 01	00	.01	LABOR STANDARD HISTORY	.000	.000	.000		0
0010				PRIOR HISTORY ON 00-ALC 494 FORM					
0020				25FEB83 NEW OCC.FACTOR STUDY UPDATE 15					
0021				01AUG84 REWRITE STD W/NEW OCC FACTOR<OLD STD> 3.67					
0022				05DEC84 ADD UNMASK ELEMENT ZUMCPV1 <OLD STD>4.89					
0023				23JUL85 NEW OCC FACTORS & REVIEW <OLD STD> 4.93					
0024				18 FEB 87 NEW OCC FACTORS & REVIEW OLD STD 5.04					
0025				20/10/87 CHANGED S/P ELIMENT EQUIP. CHANGE 0/55.74					
0900				CLINTON BENTLEY TECH MANEL 3357					

TO INTERROGATE LABOR STANDARDS, INPUT

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LABOR STANDARD OPERATION RESOURCE STANDARD AND METHOD ANALYSIS  
RCC KMPRC

09/06/88  
4S1-57-3

A-E046B-MM1-BY-M45 PAGE 0001  
81195

17143A STRUT B-52 MLG  
TECH S S W F PF A/R REV  
SUB T K #R A FA SUPPORT OCC  
STEP D L K C DC ELEMENT FACT

DESCRIPTION  
STORED SUPPLEMENTAL  
BASE PFD STD  
HOURS TIME HOURS DLY PCT C

RC004	S	E	UP	EA	B	J	88230	1.63	PERCENT ENGR 94.9	STEERING BEARING B52M 2 EA	.53		.87		
0001			UP	01		00		.00		PART NUMBER/MSN	.000	.000	.000		0
	0010								9-52299-505	1620009665426					
	0020								9-52532-501	1620009072897					
	0030								9-52299-505	1620009665426					
	0040								9-52532-501	1620009072897					
0015			UP	01		24		1.00		STRIP CAD	.136	.033	.169	.5	32
	0010	E							ZCD-ST-S1	1.00 STRIP CAD PLATE SMALL PART	.12630		.156		
	0020	E							RJP-PW-R1	1.00 REM RPL PAPWRK SIGN OFF DOC	.01001		.012		
0083			UP	01		24		1.00		DEGREASE	.097	.023	.120		22
	0010	E							RWB-CV-D1	1.00 VAPOR CL (DEGR)HOOK/BASKET	.08709		.107		
	0020	E							RJP-PW-R1	1.00 REM RPL PAPWRK SIGN OFF DOC	.01001		.012		
0087			UP	01		24		1.00		GRIT BLAST	.046	.011	.058		11
	0010	E							RWB-CB-B1	1.00 BLAST SM PT OR BSKT V/SM PTS	.03668		.045		
	0020	E							RJP-PW-R1	1.00 REM RPL PAPWRK SIGN OFF DOC	.01001		.012		
0090			UP	01		24		.95		CAD PLATE	.102	.023	.120		22
	0010	E							ZPL-CD-S1	1.00 CADMIUM PLATE SMALL PART	.09212		.114		
	0020	E							RJP-PW-R1	1.00 REM RPL PAPWRK SIGN OFF DOC	.01001		.012		
0120			UP	01		24		.95		CHROMATE CONVERSION(IRIDITE)	.033	.008	.040		7
	0010	E							ZPL-IR-S1	1.00 IRIDITE SMALL PART	.02362		.029		
	0020	E							RJP-PW-R1	1.00 REM RPL PAPWRK SIGN OFF DOC	.01001		.012		
			UP	01		24		.05		I.V.D. ALUMINUM PLATE	.230	.003	.014	1.0	3
	0010	N						1.00		I.V.D. PLATE	.22000		.272		
	0020	E							RJP-PW-R1	1.00 REM RPL PAPWRK SIGN OFF DOC/	.01001		.012		
0130			UP	01		24		.05		ALODINE I.V.D. ALUM PLATE	.230	.003	.014		3
	0010	N						1.00		ALODINE	.22000		.272		
	0020	E							RJP-PW-R1	1.00 REM RPL PAPWRK SIGN OFF DOC/	.01001		.012		
9000			UP	01		24		.01		LABOR STANDARD HISTORY	.000	.000	.000		0
	0010									PRIOR HISTORY ON 00-ALC 494 FORM					
	0020									25FEB83 NEW OCC. FACTOR STUDY UPDATE					
	0021									01AUG84 REWRITE STD W/NEW OCC FACTOR<OLD STD>	.72				
	0022									05DEC84 CHG BLAST ELEMENT TO RWBCBB1 <OLD STD>	.37				
	0023									23JUL85 NEW OCC FACTORS & REVIEW <OLD STD>	.31				
	0024									18 FEB 87 NEW OCC FACTORS & REVIEW OLD STD	.29				
	0900									CLINTON BENTLEY TECH MANEL 3357					

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LABOR STANDARD OPERATION RESOURCE STANDARD AND METHOD ANALYSIS

09/06/88

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17143A STRUT B-52 ML6

RCC KMPC

4S1-S7-3

81195

OPER	TECH	S	S	W	F	P	A/R	REV											
SUB	T	K	#R	A	FA	SUPPORT	OCC	<-----	DESCRIPTION	----->	BASE	PF	ST						
STEP	D	L	K	C	DC	ELEMENT	FACT		STORED	SUPPLEMENTAL	HOURS	TIME	HOURS	DLY	PCT	C			
RC005	S	E	UP	EA	B	J 88231	.96		PERCENT ENGR 95.7	LOWER TRIPOD LINK B52M	.64		.61						
0001			UP	01	00		.00			PART NUMBER/NSN	.000	.000	.000						0
0010								25-4211		162006099886									
0123			UP	01	24		1.00			DEGREASE	.097	.023	.120						19
0010	E					RWB-CV-D1	1.00			VAPOR CL (DEGR)HOOK/BASKET	.08709		.107						
0020	E					RJP-PW-R1	1.00			REM RPL PAPWRK SIGN OFF DOC	.01001		.012						
0127			UP	01	24		.95			STRIP CAD	.136	.031	.161	.5					25
0010	E					ZCD-ST-S1	1.00			STRIP CAD PLATE SMALL PART	.12630		.156						
0020	E					RJP-PW-R1	1.00			REM RPL PAPWRK SIGN OFF DOC	.01001		.012						
0130			UP	01	24		.05			STRIP RUST	.136	.002	.008	.3					1
0010	E					ZCD-ST-S1	1.00			STRIP RUST	.12630		.156						
0020	E					RJP-PW-R1	1.00			REM RPL PAPWRK SIGN OFF DOC	.01001		.012						
0135			UP	01	24		1.00			GRIT BLAST	.046	.011	.058						9
0010	E					RWB-CB-B1	1.00			BLAST SM PT OR BSKT V/SM PTS	.03668		.045						
0020	E					RJP-PW-R1	1.00			REM RPL PAPWRK SIGN OFF DOC	.01001		.012						
40			UP	01	24		.95			CAD PLATE	.102	.023	.120						19
0010	E					ZPL-CD-S1	1.00			CADMIUM PLATE SMALL PART	.09212		.114						
0020	E					RJP-PW-R1	1.00			REM RPL PAPWRK SIGN OFF DOC	.01001		.012						
0160			UP	01	24		.95			BAKE AFTER CAD PLATE	.090	.021	.107	38.0					17
0010	E					ZPL-BK-S1	1.00			BAKE SM PART 4HR/24HR BAKE	.08088		.100						
0020	E					RJP-PW-R1	1.00			REM RPL PAPWRK SIGN OFF DOC	.01001		.012						
0200			UP	01	24		.95			CHROMATE CONVERSION(IRIDITE)	.033	.008	.040						6
0010	E					ZPL-IR-S1	1.00			IRIDITE SMALL PART	.02362		.029						
0020	E					RJP-PW-R1	1.00			REM RPL PAPWRK SIGN OFF DOC	.01001		.012						
0213			UP	01	24		.05			I.V.D. ALUMINUM PLATE	.230	.003	.014	1.0					2
0010	N						1.00			I.V.D. PLATE	.22000		.272						
0020	E					RJP-PW-R1	1.00			REM RPL PAPWRK SIGN OFF DOC/	.01001		.012						
0217			UP	01	24		.05			ALODINE I.V.D. ALUM PLATE	.230	.003	.014						2
0010	N						1.00			ALODINE	.22000		.272						
0020	E					RJP-PW-R1	1.00			REM RPL PAPWRK SIGN OFF DOC/	.01001		.012						
9000			UP	01	24		.01			LABOR STANDARD HISTORY	.000	.000	.000						0
0010										PRIOR HISTORY ON OO-ALC 494 FORM									
0020										25FEB83 NEW OCC. FACTOR STUDY UPDATE	.58								
0021										01AUG84 REWRITE STD W/NEW OCC FACTORS<OLD STD>	.33								
0022										05DEC84 CHG BLAST ELEM TO ZLGBC03 <OLD STD>	1.29								
0023										23JUL85 NEW OCC FACTORS & REVIEW <OLD STD>	1.27								
0024										16SEPT86-DEL SUBOP 0055 WORK NOT DONE:OLD STD	1.47								

INTERROGATE LABOR STANDARDS. INPUT

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LABOR STANDARD OPERATION RESOURCE STANDARD AND METHOD ANALYSIS 09/06/88 A-E046B-HM1-DY-M45 PAGE 0001  
 RCC MNPRC 4S1-57-3 81195

OPER	TECH	S	S	W	F	P	F	A/R	REV												
SUB	T	K	#R	A	FA	SUPPORT	OCC	←-----	DESCRIPTION	-----→	BASE	PF	STD						A		
STEP	D	L	K	C	DC	ELEMENT	FACT	STORED		SUPPLEMENTAL	HOURS	TIME	HOURS						DLY	PCT	C
RC006	S	E	UP	EA	B	J 88231	1.00	PERCENT ENGR 95.7		OUTBOARD TRIPOD LINK B52M	.64		.64								
0001			UP	01	00		.00			PART NUMBER/NSM	.000	.000	.000								0
			0010					5-36035-3		1620006207642											
0163			UP	01	24		1.00			DEGREASE	.097	.023	.120								19
			0010	E		RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET			.08709		.107								
			0020	E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC			.01001		.012								
0167			UP	01	24		.95			STRIP CAD	.136	.031	.161						.5		25
			0010	E		ZCD-ST-S1	1.00	STRIP CAD PLATE SMALL PART			.12630		.156								
			0020	E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC			.01001		.012								
0170			UP	01	24		.05			STRIP RUST	.136	.002	.008						.3		1
			0010	E		ZCD-ST-S1	1.00	STRIP RUST			.12630		.156								
			0020	E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC			.01001		.012								
0175			UP	01	24		1.00			GRIT BLAST	.046	.011	.058								9
			0010	E		RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS			.03668		.045								
			0020	E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC			.01001		.012								
0180			UP	01	24		.95			CAD PLATE	.102	.023	.120								19
			0010	E		ZPL-CD-S1	1.00	CADMIUM PLATE SMALL PART			.09212		.114								
			0020	E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC			.01001		.012								
000			UP	01	24		.95			BAKE AFTER CAD PLATE	.090	.021	.107	38.0							17
			0010	E		ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE			.08088		.100								
			0020	E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC			.01001		.012								
0240			UP	01	24		.95			CHROMATE CONVERSION(IRIDITE)	.033	.008	.040								6
			0010	E		ZPL-IR-S1	1.00	IRIDITE SMALL PART			.02362		.029								
			0020	E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC			.01001		.012								
0253			UP	01	24		.05			I.V.D. ALUMINUM PLATE	.230	.003	.014	1.0							2
			0010	N			1.00			I.V.D. PLATE	.22000		.272								
			0020	E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC/			.01001		.012								
0257			UP	01	24		.05			ALODINE I.V.D. ALUM PLATE	.230	.003	.014								2
			0010	N			1.00			ALODINE	.22000		.272								
			0020	E		RJP-PW-R1	1.00	REM RPL PAPERWK SIGN OFF DOC/			.01001		.012								
9000			UP	01	24		.01			LABOR STANDARD HISTORY	.000	.000	.000								0
			0010					PRIOR HISTORY ON OO-ALC 494 FORM													
			0020					25FEB83 NEW OCC. FACTOR STUDY UPDATE		.54											
			0021					01AUG84 REWRITE STD W/NEW OCC FACTORS<OLD STD>		.57											
			0022					05DEC84 CHG BLAST ELEM TO RWBCBB1 <OLD STD>		.82											
			0023					23JUL85 NEW OCC FACTORS & REVIEW <OLD STD>		.76											
			0024					01APR86 DELETE SUB OP 0060 <OLD STD>		.80											

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LABOR STANDARD OPERATION RESOURCE STANDARD AND METHOD ANALYSIS

09/06/88

A-E046B-MH1-DY-M45

PAGE 0001

17143A STRUT B-52 MLG

RCC MWPRC

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OPER	TECH	S	S	W	F	PF	A/R	REV	SUB	T	K	#R	A	FA	SUPPORT	OCC	DESCRIPTION	BASE	PFD	STD	A		
STEP	D	L	K	C	DC	ELEMENT	FACT	STO	STO	STO	STO	STO	STO	STO	STO	STO	STO	HOURS	TIME	HOURS	DLY	PCT	C
RC007	S	E	UP	EA	B	J 88231	.92	PERCENT ENGR 96.4									INBOARD LINK B52M	.76		.70			
0001			UP	01	00		.00										PART NUMBER/NSN	.000	.000	.000		0	
																	5-35964-3						
																	1620000922837						
0075			UP	01	24		1.00										DEGREASE	.097	.023	.120		16	
	0010	E				RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET										.08709		.107			
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC										.01001		.012			
0080			UP	01	24		.95										STRIP CAD	.136	.031	.161	.5	21	
	0010	E				ZCD-ST-S1	1.00	STRIP CAD PLATE SMALL PART										.12630		.156			
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC										.01001		.012			
0090			UP	01	24		.05										STRIP RUST	.136	.002	.008	.3	1	
	0010	E				ZCD-ST-S1	1.00	STRIP RUST										.12630		.156			
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC										.01001		.012			
0130			UP	01	24		1.00										DEGREASE	.097	.023	.120		16	
	0010	E				RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET										.08709		.107			
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC										.01001		.012			
0135			UP	01	24		1.00										GRIT BLAST	.046	.011	.058		8	
	0010	E				RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS										.03668		.045			
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC										.01001		.012			
0140			UP	01	24		.95										CAD PLATE	.102	.023	.120		16	
	0010	E				ZPL-CD-S1	1.00	CADMIUM PLATE SMALL PART										.09212		.114			
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC										.01001		.012			
0160			UP	01	24		.95										BAKE AFTER CAD PLATE	.090	.021	.107	38.0	14	
	0010	E				ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE										.08088		.100			
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC										.01001		.012			
0200			UP	01	24		.95										CHROMATE CONVERSION(IRIDITE)	.033	.008	.040		5	
	0010	E				ZPL-IR-S1	1.00	IRIDITE SMALL PART										.02362		.029			
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC										.01001		.012			
0213			UP	01	24		.05										I.V.D. ALUMINUM PLATE	.230	.003	.014	1.0	2	
	0010	N					1.00										I.V.D. PLATE	.22000		.272			
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC/										.01001		.012			
0217			UP	01	24		.05										ALODINE I.V.D. ALUM PLATE	.230	.003	.014		2	
	0010	N					1.00										ALODINE	.22000		.272			
	0020	E				RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC/										.01001		.012			
9000			UP	01	24		.01										LABOR STANDARD HISTORY	.000	.000	.000		0	
	0010							25FEB83 NEW OCC. FACTOR STUDY UPDATE<OLD STD>	.56														
	0011							01AUG84 REWRITE STD W/NEW OCC FACTORS<OLD STD>	.55														
	0012							05DEC84 CHG BLAST ELEM TO RWBCBB1 <OLD STD>	.76														
	0013							23JUL85 NEW OCC FACTORS & REVIEW <OLD STD>	.70														
	0014							01APT86 DELETE SUB OP 0055 <OLD STD>	.73														
	0015							19 FEB 87 NEW OCC FACTORS & REVIEW OLD STD	.73														
	0900							CLINTON BENTLEY TECH MANEL 3357															

INTERROGATE LABOR STANDARDS. INPUT

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LABOR STANDARD OPERATION RESOURCE STANDARD AND METHOD ANALYSIS  
RCC MNPCC

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451-57-3

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81195

OPER	TECH	S	S	W	F	PF	A/R	REV	OCC	DESCRIPTION	BASE	PTD	STD	A
SUB	T	K	#R	A	FA	SUPPORT	FACT	STOR	DESCRIPTION	HOURS	TIME	HOURS	DLY	PCT
STEP	D	L	K	C	DC	ELEMENT	FACT	STOR	SUPPLEMENTAL	HOURS	TIME	HOURS	DLY	PCT
RC008	S	N	UP	EA	B	J 88231	.63	PERCENT ENGR 61.9	STEERING PLATE ASSY B52M	13.96		8.79		
0001			UP	01	00		.00		PART NUMBER/MSN	.000	.000	.000		0
			0010					5-68457-5	162006052768					
0070			UP	01	24		1.00		DEGREASE	.271	.065	.336		2
	0010	E				RWB-CV-D1	3.00	VAPOR CL (DEGR)HOOK/BASKET	OCC. 3 EA PARTS	.08709		.323		
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0080			UP	01	24		.95		STRIP CAD	.767	.175	.904	.5	6
	0010	E				ZCD-ST-M1	3.00	STRIP CAD ID/OD MED/LRG PARTOCC. 3 EA PARTS		.25260		.939		
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0090			UP	01	24		.05		STRIP RUST	.767	.009	.048	.3	0
	0010	E				ZCD-ST-M1	3.00	OCC. 3 EA PARTS		.25260		.939		
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0100			UP	01	24		.87		STRIP CHROME MED PART O.D.	1.069	.223	1.153	24.0	8
	0010	E				ZCR-ST-M2	3.00	STRIP CHROME OD MED/LRG PART	OCC. 3 EA PARTS	.35303		1.313		
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0190			UP	01	24		.54		BAKE AFTER ETCH	.495	.064	.332	8.0	2
	0010	E				ZPL-BK-M1	3.00	BAKE MED/LRG SIZE PART	OCC. 3 EA PARTS	.6175		.601		
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0220			UP	01	24		.54		DEGREASE	.271	.035	.182		1
	0010	E				RWB-CV-D1	3.00	VAPOR CL (DEGR)HOOK/BASKET	OCC. 3 EA PARTS	.08709		.323		
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0230			UP	01	24		.87		GRIT BLAST	.315	.066	.340		2
	0010	E				RPL-SB-M2	3.00	SANDBLAST MED PART WALK-IN B	OCC. 3 EA PARTS	.10180		.378		
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0235			UP	01	24		.87		PREP FOR CHROME MED PART O.D	2.140	.447	2.309		17
	0010	N					3.00	OCC. 3 EA PARTS		.71000		2.641		
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0240			UP	01	24		.87		CHROME PLATE MED PART O.D.	1.780	.372	1.920	24.0	14
	0010	N					3.00	OCC. 3 EA PARTS		.59000		2.194		
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0250			UP	01	24		.87		BAKE AFTER CHROME PLATE	.495	.103	.534	8.0	4
	0010	E				ZPL-BK-M1	3.00	BAKE MED/LRG SIZE PART	OCC. 3 EA PARTS	.16175		.601		
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0255			UP	01	24		1.00		GRIT BLAST	.315	.076	.391		3
	0010	E				RPL-SB-M2	3.00	SANDBLAST MED PART WALK-IN B	OCC. 3 EA PARTS	.10180		.378		
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0260			UP	01	24		.95		CAD PLATE	1.841	.420	2.170		16
	0010	E				ZPL-CD-M1	3.00	CADMIUM PLATE MEDIUM PART	OCC. 3 EA PARTS	.61058		2.271		
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0280			UP	01	24		.95		BAKE AFTER CAD PLATE	.495	.113	.583	38.0	4
	0010	E				ZPL-BK-M1	3.00	BAKE MED/LRG SIZE PART	OCC. 3 EA PARTS	.16175		.601		
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0302			UP	01	24		.95			.271	.062	.320		2
	0010	E				RWB-CV-D1	3.00	VAPOR CL (DEGR)HOOK/BASKET	OCC. 3 EA PARTS	.08709		.323		
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
'3			UP	01	24		.05		I.V.D. ALUMINUM PLATE	1.330	.016	.082	1.0	1
	0010	N					3.00	OCC. 3 EA PARTS		.44000		1.636		
	0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/		.01001		.012		

0305	UP 01	00	.54	BRUSH PLATE I.D.	.568	.000	.307	2
0010 E		RLG-RS-B2	3.00	BRUSH PLATE ID OF CYLINDER	.18615		.558	
0020 E		RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.010	
	UP 01	24	.54	BAKE AFTER NICKEL	.495	.064	.332	38.0 2
0010 E		ZPL-BK-M1	3.00	BAKE MED/LRG SIZE PART	.16175		.601	
0020 E		RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012	
0320	UP 01	24	1.00	DRY FILM LUBE MED PART	.816	.196	1.013	2.0 7
0010 N			3.00	OCC. 3 EA PARTS	.27233		1.013	
0290								
0340	UP 01	24	1.00	BAKE ANY 1 HR BAKE	.252	.061	.313	2.0 2
0010 E		ZPL-BK-S1	3.00	BAKE SM PART 4HR/24HR BAKE	.08088		.300	
0020 E		RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012	
0360	UP 01	24	.95	CHROMATE CONVERSION(IRIDITE)	.299	.068	.352	3
0010 E		ZPL-IR-M1	3.00	IRIDITE MEDIUM PART-HOIST	.09635		.358	
0020 E		RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC	.01001		.012	
0370	UP 01	24	.05	ALODINE I.V.D. ALUM PLATE	.670	.008	.042	0
0010 N			3.00	OCC. 3 EA PARTS	.22000		.818	
0020 E		RJP-PW-R1	1.00	REM RPL PAPWRK SIGN OFF DOC/	.01001		.012	
9000	UP 01	24	.01	LABOR STANDARD HISTORY	.000	.000	.000	0
0010				PRIOR HISTORY ON 00-ALC 494 FORM				
0020				25FEB83 NEW OCC.FACTOR STUDY UPDATE			10.69	
0021				01AUG84 REWRITE STD W/NEW OCC FACTOR<OLD STD>			10.68	
0022				08AUG84 ADD SUB O/P 305 & 310 OCC EST<OLD STD>			7.49	
0023				05DEC84 CHG BLAST ELEMENT TO ZLGBC03<OLD STD>			7.89	
0024				23JUL85 NEW OCC FACTORS & REVIEW <OLD STD>			7.81	
0025				01APR86 DELETE SUB OP 0092 <OLD STD>			8.23	
0026				23 FEB 87 NEW OCC FACTOR & REVIEW OLD STD			8.20	
0027				31 MARCH 87 ADDED SUBOP 0255 <OLD STD 12.54>				
0900				KERRY COOP HANEL TECHM 73357				

TO INTERROGATE LABOR STANDARDS. INPUT

RCC PRD NROP NR

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LABOR STANDARD OPERATION RESOURCE STANDARD AND METHOD ANALYSIS  
RCC MNPRC

09/06/88  
4S1-57-3

A-E046B-MN1-DY-M45 PAGE 0001  
81195

17143A STRUT B-52 MLG  
TECH S S W F PF A/R REV  
SUB T K #R A FA SUPPORT OCC  
STEP D L K C DC ELEMENT FACT

DESCRIPTION  
STORED SUPPLEMENTAL

BASE PFD STD  
HOURS TIME HOURS DLY PCT C

STEP	DC	ELEM	FACT	STANDARD	OPERATION	RESOURCE	STANDARD	METHOD	ANALYSIS	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	C
0010	S	E	UP	EA	B	J	88232	.42	PERCENT ENGR 86.8	CENTERING CAM B52M	1.53	.64			
0001			UP	01	00			.00		PART NUMBER/NSM	.000	.000	.000		0
										25-4214-501					
										1620007330993					
0070			UP	01	24			1.00		DEGREASE	.097	.023	.120		8
										RWB-CV-D1	1.00	.08709	.107		
										RJP-PW-R1	1.00	.01001	.012		
0080			UP	01	24			1.00		REM RPL PAPWRK SIGN OFF DOC	.252	.061	.313	24.0	20
										ZCR-ST-S1	1.00	.24234	.300		
										RJP-PW-R1	1.00	.01001	.012		
0132			UP	01	24			1.00		DEGREASE	.097	.023	.120		8
										RWB-CV-D1	1.00	.08709	.107		
										RJP-PW-R1	1.00	.01001	.012		
0134			UP	01	00			1.00		PREP FOR SILVER PLATE	.177	.000	.177		12
										PREP SILVER	.16700	.167			
										RJP-PW-R1	1.00	.01001	.010		
0136			UP	01	24			1.00		GRIT BLAST	.046	.011	.058		4
										RWB-CB-B1	1.00	.03668	.045		
										RJP-PW-R1	1.00	.01001	.012		
0140			UP	01	24			1.00		SILVER PLATE SMALL PART	.239	.057	.297	24.0	19
										ZPL-SL-S1	1.00	.22924	.284		
										RJP-PW-R1	1.00	.01001	.012		
										UP 01 24	1.00	.090	.022	.113	8.0 7
										ZPL-BK-S1	1.00	.08088	.100		
										RJP-PW-R1	1.00	.01001	.012		
0155			UP	01	24			1.00		GRIT BLAST	.046	.011	.058		4
										RWB-CB-B1	1.00	.03668	.045		
										RJP-PW-R1	1.00	.01001	.012		
0160			UP	01	24			1.00		PHOSPHATE COAT SMALL PART	.132	.032	.164	.3	11
										RPL-PK-B1	1.00	.12217	.151		
										RJP-PW-R1	1.00	.01001	.012		
0180			UP	01	24			1.00		BAKE AFTER PHOSPHATE SM PART	.090	.022	.113	9.0	7
										ZPL-BK-S1	1.00	.08088	.100		
										RJP-PW-R1	1.00	.01001	.012		
9000			UP	01	24			.01		LABOR STANDARD HISTORY	.000	.000	.000		0
										PRIOR HISTORY ON 00-ALC 494 FORM					
										25FEB83 NEW OCC.FACTOR STUDY UPDATE	1.76				
										14OCT83 UPGRADE TO'E' STANDARD <OLD STD>	1.09				
										01AUG84 REWRITE STD W/NEW OCC FACTORS<OLD STD>	1.20				
										05DEC84 CHG BLAST ELEM TO RWCB01 <OLD STD>	2.07				
										23JUL85 NEW OCC FACTORS & REVIEW <OLD STD>	1.86				
										27 FEB 87 NEW OCC FACTORS & REVIEW OLD STD	1.78				
										12 MAY 87 DELETED SUB 0200 & CHANGED SUB 0160					
										FROM CAD PLT TO PHOSPHATE COAT <OLD STD 4.23>					
										KERRY COOP TECH MANEL 3357					

0 ...ERROGATE LABOR STANDARDS. INPUT

PER	TECH	S	S	W	F	PF	A/R	REV	LABOR STANDARD OPERATION RESOURCE STANDARD AND METHOD ANALYSIS			09/06/88	A-E046B-MM1-DY-M45	PAGE 0001
SUB	T	K	#R	A	FA	SUPPORT	OCC	←-----	DESCRIPTION	-----→	BASE	PFD	STD	A
STEP	D	L	K	C	DC	ELEMENT	FACT	STORED		SUPPLEMENTAL	HOURS	TIME	HOURS	DLY PCT C
0013	S	E	UP	EA	B	J	88235	2.00	PERCENT ENGR 95.7	TRUNNION CAP B52M 2 EA	.64		1.28	
0001			UP	01	00		.00			PART NUMBER/NSN	.000	.000	.000	0
	0010							9-52976		1620003270505				
	0020							9-52977		1620003270506				
0023			UP	01	24		1.00			DEGREASE	.097	.023	.120	19
	0010	E				RWB-CV-D1	1.00			VAPOR CL (DEGR)HOOK/BASKET	.08709		.107	
	0020	E				RJP-PW-R1	1.00			REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0025			UP	01	24		.95			STRIP CAD	.136	.031	.161	.5 25
	0010	E				ZCD-ST-S1	1.00			STRIP CAD PLATE SMALL PART	.12630		.156	
	0020	E				RJP-PW-R1	1.00			REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0027			UP	01	24		.05			STRIP RUST	.136	.002	.008	.3 1
	0010	E				ZCD-ST-S1	1.00			STRIP RUST	.12630		.156	
	0020	E				RJP-PW-R1	1.00			REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0030			UP	01	24		1.00			GRIT BLAST	.046	.011	.058	9
	0010	E				RWB-CB-B1	1.00			BLAST SH PT DR BSKT V/SH PTS	.03668		.045	
	0020	E				RJP-PW-R1	1.00			REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0040			UP	01	24		.95			CAD PLATE	.102	.023	.120	19
	0010	E				ZPL-CD-S1	1.00			CADMIUM PLATE SMALL PART	.09212		.114	
	0020	E				RJP-PW-R1	1.00			REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0043			UP	01	24		.95			BAKE AFTER CAD PLATE	.090	.021	.107	38.0 17
	0010	E				ZPL-BK-S1	1.00			BAKE SH PART 4HR/24HR BAKE	.08088		.100	
	0020	E				RJP-PW-R1	1.00			REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0045			UP	01	24		.95			CHROMATE CONVERSION(IRIDITE)	.033	.008	.040	6
	0010	E				ZPL-IR-S1	1.00			IRIDITE SMALL PART	.02362		.029	
	0020	E				RJP-PW-R1	1.00			REM RPL PAPRWRK SIGN OFF DOC	.01001		.012	
0048			UP	01	24		.05			I.V.D. ALUMINUM PLATE	.230	.003	.014	1.0 2
	0010	M					1.00			I.V.D. PLATE	.22000		.272	
	0020	E				RJP-PW-R1	1.00			REM RPL PAPRWRK SIGN OFF DOC/	.01001		.012	
0049			UP	01	24		.05			ALODINE I.V.D. ALUM PLATE	.230	.003	.014	2
	0010	M					1.00			ALODINE	.22000		.272	
	0020	E				RJP-PW-R1	1.00			REM RPL PAPRWRK SIGN OFF DOC/	.01001		.012	
9000			UP	01	24		.01			LABOR STANDARD HISTORY	.000	.000	.000	0
	0010									PRIOR HISTORY ON 00-ALC 494 FORM				
	0020									25FEB83 UPDATE OPERATION LINE 2YR REVIEW	.00			
	0021									01AUG84 REWRITE STD W/NEW OCC FACTORS<OLD STD>	.00			
	0022									05DEC84 CHG BLAST ELEM TO RWBCBB1 <OLD STD>	.07			
	0023									23JUL85 NEW OCC FACTORS & REVIEW <OLD STD>	.06			
	0024									04AUG86 NEW OCC FACTOR STUDY <OLD STD>	.24			
	0025									19 FEB 87 NEW OCC FACTORS & REVIEW OLD STD	.80			
	0900									CLINTON BENTLEY TECH MANEL 3357				

TRROGATE LABOR STANDARDS. INPUT

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ER	TECH	S	S	W	F	PF	A/R	REV	OCC	DESCRIPTION	BASE	PFD	STD	A
SUB	T	K	#R	A	FA	SUPPORT	FACT	STANDARD	AND	METHOD	HOURS	TIME	HOURS	PCT
STEP	D	L	K	C	DC	ELEMENT	FACT	STORED	SUPPLEMENTAL					C
0014	S	E	UP	EA	B	J	88235	.54	PERCENT ENGR 94.9	PISTON HEAD NUT, B52M	.68		.36	
0001			UP	01	00			.00		PART NUMBER/NSN	.000	.000	.000	0
	0010								3-80736-3	5310006035970LE				
0029			UP	01	24			1.00		DEGREASE	.097	.023	.120	18
	0010	E				RWB-CV-D1		1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107	
	0020	E				RJP-PW-R1		1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012	
0030			UP	01	24			.95		STRIP CAD	.136	.031	.161	.5 24
	0010	E				ZCD-ST-S1		1.00	STRIP CAD PLATE SMALL PART		.12630		.156	
	0020	E				RJP-PW-R1		1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012	
0035			UP	01	24			.05		STRIP RUST	.136	.002	.008	.3 1
	0010	E				ZCD-ST-S1		1.00	STRIP RUST		.12630		.156	
	0020	E				RJP-PW-R1		1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012	
0060			UP	01	24			.23		SHOTPEEN SM STEEL PART/MASK	.278	.015	.079	12
	0010	E				ZMA-CP-S2		1.00	MASK SMALL COMPONENT PART		.08183		.101	
	0020	E				RPL-SP-M1		1.00	SHOT PEEN SMALL/MED PART		.16131		.200	
	0030	N				ZUM-CL-02		.50	UNMASK MEDIUM SIZE CYL PART OCC 50% FOR SMALL PART		.05067		.031	
	0040	E				RJP-PW-R1		1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012	
0055			UP	01	24			1.00		GRIT BLAST	.046	.011	.058	8
	0010	E				RWB-CB-B1		1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045	
	0020	E				RJP-PW-R1		1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012	
0070			UP	01	24			.95		CAD PLATE	.102	.023	.120	18
	0010	E				ZPL-CD-S1		1.00	CADMIUM PLATE SMALL PART		.09212		.114	
	0020	E				RJP-PW-R1		1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012	
0080			UP	01	24			.95		BAKE AFTER CAD PLATE	.090	.021	.107	38.0 16
	0010	E				ZPL-BK-S1		1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100	
	0020	E				RJP-PW-R1		1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012	
0093			UP	01	24			.05		I.V.D. ALUMINUM PLATE	.230	.003	.014	1.0 2
	0010	N						1.00		I.V.D. PLATE	.22000		.272	
	0020	E				RJP-PW-R1		1.00	REM RPL PAPRWRK SIGN OFF DOC/		.01001		.012	
0097			UP	01	24			.05		ALODINE I.V.D. ALUM PLATE	.230	.003	.014	2
	0010	N						1.00		ALODINE	.22000		.272	
	0020	E				RJP-PW-R1		1.00	REM RPL PAPRWRK SIGN OFF DOC/		.01001		.012	
9000			UP	01	24			.01		LABOR STANDARD HISTORY	.000	.000	.000	0
	0010									PRIOR HISTORY ON OO-ALC 494 FORM				
	0020									25FEB83 NEW OCC. STUDY UPDATE				.36
	0021									01AUG84 REWRITE STD W/NEW OCC FACTORS<OLD STD>				.20
	0022									05DEC84 ADD UNMASK & CHG BLAST CLEAN <OLD STD>				.28
	0023									23JUL85 NEW OCC FACTORS & REVIEW <OLD STD>				.25

0 INTERROGATE LABOR STANDARDS. INPUT

PRD MRDP NR  
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MANPRC



RCC EARNED HOURS FOR MNPRC... OCT 88 THRU JAN 89

X	PROD NO X	X	NOUN	RCC DPEH	X RCC DPEH X	CUMM X EARNED HR
1	17143A	1620001398474	B52M-AFT	1229.10	0.0400	0.0400
2	16837A	1620001099287	STRUTF4C	1093.88	0.0356	0.0756
3	17142A	1620001398473	B52M-FWD	1002.43	0.0326	0.1082
4	16936A	1620001099286	STRUTF4C	910.43	0.0296	0.1378
5	74805A	1005000566753	GUN M61A	853.12	0.0278	0.1656
6	15468A	1630004927144	KC-135 M	744.04	0.0242	0.1898
7	90101A	1630011826267	WHEEL	659.72	0.0215	0.2113
8	17565A	1620010204973	STRUT	604.95	0.0197	0.2310
9	16915A	1620009485066	TRUCK AY	583.06	0.0190	0.2500
10	74527A	1620004427877	BRACE DR	581.33	0.0189	0.2689
11	00124B	000F0004E	AIRCRAFT	576.70	0.0188	0.2877
12	69324A	1095011003892	MAU-12DA	528.71	0.0172	0.3049
13	69354A	1620010597842	KC-135 N	504.93	0.0164	0.3213
14	74524A	1620002468005	BOGIE B	482.43	0.0157	0.3370
15	69595A	1630012286043	ML WHEEL	450.00	0.0146	0.3516
16	00126B	00RF0004C	AIRCRAFT	447.80	0.0146	0.3662
17	17575A	1620010054191	CSMLGRHA	405.96	0.0132	0.3794
18	16019A	1620010248844	STRUT F4	399.97	0.0130	0.3924
19	17357A	1620007419178	BRACE	393.13	0.0128	0.4052
20	17576A	1620010054192	CSMLGLHA	373.82	0.0122	0.4174
21	25737A	1620011951141	MLGSTRUT	365.65	0.0119	0.4293
22	19844A	1620008961203	STRUT AY	363.35	0.0118	0.4411
23	62927A	1630011326400	WHL C141	353.56	0.0115	0.4526
24	74692A	1620001791425	BOGIE BM	325.97	0.0106	0.4632
25	69855A	1620006052768	B52PLATE	307.12	0.0100	0.4732
26	17478A	1620002990278	T38-NLG	305.10	0.0099	0.4831
27	17239A	1620006793440	TRUNNION	296.28	0.0096	0.4927
28	17451A	1620006518221	TRUNNION	290.52	0.0095	0.5022
29	26176A	1005008566885	M16RIFLE	282.72	0.0092	0.5114
30	17327A	1620009118301	TRUNNION	268.74	0.0087	0.5201
31	15139A	1630009009739	WHEEL S2	267.41	0.0087	0.5288
32	17354A	1620005459439	STRUT NL	256.63	0.0084	0.5372
33	15485A	1630004463778	WHL F4	244.84	0.0080	0.5452
34	74521A	1620001877445	NLG	243.02	0.0079	0.5531
35	26338A	1620011671000	M-LH-HW	231.81	0.0075	0.5606
36	17348A	1620007117771	S STRUT	230.01	0.0075	0.5681
37	17631A	1620010159859	DR-BRACE	225.58	0.0073	0.5754
38	17577A	1620010054193	CSM6LLHF	223.82	0.0073	0.5827
39	17402A	1620010627002	F15-NLG	219.85	0.0072	0.5899
40	63822A	1005008953726	M168 GUN	218.24	0.0071	0.5970
41	17347A	1620007099371	S STRUT	199.40	0.0065	0.6035
42	17578A	1620010054194	CSMLGRHF	197.27	0.0064	0.6099
43	26642A	1620012026349	STRUT AS	193.79	0.0063	0.6162
44	19937A	1620010816339	STRUT AY	187.84	0.0061	0.6223
45	M3009K	1450010618477AB		174.60	0.0057	0.6280
46	M7202K	3120012697856LE		173.25	0.0056	0.6336
47	19938A	1620010856039	A10-NLG	162.05	0.0053	0.6389
48	26183A	1630011375742	F15 WHL	161.87	0.0053	0.6442
49	M6276K	1620012352270		157.50	0.0051	0.6493
50	72573A	1620000271193	ACTUATOR	153.30	0.0050	0.6543
51	M9662K	3120P855926-03		151.76	0.0049	0.6592

## RCC EARNED HOURS FOR MNPRC...OCT 88 THRU JAN 89

PROD NO.	NOUN	RCC DPEH	RCC DPEH %	CUMM % EARNED HR
52 26337A 1620011670999	M-RH-HW	151.45	0.0049	0.6641
53 17245A 1620006525472	BRACE AS	150.50	0.0049	0.6690
54 16214A 1620011252217	POWER UT	145.38	0.0047	0.6737
55 42626A 1620007158562	B52-RH.T	144.44	0.0047	0.6784
56 17568A 1620000071783	FS-TRUNN	142.45	0.0046	0.6830
57 26111A 1620012007131	16PISTON	134.68	0.0044	0.6874
58 17313A 1620006518222	TRUNNION	133.93	0.0044	0.6918
59 19588A 1630010585912	WHL F15M	132.36	0.0043	0.6961
60 63819A 1005010595785	M61A1	128.96	0.0042	0.7003
61 16264A 1620006706602	COLLAR	126.00	0.0041	0.7044
62 74516A 1620001791083	BRACE DR	123.74	0.0040	0.7084
63 16297A 1620010374639	CH3-NLG	123.44	0.0040	0.7124
64 15359A 1630000139129	WHL C13S	118.99	0.0039	0.7163
65 15162A 1630002692622	KC135BRK	117.80	0.0038	0.7201
66 63393A 1095010617748	MB-3ARAC	114.24	0.0037	0.7238
67 69828A 1620005676803	ST VALVE	113.75	0.0037	0.7275
68 98929A 1650002193602LE	BUNGEZ	112.00	0.0036	0.7311
69 M6055K 5315007575890LE		104.54	0.0034	0.7345
70 62963A 1680004051042LS	SEAT	102.33	0.0033	0.7378
71 62964A 1680004182705LS	SEAT	102.33	0.0033	0.7411
72 00129B 000F0004G	AIRCRAFT	101.50	0.0033	0.7444
73 17567A 1620010381912	KC-135 N	101.05	0.0033	0.7477
74 15866A 1620011037747	STRUT	100.81	0.0033	0.7510
75 T1302A 9999POV10A		100.00	0.0033	0.7543
76 69549A 1620001386373	LWRSIDES	98.04	0.0032	0.7575
77 T6912A 1620006133512		97.60	0.0032	0.7607
78 17474A 1620002640744	T38M-L/H	96.79	0.0032	0.7639
79 15686A 1630005969637	WHEEL N	95.76	0.0031	0.7670
80 T6254A 1620000624060		94.30	0.0031	0.7701
81 63079A 1680010520816LS	REEL AS	93.13	0.0030	0.7731
82 74652A 1620001486466	BALLSCRW	92.31	0.0030	0.7761
83 17396A 1620002671046	DAMPER	91.00	0.0030	0.7791
84 17407A 1620009921498	BOLT ASY	89.76	0.0029	0.7820
85 72877A 1620004325651	NLG	81.73	0.0027	0.7847
86 M8586K 1630005022994		81.25	0.0026	0.7873
87 16123A 1620006776681	C130BASK	81.06	0.0026	0.7899
88 13822A 1560007883941BF	RING ASS	81.00	0.0026	0.7925
89 15526A 1630002420942	WHEEL B	80.88	0.0026	0.7951
90 15988A 1620009825059	POSITNER	77.93	0.0025	0.7976
91 68521A 1630010385126	WH 0130M	76.20	0.0025	0.8001
92 16296A 1620004821247	CH3-NLG	71.08	0.0023	0.8024
93 13829A 1560007906873BF	RING ASS	71.00	0.0023	0.8047
94 74955A 1095009960098	RACK	70.68	0.0023	0.8070
95 72898A 1630002861879	WHEEL N	69.76	0.0023	0.8093
96 16283A 1620007856073	SHAFT	69.65	0.0023	0.8116
97 94332A 1620000222923	ACTUATOR	68.67	0.0022	0.8138
98 74506A 1620009322368	BRACE DR	68.02	0.0022	0.8160
99 72879A 1620004463776	ML6 OUTR	67.75	0.0022	0.8182
100 62923A 1630011253957	WHL C141	66.48	0.0022	0.8204
101 62657A 1620010389102	STRUT LH	65.97	0.0021	0.8225

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## RCC EARNED HOURS FOR MNPRC...OCT 88 THRU JAN 89

PROD NO.		NOUN	RCC DPEH	RCC DPEH X	CUMM X EARNED HR	
103	35571A	1620003353404	STOP ASY	63.27	0.0021	0.8267
104	T6295I	1620002421514		63.00	0.0021	0.8288
105	16315A	1620010710535	F16MAXLE	62.88	0.0020	0.8308
106	17418A	1620010135910	SHOCK ST	61.85	0.0020	0.8328
107	17479A	1620010185924	ACTUATOR	61.70	0.0020	0.8348
108	00109B	00RF0004C	AIRCRAFT	61.20	0.0020	0.8368
109	00119B	000F0004C	AIRCRAFT	61.20	0.0020	0.8388
110	25425A	1630011158736	WHEEL	60.52	0.0020	0.8408
111	69554A	1620005251156	LWR UNIV	60.48	0.0020	0.8428
112	83317A	1620011627542	DR BRACE	60.14	0.0020	0.8448
113	M4292K	3120010595944LE		60.00	0.0020	0.8468
114	17664A	1620010700632	STRUT	59.78	0.0019	0.8487
115	69803A	1620011680338	CH3-NLG	58.12	0.0019	0.8506
116	M7139K	3120012828006LE		56.21	0.0018	0.8524
117	69651A	1620006238911	STRUT	55.98	0.0018	0.8542
118	69833A	1620011031950	STRUT	55.48	0.0018	0.8560
119	25638A	1005010086283	HOUSING	54.72	0.0018	0.8578
120	17574A	1620003977413	CRK ASSY	54.60	0.0018	0.8596
121	15865A	1620009272601	C141LKAS	54.56	0.0018	0.8614
122	74553A	1620009746793	BRACE DR	53.70	0.0017	0.8631
123	17476A	1620002795839	T38M-R/H	53.59	0.0017	0.8648
124	M3416K	4730012107834AY		49.50	0.0016	0.8664
125	17353A	1620005459395	STRUT NL	49.17	0.0016	0.8680
126	17467A	1620006509335	TORSION	47.36	0.0015	0.8695
127	16267A	1630008521432	F4N WHL	46.93	0.0015	0.8710
128	15757A	1630009141329	WHL C130	45.60	0.0015	0.8725
129	74552A	1620009270298	PIVOT P	44.84	0.0015	0.8740
130	T5046J	1560008561386BF		44.40	0.0014	0.8754
131	15523A	1630001576723	WHL F111	44.03	0.0014	0.8768
132	61427A	6720010447789	MIRR ASY	44.00	0.0014	0.8782
133	14907A	1680001598730YQ	THROTTLE	43.28	0.0014	0.8796
134	T6850A	1620001157419		43.09	0.0014	0.8810
135	17663A	1620010668946	STRUT	42.16	0.0014	0.8824
136	15746A	1630000816687	WHL-C141	42.03	0.0014	0.8838
137	17546A	1620001405241	F5-LH-DB	41.66	0.0014	0.8852
138	16743A	1620002041208	BELLCRNK	40.82	0.0013	0.8865
139	00118B	000F0004E	AIRCRAFT	40.80	0.0013	0.8878
140	25918A	1620010141934	RHSTRUT	40.12	0.0013	0.8891
141	15828A	1630010389239	WHL F16M	39.83	0.0013	0.8904
142	17527A	1620010063237	A7-MLG	39.82	0.0013	0.8917
143	16334A	1620010710537	F16MAXLE	39.30	0.0013	0.8930
144	18076A	3040001614085LE	ROD ASSY	38.10	0.0012	0.8942
145	16256A	1630007300126	F4N WHL	37.43	0.0012	0.8954
146	15054A	1630000585242	KC135BRK	37.20	0.0012	0.8966
147	00141B	000V0010A	AIRCRAFT	36.60	0.0012	0.8978
148	14539A	1560009116682BF	STBLRF4E	36.00	0.0012	0.8990
149	17595A	1620008372427	A7-MLG	35.82	0.0012	0.9002
150	69136A	1620009272600	LINK ASY	35.52	0.0012	0.9014
151	M5514K	3120005101857LE		34.00	0.0011	0.9025
152	62905A	1630009458700	C130 WHL	33.78	0.0011	0.9036
153	72863A	1620001790438	XWIND CL	32.92	0.0011	0.9047

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PROD NO	NOUN	RCC DPEH	RCC DPEH X	CUMM X EARNED HR
154 T4798A 1620004853752		32.55	0.0011	0.9058
155 15481A 1630004534893	UHL C141	32.26	0.0011	0.9069
156 72858A 1620003238292	CYLINDER	32.18	0.0010	0.9079
157 T1434A 9999P000V0010A		32.00	0.0010	0.9089
158 17686A 162000281062P	LINK ASY	31.75	0.0010	0.9099
159 17314A 1620003069942	S STRUT	31.57	0.0010	0.9109
160 17315A 1620003069943	S STRUT	31.57	0.0010	0.9119
161 72571A 162000910189B	ACTUATOR	30.30	0.0010	0.9129
162 72845A 1620001157413	CYLINDER	30.18	0.0010	0.9139
163 74561A 1620001357877	A7-NLG	29.17	0.0009	0.9148
164 15161A 1630000810815	C141 BRK	28.50	0.0009	0.9157
165 H6927K 1560005182799BF		27.90	0.0009	0.9166
166 17324A 1620003002261	SHOCK ST	27.42	0.0009	0.9175
167 74909A 1095001419328	RACK ASY	27.20	0.0009	0.9184
168 26109A 1620012348655	F16BRACE	26.83	0.0009	0.9193
169 19841A 1620001239478	DAMPER	26.47	0.0009	0.9202
170 17547A 1620001405242	FS-RH-DB	26.25	0.0009	0.9211
171 H7527K 5975P878960F		25.00	0.0008	0.9219
172 H4250K		24.50	0.0008	0.9227
173 96722A 1630006210657	SHIELD	24.15	0.0008	0.9235
174 15941A 6760010932628	MIRROR	24.00	0.0008	0.9243
175 29244A 6720010480672	MIRROR 4	24.00	0.0008	0.9251
176 T6674L 1440010738446JB		24.00	0.0008	0.9259
177 17687A 1620010805925	INNER CL	23.61	0.0008	0.9267
178 T7601J 1620000071783		23.52	0.0008	0.9275
179 69626A 1620005051184	STRUT AY	23.19	0.0008	0.9283
180 17757A 4730007586711LE	BOLT	23.18	0.0008	0.9291
181 72864A 1620002307141	PITCH PD	23.00	0.0007	0.9298
182 68735A 1630010830445	F15ABBRK	22.53	0.0007	0.9305
183 H1290K 1560002462632BF		22.50	0.0007	0.9312
184 19839A 1620007391746	DAMPER	22.45	0.0007	0.9319
185 74958A 1095004538407	RACK	22.32	0.0007	0.9326
186 69551A 1620003129664	LINKASSY	22.04	0.0007	0.9333
187 17662A 1620010668945	STRUT-MC	21.76	0.0007	0.9340
188 63711A 1620000254773	B52-DRAG	21.63	0.0007	0.9347
189 74518A 1620001791087	BRACE DR	21.52	0.0007	0.9354
190 93236A 1620001058930	ACTUATOR	21.24	0.0007	0.9361
191 45578A 1630011392892	WHEEL ML	21.00	0.0007	0.9368
192 24372A 1620008242889	LINK ASY	20.51	0.0007	0.9375
193 15641A 1630002769849	F4 HSC	20.43	0.0007	0.9382
194 00121B 000F0004B	AIRCRAFT	20.40	0.0007	0.9389
195 H5244K 1560ND0288850BF		20.00	0.0007	0.9396
196 H7490K 5365012790018WF		20.00	0.0007	0.9403
197 H7492K 5365012790017WF		20.00	0.0007	0.9410
198 H7493K 5365012790023WF		20.00	0.0007	0.9417
199 H7495K 5365012790022WF		20.00	0.0007	0.9424
200 H7496K		20.00	0.0007	0.9431
201 H7498K		20.00	0.0007	0.9438
202 H7499K 536501279204WF		20.00	0.0007	0.9445
203 H7502K 5365012793475WF		20.00	0.0007	0.9452
204 H7503K		20.00	0.0007	0.9459

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PROD NO.	NOUN	RCC OPEH	RCC OPEH X	CUMM % EARNED HR
205 M7504K 5365012793474WF		20.00	0.0007	0.9466
206 M7871K 1450ND029644GAH		20.00	0.0007	0.9473
207 26526A 1005006743915	DRUM	19.52	0.0006	0.9479
208 T5305A 1620010888102		19.52	0.0006	0.9485
209 97709A 1620006986015	CYC	19.46	0.0006	0.9491
210 M6486K 1095004760051		18.27	0.0006	0.9497
211 M6488K 1095004760037		18.27	0.0006	0.9503
212 M6604K 1650003017883		18.00	0.0006	0.9509
213 M8168K		18.00	0.0006	0.9515
214 M5224K 1560ND028868GBF		17.80	0.0006	0.9521
215 62956A 1427011043012AB	G&C UNIT	17.52	0.0006	0.9527
216 74528A 1620004719659	D/B TRUN	17.52	0.0006	0.9533
217 26108A 1620011627518	F-16 NLG	17.48	0.0006	0.9539
218 74895A 1005009988912	FEEDER	17.36	0.0006	0.9545
219 19838A 1620001177326	DAMPER	16.95	0.0006	0.9551
220 25874A 1630011996430	F16 BRK	16.53	0.0005	0.9556
221 24373A 1620008302609	LINK/ATT	16.26	0.0005	0.9561
222 T4404N 1430ND026070GAH		16.00	0.0005	0.9566
223 62922A 1630010506139	WHL C141	15.72	0.0005	0.9571
224 15348A 1630008430965	WHLF111	15.60	0.0005	0.9576
225 60420A 1620010714803	TEN STRU	15.43	0.0005	0.9581
226 T6607A 1620007197427		15.36	0.0005	0.9586
227 97659A 1620006986014	CYLINDER	15.17	0.0005	0.9591
228 42625A 1620007158561	STRUT	15.07	0.0005	0.9596
229 72832A 1620000018416	STR ACT	14.55	0.0005	0.9601
230 68776A 1005006741425	M1 GUN	13.80	0.0004	0.9605
231 16271A 1650004558129LE	MANIFOLD	13.53	0.0004	0.9609
232 17921A 1005010446174	DRUMASSY	13.50	0.0004	0.9613
233 M5934K 1560012091468WF		13.50	0.0004	0.9617
234 68878A 1620011009806	STRUT HG	13.39	0.0004	0.9621
235 69761A 1620004427875	XWIND CL	13.16	0.0004	0.9625
236 T7546A 1620001405240		13.16	0.0004	0.9629
237 26492A 1005005287684	HANDOFF	13.02	0.0004	0.9633
238 14781A 1560008561386BF	HKPMT F4	12.71	0.0004	0.9637
239 93582A 6760004833094	MAGAZINE	12.60	0.0004	0.9641
240 15068A 1630007776698	B52 BRK	12.48	0.0004	0.9645
241 74941A 1095004767948	RACK ASY	12.40	0.0004	0.9649
242 14443A 1680007029382L8	TIMER	12.30	0.0004	0.9653
243 77261A 1620007330993	CAN	12.16	0.0004	0.9657
244 74571A 1620009317355	TORG ARM	12.04	0.0004	0.9661
245 34129A 6720010688350	MIRROR 1	12.00	0.0004	0.9665
246 15862A 1620010710538	F16PASSY	11.85	0.0004	0.9669
247 93672A 6605009497835	OSDU	11.78	0.0004	0.9673
248 26110A 1620012005320	F16PISTO	11.50	0.0004	0.9677
249 M5566K		11.43	0.0004	0.9681
250 74575A 1620009299692	P-N 3C61	11.40	0.0004	0.9685
251 M7619K 3120P879596F		11.25	0.0004	0.9689
252 M7620K 3120P879593F		11.25	0.0004	0.9693
253 15677A 1620011741655	STRUT AY	11.23	0.0004	0.9697
254 M6710K 5330ND025612GAH		11.22	0.0004	0.9701
255 63191A 1440010841618AB	LAUNCHER	11.16	0.0004	0.9705

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PROD NO.	NOUN	RCC DPEH	RCC DPEH %	CUMM X EARNED HR
256 74551A 1620008670810	SHAFT AS	11.16	0.0004	0.9709
257 68736A 1440011093258JB	MRD	11.10	0.0004	0.9713
258 34507A 1630005404253	F100 BRK	10.40	0.0003	0.9716
259 69887A 1620007057261	BS2-RH-T	10.29	0.0003	0.9719
260 M7505K 5365012790018WF		10.29	0.0003	0.9722
261 M7512K 5365012790023WF		10.29	0.0003	0.9725
262 M7511K 5365012790017WF		10.28	0.0003	0.9728
263 15752A 1630010627046	A10 BRK	10.26	0.0003	0.9731
264 M7522K 5365012793476WF		10.20	0.0003	0.9734
265 25917A 1620010141983	LHSTRUT	10.17	0.0003	0.9737
266 M9775K 5315004347447LE		10.10	0.0003	0.9740
267 M7519K 5365012793473WF		10.06	0.0003	0.9743
268 M7516K 5365012790021WF		10.00	0.0003	0.9746
269 M7521K 5365012793475WF		10.00	0.0003	0.9749
270 M7524K 5365012793474WF		10.00	0.0003	0.9752
271 M9195K 5306008249117		10.00	0.0003	0.9755
272 69573A 1620006238913	TORO ST	9.97	0.0003	0.9758
273 68965A 6760010447792	SPIN MOT	9.92	0.0003	0.9761
274 74851A 1005007265650	GUN	9.92	0.0003	0.9764
275 15053A 1630000528403	BRAKEASS	9.88	0.0003	0.9767
276 17964A 1630010716112	F15 NW	9.88	0.0003	0.9770
277 T7040Q 1560007886321BF		9.86	0.0003	0.9773
278 15728A 1630009376604	HOUSING	9.69	0.0003	0.9776
279 69103A 1620010972968	LH CONTR	9.66	0.0003	0.9779
280 M7565K 5365P32-41126-3		9.60	0.0003	0.9782
281 69104A 1620010976091	RH CONTR	8.74	0.0003	0.9785
282 15753A 1630010098474	WHL E3AM	8.67	0.0003	0.9788
283 M5801K 1560011990571BF		8.64	0.0003	0.9791
284 15361A 1630000542557	WHLB52	8.56	0.0003	0.9794
285 22420A 1630008329007	WHEEL MC	8.40	0.0003	0.9797
286 M9408K		8.25	0.0003	0.9800
287 M9409K 3120012146745		8.25	0.0003	0.9803
288 26578A 1620ND053797C	DRG BRAC	8.07	0.0003	0.9806
289 78048A 1620009438754	BRACE	8.07	0.0003	0.9809
290 63826A 1005000431167	FEEDUNIT	8.06	0.0003	0.9812
291 74535A 1620008699889	BRACE DR	7.96	0.0003	0.9815
292 16582A 1620010715592	F-16TARM	7.81	0.0003	0.9818
293 T6301A 1620002421519		7.50	0.0002	0.9820
294 M0124K 1560ND0242336BF		7.20	0.0002	0.9822
295 T9439A 1620009872517		7.20	0.0002	0.9824
296 69775A 5315005006801LE	ROOT PIN	7.12	0.0002	0.9826
297 34456A 1620000922837	DRG LINK	6.90	0.0002	0.9828
298 69658A 1620010389101	STRUT RH	6.81	0.0002	0.9830
299 16288A 1620009248927	YOKE	6.75	0.0002	0.9832
300 M0002K 1560P16P194-67		6.75	0.0002	0.9834
301 M0005K 1560P16P194-241		6.75	0.0002	0.9836
302 16727A 1620011249137	F-16TARM	6.72	0.0002	0.9838
303 15327A 1630008254794	BRKC130	6.65	0.0002	0.9840
304 74568A 1630004100858	A7 BRK	6.65	0.0002	0.9842
305 14991A 3040001646783LE	LINK CON	6.60	0.0002	0.9844
306 63153A 1005010429820	GUNGUUSP	6.20	0.0002	0.9846

## RCC EARNED HOURS FOR MNPRC...OCT 88 THRU JAN 89

PROD NO.	NOUN	RCC DPEH	RCC DPEH %	CUMM % EARNED HR
307 19314A 1620010710968	F16COLAR	6.10	0.0002	0.9848
308 T1067H 1680011089660		6.00	0.0002	0.9850
309 T6779I 1620000563339		6.00	0.0002	0.9852
310 62486A 1095004767947	RACK MAU	5.94	0.0002	0.9854
311 M7639K		5.88	0.0002	0.9856
312 16317A 1450011005926AH	ELV W C	5.76	0.0002	0.9858
313 87051H 1005010086283	HOUSING	5.76	0.0002	0.9860
314 M6114K 1430ND027897GBF		5.70	0.0002	0.9862
315 69088A 1005010502735	EXITUNIT	5.58	0.0002	0.9864
316 69794A 1630011414695	F15 WHL	5.32	0.0002	0.9866
317 17517A 1620003486485	TUBE	5.22	0.0002	0.9868
318 15295A 1630000827955	F111 BRK	5.13	0.0002	0.9870
319 16298A 1630010659469	F15CDHSG	5.13	0.0002	0.9872
320 57174A 1440001727419AH	ROTARY I	5.00	0.0002	0.9874
321 74857A 1005007755578	ADAPTER	4.96	0.0002	0.9876
322 15387A 1630005557523	T30 BRK	4.94	0.0002	0.9878
323 M8840K 1430000133077AH		4.86	0.0002	0.9880
324 62902A 1620000313537	CYLINDER	4.85	0.0002	0.9882
325 42078A 1005008953722	HOUSING	4.80	0.0002	0.9884
326 94829A 1620004023387	ACTUATOR	4.80	0.0002	0.9886
327 T9564A 1620008840372		4.78	0.0002	0.9888
328 19847A 1630010597069	F15CDBRK	4.74	0.0002	0.9890
329 15834A 1620010710536	F-16 PIN	4.71	0.0002	0.9892
330 26597A 1620012548600	TORQUEAM	4.68	0.0002	0.9894
331 15651A 1630005582584	WHEEL AS	4.56	0.0001	0.9895
332 00167C 000F0016C	AIRCRAFT	4.50	0.0001	0.9896
333 M7171K 1420ND030175GAH		4.50	0.0001	0.9897
334 M7172K 1420ND030176GAH		4.50	0.0001	0.9898
335 M7173K 1420ND030177GAH		4.50	0.0001	0.9899
336 M7174K 1420ND030178GAH		4.50	0.0001	0.9900
337 T7163A 1620001753939		4.50	0.0001	0.9901
338 M6275K 3040003556251BF		4.48	0.0001	0.9902
339 M389JK 1560F733002-003		4.44	0.0001	0.9903
340 17494A 1620003084145	F15N-OUT	4.43	0.0001	0.9904
341 23284A 1005005091271	M-14 RIF	4.34	0.0001	0.9905
342 74802A 1005000431167	ENTRANCE	4.34	0.0001	0.9906
343 74817A 1005002213325	FEEDER A	4.34	0.0001	0.9907
344 52448A 6720010678701	MIRR SPN	4.00	0.0001	0.9908
345 T1209A 000F0004E		4.00	0.0001	0.9909
346 T7043A 1620005343898		3.76	0.0001	0.9910
347 T7263Q		3.75	0.0001	0.9911
348 69098A 1620003654001	BALLSCRU	3.72	0.0001	0.9912
349 92679A 6605009159319	RECON AD	3.72	0.0001	0.9913
350 15248A 1630009000745	WHL F100	3.60	0.0001	0.9914
351 96274A 1650001685965BF	TURBINE	3.52	0.0001	0.9915
352 69385A 1620004187094	ROD CYL	3.38	0.0001	0.9916
353 M9357K		3.30	0.0001	0.9917
354 25369A 1620010569656	F-16 CYL	3.10	0.0001	0.9918
355 M6265K 5306ND026872GAH		3.04	0.0001	0.9919
356 M700TK 5340008703741AH		3.00	0.0001	0.9920
357 T1065H 1680011089660		3.00	0.0001	0.9921

## RCC EARNED HOURS FOR MNPRC...OCT 88 THRU JAN 89

PROD NO.	NOUN	RCC DPEH	RCC DPEH %	CUMM % EARNED HR
358 T1066H 1680011089660		3.00	0.0001	0.9922
359 T5943Q 6760P1264-898		3.00	0.0001	0.9923
360 19557A 1680010530071LS	INE REEL	2.97	0.0001	0.9924
361 M3895K 1560P540109-017		2.96	0.0001	0.9925
362 M3896K 1560P540109-019		2.96	0.0001	0.9926
363 59596A 1450001142786AH	YOKE AY	2.88	0.0001	0.9927
364 69548A 1620007659187	CENT.CYL	2.87	0.0001	0.9928
365 69555A 1620006142351	UPUNIVLH	2.80	0.0001	0.9929
366 M5356K		2.70	0.0001	0.9930
367 26579A 1620ND052083C	DRG BRAC	2.69	0.0001	0.9931
368 69288A 1620009438753	BRACE	2.69	0.0001	0.9932
369 15438A 1630005802857	T-29 BRK	2.66	0.0001	0.9933
370 16623A 1620011146869	C141T.A.	2.64	0.0001	0.9934
371 15302A 1630009414191	WHLF111	2.61	0.0001	0.9935
372 M5789K 5310ND029610CAH		2.52	0.0001	0.9936
373 T6944J 1620007729657		2.52	0.0001	0.9937
374 00162C 000F0016A	AIRCRAFT	2.50	0.0001	0.9938
375 26679A 1325000099597	MXU AFG	2.50	0.0001	0.9939
376 M4969K 1560011136448BF		2.50	0.0001	0.9940
377 15819A 1095009118407	BREECH	2.48	0.0001	0.9941
378 74887A 1005009365371	ADAPTER	2.48	0.0001	0.9942
379 18182A 1620009224173	TUBE	2.34	0.0001	0.9943
380 19266A 1630010098475	E3A BRK	2.28	0.0001	0.9944
381 M4841K 1450000056722AH		2.25	0.0001	0.9945
382 M9354K 1620010594518		2.25	0.0001	0.9946
383 M6769K 1560001377637BF		2.16	0.0001	0.9947
384 69625A 1620004100874	CYLINDER	2.04	0.0001	0.9948
395 00169C 000F0016D	AIRCRAFT	2.00	0.0001	0.9949
386 16228A 1325004918006	AIR FOIL	2.00	0.0001	0.9950
387 M3928K 1560P16P194-95		2.00	0.0001	0.9951
388 M6118K 1430ND028568CAH		2.00	0.0001	0.9952
389 M9755K 1560ND029964CUF		2.00	0.0001	0.9953
390 M9761K 1560ND030498CUF		2.00	0.0001	0.9954
391 T1064H 1680011089660		2.00	0.0001	0.9955
392 T4047J		2.00	0.0001	0.9956
393 T4521Q 1620001877445		2.00	0.0001	0.9957
394 74709A 1630004649167	CS H6C	1.90	0.0001	0.9958
395 18395A 1005004197188	BODY ROT	1.86	0.0001	0.9959
396 19899A 1005005703715	COVER	1.86	0.0001	0.9960
397 69577A 1620009763391	BRACE AY	1.81	0.0001	0.9961
398 69578A 1620011431155	STRUT AY	1.78	0.0001	0.9962
399 74525A 5315002952512LE	ROOT PIN	1.78	0.0001	0.9963
400 16354A 1427011043011AB	CONTROL	1.75	0.0001	0.9964
401 M6576K 7105P857712F		1.75	0.0001	0.9965
402 15698A 1630010414570	CSA BRKE	1.71	0.0001	0.9966
403 69566A 1620009535572	VALVE	1.70	0.0001	0.9967
404 M9921K 1560010058769BF		1.68	0.0001	0.9968
405 M4170K 1560P877530F		1.60	0.0001	0.9969
406 M7680K		1.60	0.0001	0.9970
407 M7682K		1.60	0.0001	0.9971
408 74565A 1630000752003	ATD UHL	1.52	0.0000	0.9971



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RCC EARNED HOURS FOR MNPRC... OCT 88 THRU JAN 89

PROD NO.	NOUN	RCC DPEH	RCC OPEH X	CUMM % EARNED HR
409 69558A 1620006142352	UPUNIVRL	1.50	0.0000	0.9971
410 M3907K 1560P878263F		1.50	0.0000	0.9971
411 M6239K 5310012766189		1.50	0.0000	0.9971
412 T4162N 000F0016A		1.50	0.0000	0.9971
413 19908A 1005010525278	TURNARND	1.48	0.0000	0.9971
414 M3894K 1560P733003-003		1.48	0.0000	0.9971
415 69707A 1620003051849	BRACE	1.42	0.0000	0.9971
416 M7169K 1420ND030072GAM		1.35	0.0000	0.9971
417 M7170K 1420ND030174GAM		1.35	0.0000	0.9971
418 M7175K 1420ND030179GAM		1.35	0.0000	0.9971
419 M7176K 1420ND030180GAM		1.35	0.0000	0.9971
420 M9564K 5340ND029661GAM		1.35	0.0000	0.9971
421 M9568K 5340ND029665GAM		1.35	0.0000	0.9971
422 T5223A 1427010158956AB	G/C UNIT	1.32	0.0000	0.9971
423 M3903K 1560P210050-3		1.32	0.0000	0.9971
424 M5389K 1560001371370BF		1.32	0.0000	0.9971
425 M3933K 1560P16P194-241		1.25	0.0000	0.9971
426 18365A 1560009834324BF	WING SEC	1.24	0.0000	0.9971
427 18863A 1560001706671BF	C WING	1.24	0.0000	0.9971
428 T5039I 1620001947597		1.20	0.0000	0.9971
429 15644A 1630001238906	FIS H8G	1.14	0.0000	0.9971
430 T8586A 1630005090317		1.14	0.0000	0.9971
431 M7509K		1.08	0.0000	0.9971
432 69556A 1620005918508	ACT BEAM	1.06	0.0000	0.9971
433 T9743I 1620010403581		1.03	0.0000	0.9971
434 68884A 1620003051726	F15N-ARM	1.02	0.0000	0.9971
435 M4010K		1.02	0.0000	0.9971
436 00166C 000F00168	AIRCRAFT	1.00	0.0000	0.9971
437 M0001K 1560P32-80153-3		1.00	0.0000	0.9971
438 M3906K 1560P877246F		1.00	0.0000	0.9971
439 M4161K		1.00	0.0000	0.9971
440 M4908K		1.00	0.0000	0.9971
441 M4925K 3120ND029912GLE		1.00	0.0000	0.9971
442 M6246K 1560P16S1301-11		1.00	0.0000	0.9971
443 M7569K		1.00	0.0000	0.9971
444 M7826K 1560K01656988BF		1.00	0.0000	0.9971
445 T5652A 1630007947437		1.00	0.0000	0.9971
446 T6111A 1620011607167		1.00	0.0000	0.9971
447 M5974K 5845L879861F		0.96	0.0000	0.9971
448 69557A 1620006587980	BRAKEROD	0.93	0.0000	0.9971
449 37055A 1005000180845	FEED ASY	0.90	0.0000	0.9971
450 M4383K 1560010495906BF		0.90	0.0000	0.9971
451 M5386K		0.84	0.0000	0.9971
452 M6985K		0.84	0.0000	0.9971
453 15576A 1630001473854	FSE BRK	0.76	0.0000	0.9971
454 16404A 1630010140656LC	C130H WH	0.76	0.0000	0.9971
455 19973A 1630010109337	E3A UHL	0.76	0.0000	0.9971
456 M0031K 1560P111656F		0.75	0.0000	0.9971
457 M2031K 1630ND026148G		0.75	0.0000	0.9971
458 M3925K 1560P32-60041-2		0.75	0.0000	0.9971
459 M3927K 1560P105870F		0.75	0.0000	0.9971

## RCC EARNED HOURS FOR MNPRC...OCT 88 THRU JAN 89

PROD NO.	NOUN	RCC DPEH	RCC DPEH %	CUMM % EARNED HR
460 M3930K 1560P109289F		0.75	0.0000	0.9971
461 M7819K 1560K0165698BWF		0.75	0.0000	0.9971
462 T7692A 1560011578040WF		0.75	0.0000	0.9971
463 19896A 1005005585216	ENTRUNIT	0.74	0.0000	0.9971
464 M7989K 4710ND029559GAM		0.72	0.0000	0.9971
465 M4165K		0.68	0.0000	0.9971
466 26290A 1620001058933	T38DRAG	0.67	0.0000	0.9971
467 M4930K 3120001313526		0.66	0.0000	0.9971
468 M5329K 47100100489298F		0.66	0.0000	0.9971
469 M5274K 1560ND025589G8F		0.65	0.0000	0.9971
470 M9194K 5306002972568FG		0.65	0.0000	0.9971
471 M3932K 1560P16P194-67		0.64	0.0000	0.9971
472 M6797K		0.64	0.0000	0.9971
473 19876A 1005010280626	TRANSFER	0.63	0.0000	0.9971
474 M4176K 1560P880500F		0.63	0.0000	0.9971
475 26357A 1005003441550	ROTORBDY	0.62	0.0000	0.9971
476 62228A 6760010414689	MAGAZINE	0.62	0.0000	0.9971
477 90400A 1620006099886	LINK	0.61	0.0000	0.9971
478 19959A 1620009195750	DAMPER	0.60	0.0000	0.9971
479 M0030K 1560P53-11065-3		0.60	0.0000	0.9971
480 M3923K 1560P112810F		0.60	0.0000	0.9971
481 M3946K 5340P109832F		0.60	0.0000	0.9971
482 M9096K 1430ND023219G8F		0.60	0.0000	0.9971
483 15583A 1630008329088	FB111BRK	0.57	0.0000	0.9971
484 T7863I 1630011894176		0.57	0.0000	0.9971
485 19681A 1620009383574	8-P UNIT	0.56	0.0000	0.9971
486 M9119K 1560012400000BF		0.56	0.0000	0.9971
487 M9693K		0.56	0.0000	0.9971
488 M3910K 4720P113565F		0.54	0.0000	0.9971
489 M3922K 1560P112812F		0.54	0.0000	0.9971
490 M5937K 4710005700522		0.54	0.0000	0.9971
491 M5972K		0.54	0.0000	0.9971
492 M8501K 3120003679680BF		0.54	0.0000	0.9971
493 M0033K 1560P106647F		0.52	0.0000	0.9971
494 17605A 1620010451024	CYLINDER	0.50	0.0000	0.9971
495 S6976A 1430009215077AH	03PRINTR	0.50	0.0000	0.9971
496 M4190K 1560P880769F		0.50	0.0000	0.9971
497 M6526K 1560001201711BF		0.50	0.0000	0.9971
498 M9707K 4710001499148		0.50	0.0000	0.9971
499 M6588K 4710010246631		0.49	0.0000	0.9971
500 M6590K 4710010246631		0.49	0.0000	0.9971
501 M4523K 15600119388178F		0.48	0.0000	0.9971
502 M5799K		0.48	0.0000	0.9971
503 M5996K 4710010501027BF		0.48	0.0000	0.9971
504 M6115K 1430ND030076G8F		0.48	0.0000	0.9971
505 M6906K 4730006894298BF		0.48	0.0000	0.9971
506 M3924K		0.45	0.0000	0.9971
507 M3931K 1560P16P194-67		0.45	0.0000	0.9971
508 M4813K 4710002373121BF		0.45	0.0000	0.9971
509 M5599K 53150041449368F		0.44	0.0000	0.9971
510 M6580K		0.44	0.0000	0.9971

## RCC EARNED HOURS FOR MNPRC... OCT 88 THRU JAN 89

PROD NO.	NOUN	RCC DPEH	RCC DPEH %	CUMM % EARNED HR
511	M6832K 4710010984700BF	0.44	0.0000	0.9971
512	M6925K 4710002324142BF	0.44	0.0000	0.9971
513	M7875K 1450ND059997GAH	0.42	0.0000	0.9971
514	M9697K 4710010500188BF	0.42	0.0000	0.9971
515	69321A 1620002695025	0.40	0.0000	0.9971
516	M4322K 4710001141686	0.40	0.0000	0.9971
517	M6537K 5340005273213BF	0.40	0.0000	0.9971
518	M6564K 1560010948843BF	0.40	0.0000	0.9971
519	M6774K 1560ND026767GBF	0.40	0.0000	0.9971
520	M6807K	0.40	0.0000	0.9971
521	M9700K 4710010500188BF	0.40	0.0000	0.9971
522	M4325K 4710001141686	0.37	0.0000	0.9971
523	M4774K	0.39	0.0000	0.9971
524	M4809K 4710010962886BF	0.39	0.0000	0.9971
525	M6398K 6615ND030416GWF	0.39	0.0000	0.9971
526	M6618K 4710004144105BF	0.39	0.0000	0.9971
527	M7338K 4710002383036BF	0.39	0.0000	0.9971
528	M7891K 4710ND030323GBF	0.39	0.0000	0.9971
529	M9695K 4710010500188BF	0.39	0.0000	0.9971
530	M9696K 4710010500188BF	0.39	0.0000	0.9971
531	15575A 1630001398476	0.38	0.0000	0.9971
532	15822A 1630010555056	0.38	0.0000	0.9971
533	M5844K 1560011029047BF	0.38	0.0000	0.9971
534	M4632K 4710001520931BF	0.35	0.0000	0.9971
535	M7015K 4710004144993BF	0.35	0.0000	0.9971
536	M7426K 1560003903918BF	0.35	0.0000	0.9971
537	M9880K 4710001538109	0.35	0.0000	0.9971
538	M4240K 1560P371437-3	0.32	0.0000	0.9971
539	M6777K 1560005947776BF	0.32	0.0000	0.9971
540	M7091K 3040ND029844GAH	0.32	0.0000	0.9971
541	M7484K 4730ND030191GAH	0.32	0.0000	0.9971
542	M7923K 1560ND029692GBF	0.32	0.0000	0.9971
543	M9374K 1560003421873BF	0.32	0.0000	0.9971
544	M9575K	0.32	0.0000	0.9971
545	M9744K	0.32	0.0000	0.9971
546	M9771K 1560ND030603GBF	0.32	0.0000	0.9971
547	M9773K 1560ND030468GWF	0.32	0.0000	0.9971
548	M9896K 4710001589138	0.32	0.0000	0.9971
549	M9898K 4710001538109	0.32	0.0000	0.9971
550	69901A 1620011853806	0.31	0.0000	0.9971
551	M6487K 5340ND027414GAH	0.31	0.0000	0.9971
552	16504A 6760010965035	0.30	0.0000	0.9971
553	M5275K 1560ND027702GBF	0.30	0.0000	0.9971
554	M6021K 4710004213458	0.30	0.0000	0.9971
555	M6584K 4710001241476	0.30	0.0000	0.9971
556	M6607K 4710004144991BF	0.30	0.0000	0.9971
557	M6608K 4710004144991BF	0.30	0.0000	0.9971
558	M6852K 1560010607944BF	0.30	0.0000	0.9971
559	M7002K 1560006130785BF	0.30	0.0000	0.9971
560	M7014K 4710002384132BF	0.30	0.0000	0.9971
561	M7897K 4710ND030626GBF	0.30	0.0000	0.9971

IF MECUM

WHEEL AS

WHL: FSM

INSERT

MAGAZINE

## RCC EARNED HOURS FOR MNPRC...OCT 88 THRU JAN 89

PROD NO.	NOUN	RCC DPEH	RCC DPEH %	CUMM % EARNED HR
562	M9120K 15600124000008F	0.30	0.0000	0.9971
563	M9580K 5340ND030020GAH	0.30	0.0000	0.9971
564	M9281K 4710001538663	0.30	0.0000	0.9971
565	M9395K 4710001538663	0.30	0.0000	0.9971
566	M9897K 4710010881078BF	0.30	0.0000	0.9971
567	T5578A 1630011392892	0.30	0.0000	0.9971
568	M3921K 1560P1686530-97	0.28	0.0000	0.9971
569	M4215K 1560P874634F	0.28	0.0000	0.9971
570	M5810K 4710004144985	0.28	0.0000	0.9971
571	M6594K 4710001241476	0.28	0.0000	0.9971
572	M6622K 4710004919276BF	0.28	0.0000	0.9971
573	M6795K 4710001241880	0.28	0.0000	0.9971
574	M7844K 1560P105849F	0.28	0.0000	0.9971
575	M7899K 1560P106134F	0.28	0.0000	0.9971
576	M9882K 4710010882769BF	0.28	0.0000	0.9971
577	15222A 1630009271825 F4 HSC	0.27	0.0000	0.9971
578	M4179K 1560P879536F	0.25	0.0000	0.9971
579	M4940K 1560P1686307-39	0.25	0.0000	0.9971
580	M4963K	0.25	0.0000	0.9971
581	M4965K 1560P1686307-40	0.25	0.0000	0.9971
582	M5319K 15600111560868F	0.25	0.0000	0.9971
583	M5633K 1560P1686530-61	0.25	0.0000	0.9971
584	M6762K 1450ND027212GAH	0.25	0.0000	0.9971
585	M7523K 1560P1686530-19	0.25	0.0000	0.9971
586	M7802K 1680010693585BF	0.25	0.0000	0.9971
587	M9574K	0.25	0.0000	0.9971
588	M4167K 1560P880497F	0.24	0.0000	0.9971
589	M4180K 1560P880502F	0.24	0.0000	0.9971
590	M4423K 4710001085546	0.24	0.0000	0.9971
591	M4522K 1560011938817BF	0.24	0.0000	0.9971
592	M4635K 4710001520872BF	0.24	0.0000	0.9971
593	M4777K 4710002372978BF	0.24	0.0000	0.9971
594	M5030K	0.24	0.0000	0.9971
595	M5932K 4710005700522	0.24	0.0000	0.9971
596	M5933K 4710005700522	0.24	0.0000	0.9971
597	M5935K 4710005700522	0.24	0.0000	0.9971
598	M5936K 4710005700522	0.24	0.0000	0.9971
599	M5980K 4710002324208BF	0.24	0.0000	0.9971
600	M5989K 4710002324201	0.24	0.0000	0.9971
601	M5991K 4710002324208BF	0.24	0.0000	0.9971
602	M5992K 4710002324201	0.24	0.0000	0.9971
603	M6019K 4710004213482	0.24	0.0000	0.9971
604	M6105K	0.24	0.0000	0.9971
605	M6139K 1440ND025665GAH	0.24	0.0000	0.9971
606	M6279K 1560004319668BF	0.24	0.0000	0.9971
607	M6280K 1560004319668BF	0.24	0.0000	0.9971
608	M6913K 4710002314368	0.24	0.0000	0.9971
609	M6916K 4710002324119BF	0.24	0.0000	0.9971
610	M6963K 1560006130798BF	0.24	0.0000	0.9971
611	M7016K 4710004975205	0.24	0.0000	0.9971
612	M7894K 4710ND030625GBF	0.24	0.0000	0.9971

THE PROFILE SHEETS ARE IN THE  
FOLLOWING BOOKS

MAN PGW	BRAKES
MAN PGP	WHEELS
MAN PWW	MAIN LANDING GEAR EXCEPT C5
MANPWW	NOSE LANDING GEAR EXCEPT C5
MANPRA	C5 MAIN LANDING GEAR
MANPRA	C5 BOGIE BEAM.
MANPRA	NOSE LANDING GEAR.

POTENTIAL IMPROVEMENTS

FOCUS STUDIES

**TITLE:** A potential process improvement opportunity (PIO) exists to (See Note) at RCC MANPRC  
at 20-ALC.

**POINT(S) OF CONTACT:**

**AS-IS CONDITION:** Many parts are masked with either vinyl-plastic tapes or with a hot melt plastic to prevent plating of non-essential areas or as defined per Drawing specifications prohibiting chromium plating. Due to these masking operations, flow time and touch labor man hours are significantly affected.

**TO-BE:** By pumping the chrome plating solution through an internal bore of a part and/or the use of well-designed conforming anodes and plastic masking fixtures, the use of maskants may be significantly reduced or eliminated.

**POTENTIAL IMPROVEMENTS:** A significant reduction in labor to apply the rather expensive masking materials, most of which are used only once and then discarded, plus the trimming operations associated with each maskant may be realized.

**IMPLEMENTATION COST:**

To be determined.

**SCHEDULE:**

To be determined.

**Note:** Study the potential of developing plating equipment to eliminate masking and increase plating efficiency.

## FOCUS STUDIES

**TITLE:** A potential process improvement opportunity (PIO) exists to (See Note #1) at RCC MIANPRC  
at DD-ALC.

### POINT(S) OF CONTACT:

**AS-IS CONDITION:** The proper cleaning, activation and the chromium or nickel plating of the 300 M alloy steels (used for many landing gear parts) are not being performed causing lack of proper adhesion and also pitting of the chromium deposits.

**TO-BE:** Proper cleaning and activation of the 300 M alloy steel surfaces would virtually eliminate the high reject rate attributable to insufficient adhesion. In conjunction with improved plating procedures, the occurrence of chrome pitting could also be greatly reduced.

### POTENTIAL IMPROVEMENTS:

Virtual elimination of rejects due to insufficient adhesion plus a significant reduction in chrome pitting.

### IMPLEMENTATION COST:

To be determined.

### SCHEDULE:

To be determined.

Note #1- Study and develop the best plating procedure for 300M alloy steels.



QUICK FIX OPPORTUNITY

**TITLE:** A potential process improvement opportunity (PIO) exists to (See Note) at RCC MANPRC  
at 20-ALC.

**POINT(S) OF CONTACT:**

**AS-IS CONDITION:** The cyanide/lead anodes currently used are being stored primarily in the water rinse tank or in the chrome plating solutions without current. They develop a passive, electrically-insulating film of lead chromate, lead sulfate and lead oxide which is difficult to remove or be etched to serve as an electrode.

**TO-BE:** Store all anodes in air and activate the anodes (once placed in a chrome plating solution) by plating a scrap piece of steel approximately the same length as the production parts to be plated.

**POTENTIAL IMPROVEMENTS:** Part of the reason insufficient chrome thicknesses are obtained is due to passive or non-activated anodes

**IMPLEMENTATION COST:**

To be determined.

**SCHEDULE:**

To be determined

Note: Eliminate rework due to insufficient chrome thickness caused by lack of proper care of anodes

## QUICK FIX OPPORTUNITY

**TITLE:** A potential process improvement opportunity (PI0) exists to decrease costs - (See Note) at RCC MANPRG  
at DD-ALC.

### POINT(S) OF CONTACT:

**AS-IS CONDITION:** The proper positioning of conforming anodes, used to direct the deposition of chromium to the specific areas of parts to be plated, is presently haphazard in many observed instances. This results in non-uniform deposits, particularly on cylindrical parts, and requires additional expensive grinding operations.

**TO-BE:** Design each conforming anode for positive placement on the part to be plated using plastic (CPVC) shields on both sides of the conforming anode relative to the area to be plated to position anode/cathode. Cylindrical parts are very susceptible to this improvement in the event that non-uniform deposits result and causing grinding problems.

**POTENTIAL IMPROVEMENTS:** More uniform by-thick deposits of chromium will result by the use of shields to position the conforming anodes.

### IMPLEMENTATION COST:

To be determined.

### SCHEDULE:

To be determined.

Note - Uniform Plating Deposits with Shields

QUICK FIX OPPORTUNITY

**TITLE:** A potential process improvement opportunity (PIO) exists to increase parts salvaging at RCC MANPRC  
at DD - ALC.

**POINT(S) OF CONTACT:**

**AS-IS CONDITION:** Some parts, such as trunnion pins, are not repaired due to replacement cost being less than repair cost. They are scrapped-out but not destroyed. They are saved until emergency situation arises that makes their repair necessary.

**TO-BE:** Accumulate these parts and send a large volume to qualified vendor who will replate & grind in an economical manner depending upon size of batch.

**POTENTIAL IMPROVEMENTS:** Realize savings in cost of new purchase less cost of having repairs by Vendor.

**IMPLEMENTATION COST:**

To be determined.

**SCHEDULE:**

To be determined.

OTHER OBSERVATIONS

**TITLE:** A potential process improvement opportunity (PIO) exists to use of Hull Cells at RCC MANPFC  
at OP-ALC.

**POINT(S) OF CONTACT:**

**AS-IS CONDITION:** No Hull Cell testing equipment is currently used by the operators to determine the most suitable current density and also the degree of contamination.

**TO-BE:** Provide Hengry Hull Cells to the operators and train them how to use the Cells and to interpret the results.

**POTENTIAL IMPROVEMENTS:** The use of Hengry Hull Cells will offer immediate visual results to the operators as to burning, plating efficiency, ductility, covering / throwing power and degree of contamination.

**IMPLEMENTATION COST:**

To be determined

**SCHEDULE:**

To be determined.

## OTHER OBSERVATIONS

**TITLE:** A potential process improvement opportunity (PI0) exists to improve recks & fixtures at RCC 17ANPRC  
at DD-ALC.

### POINT(S) OF CONTACT:

**AS-IS CONDITION:** Many parts, particularly those to be chrome plated, do not have proper fixturing to provide sufficient electrical contact area and thereby reduce the amount of heat generated. Fixturing materials are sometimes deteriorated due to the heat.

**TO-BE:** Establish a minimum electrical contact area of 1 sq. inch for each 1000 amps. Also, the contact area on both the parts to be plated and the copper reek fixtures should be clean of all contamination and oxidation before making contact.

**POTENTIAL IMPROVEMENTS:** Proper recks and fixtures with sufficient electrical contact area would result in less electrical power consumed and masking materials will better withstand the plating operations without deterioration.

### IMPLEMENTATION COST:

To be determined.

### SCHEDULE:

To be determined.

OTHER OBSERVATIONS

TITLE: A potential process improvement opportunity (PIO) exists to (See Note #1) at RCC MANPLC  
at 00-ALC.

POINT(S) OF CONTACT:

AS-IS CONDITION: Air-agitation is currently used on cyanide-type plating solutions (Cadmium, Copper and Silver). This causes an excessive build-up of carbonates in the solutions.

TO-BE: Incorporate mechanical mixers or pumps to provide agitation of the cyanide-type solutions.

POTENTIAL IMPROVEMENTS: Reduce potential for rough and un-even deposits plus increase the efficiency of the solution (reduction in plating time) to obtain the desired thickness of deposit.

IMPLEMENTATION COST:

To be determined.

SCHEDULE:

To be determined.

Note #1 - Extend life of cyanide-type chemical solutions

## OTHER OBSERVATIONS

**TITLE:** A potential process improvement opportunity (PIO) exists to (See Note #1) at RCC MANPRC  
at 00 - ALC.

### POINT(S) OF CONTACT:

**AS-IS CONDITION:** Most training of new operators or operators assigned to new responsibilities are being trained by more experienced operators. In addition, certain operators are permitted to attend off-site seminars which do not always address their problems.

**TO-BE:** Contract for training consultants who would conduct on-site classes and using equipment and processes currently used by the RCC.

**POTENTIAL IMPROVEMENTS:** The training would result in very practical, first-hand knowledge of the requirements of the RCC and be less hypothetical and generalised.

### IMPLEMENTATION COST:

To be determined.

### SCHEDULE:

To be determined.

Note #1 - Provide On-Site training by outside resources.

OTHER OBSERVATIONS

**TITLE:** A potential process improvement opportunity (PIO) exists to (See Note #1) at RCC MANPRC  
at QD - ALC.

**POINT(S) OF CONTACT:**

**AS-IS CONDITION:** The responsibility of the repair of defects, such as the pitting and loss of sublayer and bondings of chrome deposits are shared by both MANPRC and MANPRB with resultant confusion and excessive grinding operations when chemical stripping of the deposits would be more economical.

**TO-BE:** Establish procedure when by certain experienced operators from each RCC would meet periodically and determine the proper disposition of each part exhibiting the noted defects.

**POTENTIAL IMPROVEMENTS:** Reduce the labor touch-time and through-put time currently expended on grinding of defective chrome deposits. Deposits exhibiting poor bonding should be chemically stripped. Grinding newly affected parts this problem. Pitted deposits are sometimes ground where chemical removal stripping would be more economical.

**IMPLEMENTATION COST:**

To be determined.

**SCHEDULE:**

To be determined

Note: #1 - Improve rework accountability.



## OTHER OBSERVATIONS

**TITLE:** A potential process improvement opportunity (PIO) exists to improve record keeping at RCC MANPRC  
at 00-ALC.

### POINT(S) OF CONTACT:

**AS-IS CONDITION:** Current record-keeping of rejects at MANPRC is far-superior to all other ALC plotting shops but is not yet sufficiently accurate to pin-point plotting problems.

**TO-BE:** Include the quantity (as well as areas of parts) being plotted each day, record reject rate per process and per plotting tank, reason for the reject (per established codes), chemical tank discards and daily chemical consumption.

**POTENTIAL IMPROVEMENTS:** Improve the ability of the process engineer to pin-point causes of rejects and to ascertain the proper corrective actions.

### IMPLEMENTATION COST:

To be determined

### SCHEDULE:

To be determined.

OTHER OBSERVATIONS

**TITLE:** A potential process improvement opportunity (PIO) exists to Conform to OSHA Reg. at RCC MANPRS  
at 20 - ALC.

**POINT(S) OF CONTACT:**

**AS-IS CONDITION:** None of the approximately 110 tanks, most of which contain hazardous (corrosive, oxidizing or toxic) chemicals have any labeling as to their contents per OSHA Hazard Communication Standard - 29 CFR 1910.1200.

**TO-BE:** Determine the proper labeling for each hazardous chemical tank, obtain suitable labels and affix them in a prominent position on each specific tank.

**POTENTIAL IMPROVEMENTS:** Afford proper communication to all personnel as to the hazards associated with each of the hazardous chemicals for safety considerations.

**IMPLEMENTATION COST:**

To be Determined.

**SCHEDULE:**

To be Determined

## OTHER OBSERVATIONS

**TITLE:** A potential process improvement opportunity (PIO) exists to (See Note 1) at RCC MGNPERS  
at 00 - ALC.

### POINT(S) OF CONTACT:

**AS-IS CONDITION:** Parts leaving the chrome plating solutions are allowed to drip excess solution back into the tank. The parts are then transferred to a nearby cold water rinse tank followed by a hot water rinse tank to facilitate drying. No effort is made to conserve water or to eliminate the discharge of hazardous chemicals.

**TO-BE:** Install cascade-type rinse tanks with back-flow provisions. The rinse waters containing lead and chrome salts may be re-used to replenish water lost by evaporation in the chrome tanks. By installing an evaporator, the heavily-contaminated rinse water can be treated to remove all chromium salts which may be used to replenish the chrome tanks.

### POTENTIAL IMPROVEMENTS:

Achieve zero discharge of the hazardous chromium salts (which are also listed as carcinogens) from the waste stream and in addition, reduce the consumption of water in the RCC.

### IMPLEMENTATION COST:

To be determined

### SCHEDULE:

To be determined.

Note 1 - Improve the discharge of hazardous chemical wastes to the environment and to achieve zero discharge of a known carcinogen.

Section F - Miscellaneous

4-10. Depot Maintenance Personnel Turnover. The annual rate of turnover of personnel performing depot maintenance. This rate is based on the average number of civilian personnel assigned to AFLC depot maintenance functions during calendar year 1985 and the total depot maintenance personnel losses experienced during that year. The source of the data is the Advanced Personnel Data System-Civilian (APDS-C), E300. The OPR is HQ AFLC/DPCC.

1985 Depot Maintenance Personnel Turnover Rate

$$\frac{\text{Losses } 2,449}{\text{Assigned } 40,109} = .0611$$

4-11. AF Maintenance Personnel Turnover. The annual rate of turnover of enlisted personnel performing Air Force base level maintenance. This rate is based upon the total number of enlisted personnel assigned to aircraft maintenance Air Force specialty codes at the end of FY85 and the total number of losses experienced during that year. The source of the data is the Retention Statistic Report prescribed by AFM 30-130, Vol 1 and the Airman Force Characteristics P769 Report Prescribed by AFR 30-3 and AFR 700-4, Vol 1 and Vol 2. The OPRs are HQ AFMPC/DPMATE and HQ AFMPC/DPMYA

FY85 AF Maintenance Personnel Turnover Rate

$$\frac{\text{Losses } 18,923}{\text{Assigned } 147,567} = .1282$$

4-12. Monthly Assigned Hours. The number of hours per month a military or civilian employee is assigned for duty. Monthly assigned hours is based on a 5-day 40-hour work week. This factor equals calendar days per month less holiday and relief days (Saturday, Sunday, or compensatory weekday for weekend workday) times hours per day. The standard Air force monthly assigned hours used in allocating manpower is 167.929 hours. The source of the data is AFR 26-1. The OPR is HQ USAF/PRM. The prescribing directive is AFR 26-1 (Vol III).

4-13. Annual Available Hours. The number of hours per year a military or civilian employee is available for primary duty. Annual available hours is equal to monthly assigned hours less total nonavailable hours (leave, PCS related absences, medical leave, organizational duties, education and training, social actions, miscellaneous, overseas peculiar activities and special absences) times 12 months. The standard annual available hours for military and civilian personnel are presented. The source of the data is AFR 26-1. The OPR is HQ USAF/MPM. The prescribing directive is AFR 26-1 (Vol III).

Calendar days	30.4375
Less:	
Holiday	0.75
Relief Days	8.6964
Assigned Days	20.9911
Times hours per day	8.0
No. Assigned hours	167.929

	Military		Civilian	
	CONUS	OS	CONUS	OS
Monthly Assigned Hours	167.929	167.929	167.929	167.929
Less Total Nonavailable	22.730	24.464	22.65	20.76
Monthly Hours Available	145.2	143.5	145.3	147.2
Times Number of Months	12.0	12.0	12.0	12.0
Annual Hours Available	1742.4	1722.0	1743.6	1766.4

1744

# WAGE FOR OVERTIME

DIRECT	\$18.65
INDIRECT	10.06
OVERHEAD	<u>3.27</u>
TOTAL	31.98

BASE SALARY - WITH NO BENEFITS. \$12.44

STANDARD HOURS WORK PER 1 MAN 1744 HRS

OVERTIME IS 7.5% OF THE TIME

$$(1744 \text{ HRS})(7.5\%) = 130.8 \text{ HRS, OVERTIME / MAN}$$

$$\text{OVERTIME PAY} = \text{BASE PAY} (12.44)(1.5) = \$18.66 \text{ FOR OT.}$$

PAY FOR.

$$\text{A. STANDARD HRS.} = (1744 \text{ HR}) \left( \frac{31.98}{\text{HR}} \right) = 55,773.12 \text{ MAN/YEAR}$$

$$\text{B OVERTIME HRS.} = (130.8 \text{ HRS}) \left( \frac{18.66}{\text{HR}} \right) = 2440.73 \text{ OT PAY}$$

$$\text{TOTAL PAY WITH OVERTIME ONE MAN} = \underline{58213.85}$$

*P. 1/2/27*

ENGINEERING NOTES

NORMAN FLETCHER  
777-0899  
OO-ALC

PLATING SHOP  
MANPRC

## GENERAL INFORMATION

MANPRC IS A RESOURCE Control Center  
at OD-ALC, <sup>It's</sup> Located in Bldg 505 and performs  
various cleaning, plating, and baking processes.

## PROFILE OVERVIEW

- GENERAL INFORMATION
- INTERVIEWS

WORKLOAD

REPAIR PROCESS

STAFF

EQUIPMENT

ENGINEERING SUPPORT

WORK SCHEDULE

Changes (problems and suggestions)

## DATABASE

- PROCESS FLOW CHARTS (GENERIC), (INDIVIDUAL PENS)
- FACILITY LAYOUT
- EQUIPMENT
- WORKFORCE
- REPAIR PROCESS TECHNOLOGY
- WORKLOAD VOLUME & MIX
- MATERIAL HANDLING
- STORAGE

# INTRODUCTION TO PROCESS

**ELECTRODEPOSITION:** PROCESS OF DEPOSITING A SUBSTANCE UPON AN ELECTRODE BY ELECTROLYSIS.

**ELECTROLYTE:** METAL SALT IONS DISSOLVED IN A SOLVENT.

**CATHODE:** NEGATIVELY CHARGED ELECTRODE WHICH ATTRACTS + IONS

**ANODE:** POSITIVELY " " " " - IONS

**PROCESS VARIABLE:** SOLUTION PH & CONCENTRATION, TEMPERATURE, CURRENT DENSITY, AGITATION

- **CRYSTALLINE FACTORS:** RATE OF FORMATION; CURRENT DENSITY, AGITATION (METHOD AND DESIGN), TEMPERATURE
- **CURRENT DENSITY:**  $\uparrow$  =  $\uparrow$  PRODUCTION,  $\downarrow$  CRYSTAL SIZE = THICKER FINE CRYSTALLINE DEPOSIT  
" " ;  $\uparrow$  = ROUGH, TRODD, BURNT DEPOSITS
- **AGITATION:** A SUPPLEMENT TO NATURAL CONVECTION
  - DIFFUSION FILM  $\downarrow$  =  $\downarrow$  RESISTANCE =  $\downarrow$  CURRENT DENSITY  $\Rightarrow$  NATURAL CONVECTION!
  - **PURPOSE:** (1) REPLENISH CATHODE DIFFUSION FILM, (2) DISLodge GAS BUBBLES FROM WORKPIECE, (3) PREVENT STRATIFICATION OF SOLUTION.
  - **TYPES:** AIR, CAVITATION, SOLUTION CIRCULATION, CONVECTION, MECHANICAL
    - **AIR:** LOW PRESSURE AIR LINE RELEASES AIR AT BOTTOM OF TANK CAUSING A "ROLL" OF SOLUTION AS AIR RISES. (+) WATER RINSE, (-) PLATING SOLUTION
    - **CAVITATION:** ULTRASONIC PRESSURE WAVES EXPAND THEN COLLAPSE BUBBLES, (-)  $\uparrow$  EQUIPMENT INITIAL/MAINTENANCE COSTS
    - **CIRCULATION:** RECIRCULATE SOLUTION TO TANK UNDER PRESSURE, (-) MUST BE SUPPLEMENTED BY CATHODE MOVEMENT
    - **CONVECTION:** HEATED SOLUTION RISES CAUSING CIRCULATION, (-) VERY GENTLE PROCESS, FOR VIGOROUS REQUIREMENTS MUST BE SUPPLEMENTED
    - **MECHANICAL:**
      - **CATHODE MOVEMENT:** (+) MOST POPULAR
        - PROPELLERS & PADDLES (-) AIR INDUCTION TO SOLUTION,  $\uparrow$  COSTS, MAY NOT REPLACE FILM OR MOVE GAS BUBBLES ON ENTIRE CATHODE.
        - BARRELS: LOWERED INTO SOLUTION & ROTATED, SOLUTION MOVEMENT BY ROTATION OF BARREL, ELECTRICAL CONTACT WHEN PART TOUCHES BARREL.
- **TEMPERATURE**  $\uparrow$  =  $\uparrow$  CRYSTAL SIZE,  $\uparrow$  FILM REPLACEMENT =  $\downarrow$  WRECKING,  $\downarrow$  LIFE,  $\downarrow$  STRESS,  $\downarrow$  CRACKING
- **WATER:** TRACES OF IMPURITIES WILL AFFECT PROCESS
  - DISTILLED OR DEIONIZED FOR SOLUTION BATHS
  - TAP FOR RINSE, CLEANING, ETCHING, COOLING
  - **RINSE:** (1) MOVE QUICKLY TO RINSE FROM CLEANING OPERATION, (2) OVERFLOW WEIR TO KEEP SURFACE FREE FROM FLOATING CONTAMINATION, (3) CONSTANT FLOW OF FRESH WATER, AGITATION WILL INCREASE EFFECTIVITY OF RINSE, (4) USE 2 RINSES WHERE POSSIBLE, SPRAY HARD TO REACH AREAS (5) DO NOT LEAVE PART IN RINSE TOO LONG OR IT WILL OXIDIZE.



- HYDROGEN EMBRITTLEMENT: FERROUS ALLOYS ESPECIALLY WITH HIGH CARBON ABSORB HYDROGEN DURING CLEANING, PICKLING, PLATING, AMOUNTS ARE DUE BECAUSE OF KNOWN AND UNKNOWN CAUSES. THERE IS NO ACCURATE TEST FOR AMOUNTS ABSORBED
  - IT CAUSES PART TO BE BRITTLE, THE EFFECT IS PRONOUNCED ON PARTS SUBJECTED TO ALTERNATING STRESS.
  - PREVENT BY (1) RESTRICT ELECTROLYTIC CLEANING TO THE ANODIC CYCLE (2) LIMIT PICKLING TO SHORT NONGASSING ACID DIP (3) USE PLATING SOLUTIONS WITH ↑ CATHODE EFFICIENCY, DESIGN TO REDUCE EMBRITTLEMENT
  - REMOVE BY HEAT, (-) CADMIUM & ZINC COATED PARTS SEAL IN HYDROGEN
- ANODE FACTORS: PURITY, POSITION, LENGTH, SHAPE, EFFICIENCY, ELECTROLYTE TYPE, CURRENT & CURRENT DENSITY CAPACITY, FABRICATION METHOD.
  - AFFECT: DEPOSIT DISTRIBUTION, ↓ SOLUTION CONTAMINATION, ↓ CHEMICAL COSTS, ↑ PRODUCTION EFFICIENCY, ↓ PLATING PROBLEMS
  - SOLVABLE: (-) REPLACEMENT OF CHEMICAL ADDITIVE (
  - INSOLVABLE: (-) SPACING BETWEEN ANODE/CATHODE, EXCESSIVE BUILDUP, OXIDIZE IN BATH WITH ORGANIC OR CYANIDE AGENTS
  - ANODE CURRENT DENSITY MUST BE ↑ TO PERMIT DISSOLUTION ↓ TO PREVENT PASSIVATION
- FILTRATION CONTINUOUS OR BATCH FILTRATION
  - CONTAMINATION FROM: ANODE, AIRBORN DUST, DRAG IN, CHEMICALS, AIR AGITATION
  - PREVENTATIVE MEASURES: BAG ON PURE ANODE, PROPER CLEANING, THOROUGH RINSING
  - FILTRATION SYSTEM SIZE & TYPE BASED ON WORKLOAD, CONTAMINATION, SOLUTION
- FIXTURE (RACK) DESIGNED TO HOLD ONE OR MORE PARTS, POSSIBLE EVEN AUXILIARY ANODE MATERIAL THICKNESS DETERMINED BY STRUCTURE, ELECTRICAL, CHEMICAL CAPACITY, TANK ENVELOPE SIZE. GOOD DRAINAGE, REDUCE GASSING, CURRENT DISTRIBUTION, PREVENT AIR/GAS POCKETS, #PARTS ON FIXTURE DETERMINED BY WEIGHT, SIZE, ELECTRICAL, PART SPACING, TOTAL SIZE FOR SHALLEST TANK ENVELOPE IN PROCESS,
  - PART MUST BE SUBMERSED TWO INCHES BELOW SURFACE

- STRESS RELIEF      HEAT BAKE OR SHOT PEEN
- CLEANING      CRITICAL TO PLATING
  - SOLVENT      VAPOR DEGRASS      FOR GREASE, LOOSE PARTICLES
  - EMULSION      ORGANIC SOLVENT-DETERGENT, WATER      FOR LOOSENING & FLUSHING
  - ALKALINE      ALKALINE      FOR GREASY MATERIAL  
OR 2nd clean AFTER EMULSION
  - ELECTROLYTIC ALKALINE      FOR SCRUBBING ACTION (-) CONTAMINATED SURF. (-) NEED TO CHANGE FOR METAL
  - ACID PICKLING      (-) HIGH HYDROGEN OVERBURDENMENT
  - MECHANICAL      FOR PAINTS & SOIL RUST & SCALE REMOVAL  
ROUGHEN SURFACE FOR PLATING/BONDING  
MATE SURFACE FINISH  
REMOVE: BURS, METAL FEATHERS, FUZZ
  - ABRASIVE BLAST (WET/DRY)
  - HAND MANUAL
- (+) ↓ COST COMPARED TO OTHERS (↓ #: MANPOWER, EQUIPMENT, MAINTENANCE, TRAVEL)
- (-) MUST BE OIL/OIL FREE
- NOTE: ELECTRO CLEAN (DIRECT/REVERSE/PERIODIC)
- ANODIC (IODINE IS ANODIC)
  - REMOVE METALLIC SMUTS, PREVENTS NONADHERENT METALLIC FILM DEPOSITION
  - (+) NO HYDROGEN OVERBURDENMENT, (-) NOT FOR ALUM, CHROM, LEAD, RISC ALKALINE SOLUTIONS
- CATHODIC (IODINE IS CATHODIC)
  - (-) POOR ADHESION, ROUGHNESS, STAINING, HYDROGEN OVERBURDENMENT
- MASKANTS
  - WAX (-) REPEATED IMMERSIONS, ↑ PREP TIME, MUST TRIM WHILE HOT, (-) EASILY CHIPPED, OPABLE, ↑ CLEANING TIME
  - PLASTIC (+) TRANSPARENT, DOESNT GET BULTRIE, LESS CLEANING OF PREP SURFACE (-) SPECIAL TANKS, HIGH TEMP, LOW FLASH POINT, SMELL, LOW REUSEABILITY.
  - TAPES (-) ↑ APPLICATION TIME
  - RUBBER SHIELDS (+) REUSEABLE (-) FITS ONLY CERTAIN PARTS, CUSTOM MADE

## ANODIZE COATING

CANAL I, II USED FOR CORROSION PROTECT, ADHESION, ORGANIC FINISH FOUNDATION, ELECTRICAL ISOLATION, ABRASION RESISTANCE, DETECT SURFACE FLAWS, EASILY DYED WITH USOD (CHROMATE, SILICATE, LIGHT SENSITIVE MATERIALS, IMPROVED CORROSION ~~ADHESION~~ <sup>ADHESION</sup> TO PORCEL

III WORK, ABRASION RESIST, CORROSION, ELECTRICAL INSULATOR, FOUNDATION FOR PAINTS, ADHESIVES, DRY FILM LUBRICANTS NOT FOR DIMENSIONAL RESTORATION PURPOSE

RESIST FATIGUE LIFE SO GET POREN FIRST FOR COMPRESSIVE LOAD

SEAL I, II IMPROVE <sup>5-10%</sup> SODIUM DICHLORATE 5 minutes or boiling deionized water <sup>OR</sup> <sup>NICKEL</sup> <sup>WATER</sup> ACETATE DYE (NOT ~~ADHESION~~ <sup>NICKEL</sup> <sup>WATER</sup> ACETATE

FOR MAX ADHESION PORE DO NOT SEAL OTHERWISE <sup>5%</sup> SODIUM DICHLORATE OR HOT <sup>NICKEL</sup> <sup>WATER</sup> ACETATE

REVISION: AIR, MECHANICAL IMPACTS, SOLUTION RESTORATION ETC TO reduce heat

## ALODIN COATING

BOXING: CHEMICAL OXIDATION NOT ELECTROLYTIC IN ANODIZE. NO FATIGUE LIFE LOSS THINER COATS CAUSE EASILY DAMAGED SURFACE OTHERWISE GOOD ACT TO ANODIZE CLEANING IS CRITICAL

- (1) Corrosion NOT PROTECTION UNDER ORGANIC FINISHES, (2) ADHESION UNDER ORGANIC FINISH,
- (3) No change in electrical contact, (4) Mild wear, (5) :

STRIP ANODIZE  
ANODIZES I, II, III  
CONVERSION COAT

## CADMIUM ELECTRODEPOSITION

PURPOSE: PROTECT STEEL, CAST IRON AGAINST ATM. CORROSION (CADMIUM PROTECTS BY SACRIFICIAL MEANS

ON FOREIGN PARTS, ALUMINUM, COPPER ALLOYS PARTS FROM DISSIMILAR METAL CORROSION

GOOD SOLIDABILITY, LOW CONTACT RESISTANCE (ELECTRICAL APPLICATIONS)

OUTDOOR, INDUSTRIAL ZINC IS BETTER / INDOOR / MARINE CADMIUM IS BETTER

MORE EXPENSIVE THAN ZINC. LESS AP. TO CAUSE HYDROGEN BRITTLING

CORROSION PRODUCTS LESS VOLUMINOUS.

NOT REG FOR STEEL TENSILE  $\uparrow$  240,000 PSI

APPL. AFTER ALL HEAT TREATMENTS AND MACHINING / WELDING

UNDERPLATING: ALUM W/ ZINCATE COATING AND NICKEL STRIKE, CORROSION RESISTANT ALLOYS W/ NICKEL COATING

TANK: LOW CARBON STEEL, STAINLESS STEEL, PLASTIC, HARD RUBBER

FILTRATION: CONTINUOUS, 2 TURNOVERS 2/HR

AGITATION: MECHANICAL SUGGESTED UNLESS SOLUTION FILTRATION PROVES EFFECTIVE

PLATE

PLATE FOREIGN MATERIALS OTHER THAN LANDING GEAR

" HIGH STRENGTH STEEL " " " ABOVE 180,000 PSI

" " " " " " " " " " " "

## CHROMIUM ELECTRODEPOSITION

PURPOSE: HARD, <sup>RESISTANT TO HEAT TREAT</sup> ~~RESISTANT TO~~ WEAR, STAIN, WORN, REFLECTIVE,  $\downarrow$  COEFFICIENT FRICTION, ANTI ROLLING,

COATED W/ NICKEL OR COPPER NICKEL GOOD ATM CORROSION RESISTANCE

APPL. AFTER ALL MACH. HT, WELD

UNDERPLATING: ALUM W/ ZINCATE, NICKEL STRIKE OR <sup>USED FOR</sup> CORROSION W/ NICKEL OR COPPER NICKEL

CHROMIUM OVER CHROMIUM IS OKAY IF NOT BEEN USED

TANK: STEEL LINED WITH LEAD, BRICK OR PLASTIC

FILTRATION: PERIODIC 4 TURNOVERS 1/HR

AGITATION: MECHANICAL OR LOW <sup>PRESSURE</sup> FILTER AIR IN MEDIUM

STRIP

PLATE ALUMINUM ALLOYS

STEEL PARTS OTHER THAN LANDING GEAR

STAINLESS STEEL, NICKEL, COBALT

HIGH STRENGTH STEEL LANDING GEAR COMPONENTS

CHROMIUM OVER CHROMIUM

## ELECTROLESS NICKEL PLATING

PURPOSE: FINISHED WITH AUTOCATALYTIC CHEMICAL PROTECTION GIVING PROTECTION RATHER THAN ELECTRICAL CURRENT. NONPOROUS, BRITTLE, HARD DUCTILE W/HEAT TREATMENT WITH STRENGTH OF HARD CHROMIUM (70% PLATES EQUALLY RESISTANT) OF SURFACE

UNDERPLATE: ~~ALLOY~~ EXCEPT <sup>(1) CORROSION</sup> ~~FOR~~ RESISTANT STEEL WITH NICKEL FROM WORTH PLATE, (2) CORROSION WITH COPPER, (3) ALUMINUM WITH NECESSARY CIRCUITS

AGITATION: PART OR SOLUTION MOUNTING AVOID VIBRATIONS

### STRIP

PLATE ALUMINUM ALLOY

PLATE STEEL

PLATE CORROSION RESISTANT STEEL, HIGH STRENGTH STEEL, LEAD AND NICKEL BASE ALLOYS

PLATE TITANIUM ALLOYS

## NICKEL - CADMIUM

PURPOSE: MADE BY APPLYING CADMIUM OVER NICKEL PLATE THEN BAKE TO DIFFUSE. CORROSION RESISTANCE FOR PARTS OPERATING AT 900°F

UNDERPLATE: <sup>NICKEL</sup> DIRECT TO BASE METAL EXCEPT CORROSION RESISTANT STEELS W/ NICKEL STRIKE THAN CADMIUM DIRECT TO NICKEL

### STRIP

PLATE STEEL

## NICKEL ELECTRODEPOSITION

PURPOSE: GOOD CORROSION RESISTANCE, ESPECIALLY MACHINED. THIN PLATE CORROSION PROTECTION, THICK PLATE  
CORROSION AND WEAR, SURFACE OF WORN/CONVEX PARTS AND ELECTROFORMING.

UNIQUE: NICKEL EXCEPT CORROSION RESISTANT STEEL ON A PRELIMINARY COATING OF NICKEL FROM  
A WOODS BATH, CORROSION PROTECTION WITH A PRELIMINARY COPPER COATING IS PERMISSIBLE,  
ALUMINUM PARTS WITH ZINCATE FOLLOWED BY Ni. STRIKE

AGITATION: MECHANICAL PARTIAL SOLUTION MOVEMENT, AIR IF FEASIBLE AND COMPATIBLE  
STRIP

PLATE STEEL

PLATE LIGHT STRENGTH STEEL

## PHOSPHATE COATING

GENERAL: NON REFLECTIVE, WATER INSULATING, BASE FOR PAINT, PREVENT UNDER PAINT CORROSION,  
"BRIGHT" SURFACE FOR WELDING, CORROSION RESISTANCE. ONLY ITS INSUFFICIENT PROTECTION  
BUT ITS EXTREMELY ADHESIVE.

"M" MANGANESE BASE: MODERATE CORROSION PROTECT, WEAR, LONG TERM STORAGE

"Z" ZINC BASE: PREVENT WELDING IN COLD EXTRUSION/DIE DRAWING, SLIDING FRICTION, RUST PROTECT,  
COATING FOR PARTS IN SERVICE

UNIQUE: NONE EXCEPT TEMP MASKING

~~STEEL~~

COAT POROUS WITH

# MAGNESIUM TREATMENTS

GENERAL: MAX CORROSION PROTECTION PROCESS AAE or DOW 17, WASH PRIMER COAT, 4 coats of ZINC CHROMATE VINYL RESIN PRIMER WITH TOP COAT OF ALKYD OR ALKYD-VINYL ENAMEL

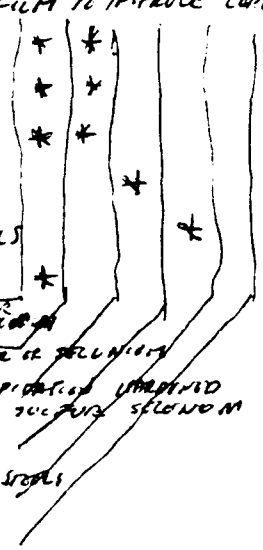
- DOW 1 MACROD 10 - CATHODIC PICKLE TREAT (I) <sup>NOT</sup> FOR CLOSE TOLERANCES, TEMP STABILITY, ELECTRIC BONDING, TOUCH UP, BRUSH
  - DOW 10 SCHEDULE CATHODIC PICKLE TREAT (II) COMBINATION I, III, CORROSION PROTECT, NOT CROSS TOLERANCE
  - DOW 17 MACROD 0-7 DICHROMATE TREAT (III) <sup>padding</sup> protect, NO DIMENSION CHANGE, AFTER MACHINE prior to plate, DRY
  - DOW 9 MACROD 0-9 GALVANIC ANODIZE (IV) ALT TO III, NO DIMENSION CHANGE
  - DOW 12 CAUSTIC ANODIZE (V) ELECTROCHEMICAL 2 layer COAT, HARD, OIL RES, ADHESION RESIST, PAINT BASE
- VARIOUS TYPES ARE MOST COMMON, PROLONGED GENERAL PROTECTION
- DOW 19 MACROD 0-4 CHROMIC ACID (VI), BRUSH ON, TEMP STABILITY, TOUCH UP
  - MAGNESIUM ELECTROLYTE FLOORING ANODIZE (VII), ELECT-COAT FOR ALL ALMS, NO DIMENSION CHANGE, BASK FOR I, II, III
  - FALCOTE 15 CHROMATE (VIII) (IMMERSION OR BRUSH), like III, suits hole for I, II, III, NO DIM CHANGE, PAINT BASE

## PASSIVATION COATING

GENERAL: AUSTENITIC, FERRITIC, MARTENSITIC, PRECIPITATION HARDENED CARBON-RESISTANT STEEL.

REMOVAL OF UNWANTED PARTICLES AND OXIDE FILM TO IMPROVE CORROSION RESISTANCE.

- I LOW TEMP
- II MED TEMP
- III HIGH TEMP
- IV LARGE AMOUNTS OF SURFACE SILENIUM
- V ANODIC FOR HIGH CARBON MARTENSITIC 440 STEELS
- VI LOW TEMP (OPTIONAL)



AUSTENITIC 300 CORROSION RESISTANT STEELS <sup>WITH SURFACE SILENIUM</sup>

FERRITIC 400 CORROSION RESISTANT STEELS <sup>WITH SURFACE SILENIUM</sup>

MARTENSITIC 400 CORROSION RESISTANT STEELS WITH LARGE AMOUNTS OF SURFACE SILENIUM

303, 303Se, 304Se, 416, 416Se, 430F, 430Se

HIGH CARBON MARTENSITIC 440 CORROSION RESISTANT STEELS

440F, 440Se CORROSION RESISTANT STEELS

## SILVER ELECTRODEPOSITION

GENERAL: MALLEABLE DUCTILE METAL, HEAT/ELECTRICAL CONDUCTOR, CORROSION/OXIDATION RESISTANT  
BUT TENDS TO BRUISE SURFACE, ANTI GALVANIC, REFLECTIVE, SOLUBLE,

DUE TO ANTI GALVANIC EFFECT ITS USED FOR CONTACTS SCHEMINGS; AIR SEAL, THERMAL BARRIERS  
ELECTRICAL GILDING ELECTRICAL CONTACTS, WARE-GUARD, TREATMENT OF CONTACTS OR UNDERPLATING FOR  
GOLD, SODIUM, LEAD ALLOY.

UNDERPLATE: APPLIED SILVER STRIKE COAT ON NICKEL OR NICKEL COPPER ON STEEL/ZINC ALLOY OR COPPER ALLOY  
AGITATION: KEY FOR SMOOTH FINISH BY COLLECTOR MOVEMENT WITH SOLUTION RECIRCULATION. NO MECHANICAL

STRIP

PLATE ALUMINUM ALLOYS

" STEEL

" STAINLESS STEEL, COBALT, NICKEL

## TIN ELECTRODEPOSITION

GENERAL: SOFT, DUCTILE CORROSION, STAIN, FATIGUE RESIST. POOR WARE/ABRASION RESIST  
USED ON PISTON, RINGS TO PREVENT SEIZING/SCORING CYLINDER. GOOD BRAZING SOLDERABLE  
GOOD CORROSION PROTECT STOP OFF IN MACHINING

UNDERPLATE: DIRECT EXCEPT ALUMINUM WITH ZINCATE

AGITATION: MILD PART MOVEMENT AVOID SOLUTION AGITATION!

STRIP

PLATE ALUMINUM

" STEEL



## — BRUSH PLATING

GENERAL: APPLICATION OF CONCENTRATED ELECTROLYTE SOLUTIONS ON SELECTED AREAS WITHOUT IMMERSION TANKS.

THE PART (CATHODE) IS BRUSHED WITH A STYLUS. (ANODE) PROVIDED DIPPED IN SOLUTION, DISTRIBUTION DEPENDS ON UNIFORM CONTACT TIME ON ALL AREAS BEING PLATED.

(+) PREVENT/MINIMIZE: DISASSEMBLY, MACHINING, MASKING \$; PLATE: SMALL AREAS ON LARGE PARTS, HIGH STRENGTH STEEL, DIFFICULT TO PLATE PARTS; RESIST WEAR, CORROSION, OR OVERMACHINED PARTS; NO HYDROGEN ENRICHMENT

CAPABILITIES: ALUMINUM ANODIZE; BRASS, CADMIUM, COPPER, GOLD, NICKEL, NICKEL TUNGSTEN, SILVER PLATE COBALT, NICKEL COBALT, PLATINUM

## — SOLID FILM LUBRICANTS (DRY)

GENERAL: USED AT HIGH TEMPERATURES (500°F) IN VACUUMS, DIRTY CONDITIONS, WHERE CONVENTIONAL LUBRICANTS WAX CONTAMINATE PART, AND WHERE RE-LUBRICATION IS DIFFICULT TO DO, AND FRICTING COATING FOR CLOSELY MATED PARTS VIBRATION, SLIDING, ANTI SEIZE FOR THREADED PARTS AND OTHER PARTS THAT ARE NOT FREQUENTLY

APPLICATION IS ~~LIKE~~ <sup>SIMILAR TO</sup> PAINT (SPRAY, BRUSH, ROLLED, AND IMMERSED) MUST BE FREE FROM PRESERVATIVES, OILS, WATERS, ETC.

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2. JOB ORDER NO. 74521A		3. QUANTITY		4. PRODUCTION SEC/RCC MNP GP		5. DATE SCHED.		6. DATE COMPLETED	
7. PART NUMBER 3G61039-101				8. TECH DATA 4S-1-182 462-59-2				9. ITEM SERIAL NO.	
10. MODEL-DESIGN-SERIES C141 NOSE			11. STOCK NUMBER 1620007575889			12. OPTIONAL			
13. SERIAL NUMBER			14. NOUN TRUNNION PIN (THREADED)						
18. DISPATCH STATION	16. PERP RCC/OP NO.	17. WORK TO BE ACCOMPLISHED				18. MECHANIC	19. "P"	20. "Q"	
		GOVERNING DIRECTIVES: AFLCR 66-51 MANOI 66-3							
		F.N.P.I. IAW MIL-STD-1949 P/O N01561							
		STRIP CHROME IAW MIL-STD-871							
		GRIND IAW MIL-STD-866							
		TEMPER ETCH IAW MIL-STD-267							
		SHOT PEEN IAW MIL-S-13165							
		CHROME PLATE IAW MIL-STD-1501							
		FPI IAW MIL-STD-6866							
		CAP PLATE IAW MIL-STD-870							
		BAKE IAW 4S-1-182 MAOI 74-12							
		VAD I.V.D. ALUM IAW MIL-C-83488A							
		ALODINE IAW MIL-C-5541							
		***4140 STEEL 180,000/200,000 PSI**							
		***UNIT COST 3G61014-101 \$189.43***							
		*** UNIT COST 3G61039-101 \$115.30***							
		ALL PERSONNEL INVOLVED IN THE WORK							
		PROCESSES IN THIS DOCUMENT HAVE BEEN							
		THOROUGHLY TRAINED AND ARE FAMILIAR							
		WITH ALL PERTINENT SAFETY PRACTICES							
		AND HAZARDS CONTAINED IN THE BASIC							
		TECHNICAL ORDER (T.O.) AND T.O.							
		SUPPLEMENTS REFERENCED IN BLOCK 8							
		OF THIS AFLC FORM 958. THE							
		APPLICABLE T.O.'S AND SUPPLEMENTS							
		WILL ALWAYS BE USED IN CONJUNCTION							
		WITH THIS DOCUMENT.							
		*COMPONENTS WILL BE THOROUGHLY							
		CLEANED & PROTECTED (C/P MOVE) FOR							
		MOVES BETWEEN OPERATIONS/DISPATCH							
		STATIONS.							
		WARNING							
		MANY OF THE FOLLOWING REPAIR							
		PROCEDURES REQUIRE THE USE OF							
		EQUIPMENT, PROCESSES & CHEMICALS							
		WHICH ARE POTENTIALLY DANGEROUS TO							
		(CONTINUED)							
21. FINAL DESTINATION		22. COORDINATION/INITIATING RCC SIGNATURE/DATE				23. DOCUMENT/SN			
DISPATCH	FUNCTIONAL CODE	A	C		19508N				
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2. JOB ORDER NO.		3. QUANTITY		4. PRODUCTION SEC/RCC		5. DATE SCHED.		6. DATE COMPLETED	
7. PART NUMBER				8. TECH DATA				9. ITEM SERIAL NO.	
10. MODEL-DESIGN-SERIES			11. STOCK NUMBER			12. OPTIONAL			
13. SERIAL NUMBER			14. NOUN TRUNNION PIN (THREADED)						
18. DISPATCH STATION	16. PERF RCC/OP NO.	17. WORK TO BE ACCOMPLISHED				18. MECHANIC	19. "P"	20. "Q"	
		PERSONNEL, ADEQUATE SAFEGUARDS AND PRECAUTIONS MUST BE EMPLOYED TO PRECLUDE INJURIES.							
		*REQD* (MANDATORY REQUIREMENT) IN COLUMN 16 IS EQUIVALENT TO DELTA STAMP.							
	001	3G61039-101							
34D	005 *REQD*	DISASSEMBLE		*C/P MOVE			M		
34C	007 *REQD*	CHEM CLEAN		*C/P MOVE			M		
34B	009 *REQD*	BLAST CLEAN		*C/P MOVE			M		
34E	011 *REQD*	BAKE 4 HRS AT 350-400F		DATE IN _____ TIME IN _____					
				DATE OUT _____ TIME OUT _____					
				*C/P MOVE					
34M	013 *REQD*	FMPI		*C/P MOVE		M	K		
34E	030 *REQD*	E AND I INSPECTION		PIN LARGE DIAMETER O.D.					
21. FINAL DESTINATION		22. COORDINATION/INITIATING RCC SIGNATURE/DATE				23. DOCUMENT/SN			
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2. JOB ORDER NO.		3. QUANTITY		4. PRODUCTION SEC/RCC		5. DATE SCHED.		6. DATE COMPLETED	
7. PART NUMBER			8. TECH DATA			9. ITEM SERIAL NO.			
10. MODEL-DESIGN-SERIES		11. STOCK NUMBER			12. OPTIONAL				
13. SERIAL NUMBER		14. NOUN TRUNNION PIN (THREADED)							
15. DISPATCH STATION	16. PERFRCC/OP NO.	17. WORK TO BE ACCOMPLISHED				18. MECHANIC	19. "P"	20. "Q"	
		3.8105/3.8125 WEAR 3.8098 PIN SMALL DIAMETER O.D. 2.3097/2.3112 WEAR 2.3092 PIN I.D. LARGE AREA 2.452 MAX PIN I.D. SMALL AREA 1.600 MAX PIN I.D. THREADED AREA 1.030 MAX CROSS BOLT HOLE I.D. 0.625/0.626 *NOTE*IT IS NOT ECONOMICALLY FEASIBLE TO REPAIR THIS ITEM IF GRINDING OR PLATING IS REQUIRED IDENTIFY TO MMIL ON AFLC 103 FOR DISPOSITION. *C/P MOVE							
26	032	VAPOR DEGREASE							*C/P MOVE
26	034	STRIP CAD							*C/P MOVE
26	036	STRIP RUST							*C/P MOVE
26	040	STRIP CHROME FROM LARGE DIAMETER							*C/P MOVE
26	050	STRIP CHROME FROM SMALL DIAMETER							*C/P MOVE
8	060	FIRST GRIND LARGE DIAMETER CLEANUP MINIMUM O.D. 3.800 32 RMS 3661039-101 (CONTINUED)							
21. FINAL DESTINATION		22. COORDINATION/INITIATING RCC SIGNATURE/DATE				23. DOCUMENT/BN			
DISPATCH	FUNCTIONAL CODE	A		C		19508N			
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2. JOB ORDER NO.	3. QUANTITY	4. PRODUCTION SEC/RCC	5. DATE SCHED.	6. DATE COMPLETED
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7. PART NUMBER	8. TECH DATA	9. ITEM SERIAL NO.
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10. MODEL-DESIGN-SERIES	11. STOCK NUMBER	12. OPTIONAL
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13. SERIAL NUMBER	14. NOUN TRUNNION PIN (THREADED)
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18. DISPATCH STATION	19. PERP RCC/OP NO.	17. WORK TO BE ACCOMPLISHED	18. MECHANIC	19. "P"	20. "Q"
		*C/P MOVE			
B	080	FIRST GRIND SMALL DIAMETER CLEANUP MINIMUM O.D. 2.285 32 RMS P/N 3661039-101 THREADED PIN *C/P MOVE			
B	085	GRIND CROSS BOLT HOLE TO CLEAN UP NOT TO EXCEED .0641 MAX *C/P MOVE			
26	090	TEMPER ETCH  TIME OUT _____ DATE OUT _____ *C/P MOVE	M	K	
		***** NOTE ***** IF LAST NDI OPERATION IS COMPLETED* HERE, TAKE PRODUCTION COUNT. * *****			
26B	100	BAKE 4 HRS AT 350 TO 400F WITHIN 8 HRS OF ETCH  DATE IN _____ TIME IN _____  DATE OUT _____ TIME OUT _____ *C/P MOVE			
BA	110	FMPI *C/P MOVE ***** NOTE ***** IF LAST NDI OPERATION IS COMPLETED* HERE, TAKE PRODUCTION COUNT. * *****	M	K	
26	115	VAPOR DEGREASE *C/P MOVE			

21. FINAL DESTINATION		22. COORDINATION/INITIATING RCC SIGNATURE/DATE		23. DOCUMENT/SN
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2. JOB ORDER NO.	3. QUANTITY	4. PRODUCTION SEC/RCC	5. DATE SCHED.	6. DATE COMPLETED
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7. PART NUMBER	8. TECH DATA	9. ITEM SERIAL NO.
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10. MODEL-DESIGN-SERIES	11. STOCK NUMBER	12. OPTIONAL
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13. SERIAL NUMBER	14. NOUN TRUNNION PIN (THREADED)
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15. DISPATCH STATION	16. PERF RCC/OP NO.	17. WORK TO BE ACCOMPLISHED	18. MECHANIC	19. "P"	20. "Q"
26	120	SHOT PEEN LARGE DIA INTENSITY .008/.012 A2 *C/P MOVE		M	
26	122	SHOT PEEN SMALL DIA INTENSITY OF .008/.012 A2 *C/P MOVE		M	
26	125	PREPARE FOR CHROME PLATING OF LARGE O.D. FIXTURE/MASK/ETC. MECHANIC SIGN OFF REQUIRED		M	
26	130	CHROME PLATE LARGE O.D. SUFFICIENT TO GRIND BACK TO 3.8105/3.8125 TYPE II CLASS III MECHANIC SIGN OFF REQUIRED *C/P MOVE		M	
26	135	PREPARE FOR CHROME PLATING OF SMALL O.D. FIXTURE/MASK/ETC. MECHANIC SIGN OFF REQUIRED		M	
26	140	CHROME PLATE SMALL O.D. SUFFICIENT TO GRIND BACK TO FINISHED DIMENSION OF 2.3097/2.3112 TYPE II CLASS III DATE OUT _____ TIME OUT _____ MECHANIC SIGN OFF REQUIRED *C/P MOVE		M	
26B	150	BAKE 4 HRS AT 350 TO 400F WITHIN 4 HRS OF CHROME DATE IN _____ TIME IN _____ DATE OUT _____ TIME OUT _____ *C/P MOVE			

21. FINAL DESTINATION		22. COORDINATION/INITIATING RCC SIGNATURE/DATE		23. DOCUMENT/SN
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2. JOB ORDER NO.		3. QUANTITY		4. PRODUCTION SEC/RCC		5. DATE SCHED.		6. DATE COMPLETED	
7. PART NUMBER				8. TECH DATA				9. ITEM SERIAL NO.	
10. MODEL-DESIGN-SERIES			11. STOCK NUMBER			12. OPTIONAL			
13. SERIAL NUMBER			14. NOUN						
			TRUNNION PIN (THREADED)						
15. DISPATCH STATION	16. PERFORM. RCC/OP NO.	17. WORK TO BE ACCOMPLISHED				18. MECHANIC	19. "P"	20. "Q"	
B	160	FINISH GRIND LARGE DIAMETER O.D. 3.8105/3.8125, CONCENTRIC WITHIN .001 32 RMS RECORD WEAR DIM IF REWORK LIMITS ARE EXCEEDED RECORD REASON & CAUSE FOR EXCEEDING REWORK LIMITS *C/P MOVE					M		
B	170	FINISH GRIND SMALL DIAMETER D.D. 2.3097/2.3112, CONCENTRIC WITHIN .001, 32 RMS RECORD WEAR DIM IF REWORK LIMITS ARE EXCEEDED RECORD REASON & CAUSE FOR EXCEEDING REWORK LIMITS *C/P MOVE					M		
26B	180	BAKE 4 HRS AT 350-400F DATE IN _____ TIME IN _____ DATE OUT _____ TIME OUT _____ *C/P MOVE							
8A	190	FMPI *C/P MOVE ***** NOTE ***** IF LAST NDI OPERATION IS COMPLETED* HERE, TAKE PRODUCTION COUNT. * *****				M	K		
26	195	VAPOR DEGREASE *C/P MOVE							
26A	200	FPI *C/P MOVE ***** NOTE ***** (CONTINUED)				M	K		
21. FINAL DESTINATION		22. COORDINATION/INITIATING RCC SIGNATURE/DATE				23. DOCUMENT/SN			
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2. JOB ORDER NO.		3. QUANTITY		4. PRODUCTION SEC/RCC		5. DATE SCHED.		6. DATE COMPLETED	
7. PART NUMBER				8. TECH DATA				9. ITEM SERIAL NO.	
10. MODEL-DESIGN-SERIES			11. STOCK NUMBER			12. OPTIONAL			
13. SERIAL NUMBER			14. NOUN						
			TRUNNION PIN (THREADED)						
18. DISPATCH STATION	19. PERP RCC/OP NO.	17. WORK TO BE ACCOMPLISHED				18. MECHANIC	19. "P"	20. "Q"	
		IF LAST NDI OPERATION IS COMPLETED* HERE, TAKE PRODUCTION COUNT. *						* * * * *	
26	205	PRIOR TO CAD PLATE, GRIT BLAST ALL AREAS TO BE CAD PLATED. *C/P MOVE					M		
26	210	CAD PLATE TYPE I CLASS II .5 SQ FT AT 25-35 AMPS TIME OUT _____ DATE OUT _____ *C/P MOVE					M		
26E	220	BAKE 24 HRS AT 350 TO 400F WITHIN 4 HRS OF CAD DATE IN _____ TIME IN _____ DATE OUT _____ TIME OUT _____ *C/P MOVE							
26	221	IRIDITE *C/P MOVE					M		
8A	223	FMPI *C/P MOVE * * * * * N O T E * * * * * IF LAST NDI OPERATION IS COMPLETED* HERE, TAKE PRODUCTION COUNT. *				M	K		
26	224	VAC I.V.D. ALUM OPTIONAL NOTE: 24 HR BAKE AND F.M.P.I. MUST BE ACCOMPLISH ED PRIOR TO THIS OPTION *C/P MOVE					M		
26	225	ALODINE I.V.D. ALUM *C/P MOVE					M		
21. FINAL DESTINATION		22. COORDINATION/INITIATING RCC SIGNATURE/DATE				23. DOCUMENT/SN			
DISPATCH	FUNCTIONAL CODE	A		C		19508N			
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2. JOB ORDER NO. 74521A		3. QUANTITY		4. PRODUCTION SEC/RCC MNP GP		5. DATE SCHED.		6. DATE COMPLETED	
7. PART NUMBER 3G61014-101				8. TECH DATA 4S-1-192 492-59-3				9. ITEM SERIAL NO.	
10. MODEL-DESIGN-SERIES C141 NOSE			11. STOCK NUMBER 1620000271196			12. OPTIONAL			
13. SERIAL NUMBER			14. NOUN TRUNNION PIN						
15. DISPATCH STATION	16. PERF RCC/OP NO.	17. WORK TO BE ACCOMPLISHED GOVERNING DIRECTIVES: AF LCR 66-51 MANOI 66-3 F.M.P.I. IAW MIL-STD-1949 P/D NO1581 STRIP CHROME IAW MIL-STD-871 GRIND IAW MIL-STD-866 TEMPER ETCH IAW MIL-STD-867 SHOT PEEN IAW MIL-S-15165 CHROME PLATE IAW MIL-STD-1501 FPI IAW MIL-STD-6866 CAD PLATE IAW MIL-STD-870 BAKE IAW 49-1-192 MAOI 74-12 VAD I.V.D. ALUM IAW MIL-C-83488A ALODINE IAW MIL-C-5541 ***4140 STEEL 100,000/200,000 PSI*** ***UNIT COST 3G61014-101 \$189.43*** *** UNIT COST 3G61039-101 \$115.30*** ALL PERSONNEL INVOLVED IN THE WORK PROCESSES IN THIS DOCUMENT HAVE BEEN THOROUGHLY TRAINED AND ARE FAMILIAR WITH ALL PERTINENT SAFETY PRACTICES AND HAZARDS CONTAINED IN THE BASIC TECHNICAL ORDER (T.O.) AND T.O. SUPPLEMENTS REFERENCED IN BLOCK 8  OF THIS AFLC FORM 958, THE APPLICABLE T.O.'S AND SUPPLEMENTS WILL ALWAYS BE USED IN CONJUNCTION WITH THIS DOCUMENT. *COMPONENTS WILL BE THOROUGHLY CLEANED & PROTECTED (C/P MOVE) FOR MOVES BETWEEN OPERATIONS/DISPATCH STATIONS.  WARNING MANY OF THE FOLLOWING REPAIR PROCEDURES REQUIRE THE USE OF EQUIPMENT, PROCESSES & CHEMICALS WHICH ARE POTENTIALLY DANGEROUS TO				18. MECHANIC	19. "P"	20. "Q"	
21. FINAL DESTINATION DISPATCH FUNCTIONAL CODE		22. COORDINATION/INITIATING RCC SIGNATURE/DATE (CONTINUED)		23. DOCUMENT/SN					
A		C		19505N					
B		D							

WORK CONTROL DOCUMENT (MEDS)

1 DATE

PAGE \_\_\_ OF \_\_\_ PAGES

10505N 2. JOB ORDER NO.		3. QUANTITY	4. PRODUCTION SEC/RCC	5. DATE SCHED. 09177	6. DATE COMPLETED
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7. PART NUMBER	8. TECH DATA	9. ITEM SERIAL NO.
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10. MODEL-DESIGN-SERIES	11. STOCK NUMBER	12. OPTIONAL
13. SERIAL NUMBER	14. NOUN	

15. DISPATCH STATION	16. PERF RCC/OP NO.	17. TRUNNION PIN WORK TO BE ACCOMPLISHED	18. MECHANIC	19. "P"	20. "O"
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PERSONNEL. ADEQUATE SAFEGUARDS AND PRECAUTIONS MUST BE EMPLOYED TO PRECLUDE INJURIES.

\*REQD\* (MANDATORY REQUIREMENT) IN COLUMN 16 IS EQUIVALENT TO DELTA STAMP

	001	5581014-101			
--	-----	-------------	--	--	--

34D	005	DISASSEMBLE	*C/P MOVE		M
	*REQD*				

34C	007	CHEM CLEAN	*C/P MOVE		M
	*REQD*				

34B	009	BLAST CLEAN	*C/P MOVE		M
	*REQD*				

34E	011	BAKE 4 HRS AT 350-400F			
	*REQD*	DATE IN _____ TIME IN _____			
		DATE OUT _____ TIME OUT _____			
		*C/P MOVE			

34M	013	FMPI			K
	*REQD*	*C/P MOVE		M	

34E	030	E AND I INSPECTION			
	*REQD*	PIN LARGE DIAMETER O.D. (CONTINUED)			

21. FINAL DESTINATION		22. COORDINATION/INITIATING RCC SIGNATURE/DATE		23. DOCUMENT/SN	
DISPATCH	FUNCTIONAL CODE	A	C	19505N	
		B	D		

WORK CONTROL DOCUMENT (MEDS)

1 DATE

PAGE \_\_\_ OF \_\_\_ PAGES

2. JOB ORDER NO.		3. QUANTITY		4. PRODUCTION SEC/RCC		5. DATE SCHED.		6. DATE COMPLETED	
7. PART NUMBER				8. TECH DATA				9. ITEM SERIAL NO.	
10. MODEL-DESIGN-SERIES			11. STOCK NUMBER			12. OPTIONAL			
13. SERIAL NUMBER			14. TRUNNION PIN						
15. DISPATCH STATION	16. PERF RCC/OP NO.	17. 3.8105/3.8125 WEAR 3.8098 PIN SMALL DIAMETER S.E.T. WORK TO BE ACCOMPLISHED 2.3097/2.3112 WEAR 2.3092 CROSS PIN HOLE .375/.376/.39 MAX **N O T E** IT IS NOT ECONOMICALLY FEASIBLE TO REPAIR THIS PIN IF GRINDING AND PLATEING ARE REQUIRED IDENTIFY TO MMIL ON AFLC FORM 103 FOR DISPOSITION. *C/P MOVE				18. MECHANIC	19. "P"	20. "Q"	
26	032	VAPOR DEGREASE				*C/P MOVE			
26	034	STRIP CAD				*C/P MOVE			
26	036	STRIP RUST				*C/P MOVE			
26	040	STRIP CHROME FROM LARGE DIAMETER				*C/P MOVE			
26	050	STRIP CHROME FROM SMALL DIAMETER				*C/P MOVE			
B	060	FIRST GRIND LARGE DIAMETER CLEANUP MINIMUM O.D. 3.800 32 RMS P/N 3G61014-101				*C/P MOVE			
B	070	FIRST GRIND SMALL DIAMETER CLEANUP MINIMUM O.D. 2.290 32 RMS P/N 3G61014-101				*C/P MOVE			

(CONTINUED)

21. FINAL DESTINATION		22. COORDINATION/INITIATING RCC SIGNATURE/DATE		23. DOCUMENT/SN	
DISPATCH	FUNCTIONAL CODE	A	C	19505N	
		B	D		

19505N WORK CONTROL DOCUMENT (MEDS)

1 DATE

89177

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2. JOB ORDER NO.		3. QUANTITY		4. PRODUCTION SEC/RCC		5. DATE SCHED.		6. DATE COMPLETED	
7. PART NUMBER			8. TECH DATA				9. ITEM SERIAL NO.		
10. MODEL-DESIGN-SERIES			11. STOCK NUMBER			12. OPTIONAL			
13. SERIAL NUMBER			14. NOUN						
			TRUNNION PIN						
15. DISPATCH STATION	16. PERF RCC/OP NO.	17. WORK TO BE ACCOMPLISHED				18. MECHANIC	19. "P"	20. "Q"	
		*C/P MOVE							
8	085	GRIND PIN HOLE TO MAX DIA OF .39 CONCENTRIC & PREPENDICULAR TO CENTER LINE 2.285/2.305 FROM END TO CENTER							
26	090	UP HOLE 32 RMS *C/P MOVE TEMPER ETCH				M	K		
		TIME OUT _____ DATE OUT _____ *C/P MOVE							
		* * * * * N O T E * * * * * IF LAST NDI OPERATION IS COMPLETED* HERE, TAKE PRODUCTION COUNT. *							
26B	100	BAKE 4 HRS AT 350 TO 400F WITHIN 8 HRS OF ETCH							
		DATE IN _____ TIME IN _____							
		DATE OUT _____ TIME OUT _____ *C/P MOVE							
8A	110	FMPI *C/P MOVE * * * * * N O T E * * * * * IF LAST NDI OPERATION IS COMPLETED* HERE, TAKE PRODUCTION COUNT. *				M	K		
		* *							
26	115	VAPOR DEGREASE							
		*C/P MOVE							
26	120	SHOT PEEN LARGE DIA INTENSITY .008/.012 A2 *C/P MOVE					M		
21. FINAL DESTINATION		22. COORDINATION/INITIATING RCC SIGNATURE/DATE				23. DOCUMENT/SN			
DISPATCH	FUNCTIONAL CODE	A		C		19505N			
		B		D					

19505N WORK CONTROL DOCUMENT (MEDS)

DATE 89177

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2. JOB ORDER NO.		3. QUANTITY		4. PRODUCTION SEC/RCC		5. DATE SCHED.		6. DATE COMPLETED	
7. PART NUMBER				8. TECH DATA				9. ITEM SERIAL NO.	
10. MODEL-DESIGN-SERIES			11. STOCK NUMBER			12. OPTIONAL			
13. SERIAL NUMBER			14. NOUN						
			TRUNNION PIN						
15. DISPATCH STATION	16. PERF RCC/OP NO.	17. WORK TO BE ACCOMPLISHED				18. MECHANIC	19. "P"	20. "Q"	
26	122	SHOT PEEN SMALL DIA INTENSITY OF .008/.012 A2 *C/P MOVE					M		
26	125	PREPARE FOR CHROME PLATING OF LARGE O.D. FIXTURE/MASK/ETC. MECHANIC SIGN OFF REQUIRED					M		
26	130	CHROME PLATE LARGE O.D. SUFFICIENT TO GRIND BACK TO 3.8105/3.8125 TYPE II CLASS III MECHANIC SIGN OFF REQUIRED *C/P MOVE					M		
26	135	PREPARE FOR CHROME PLATING OF SMALL O.D. FIXTURE/MASK/ETC. MECHANIC SIGN OFF REQUIRED					M		
26	140	CHROME PLATE SMALL O.D. SUFFICIENT TO GRIND BACK TO FINISHED DIMENSION OF 2.3097/2.3112 TYPE II CLASS III DATE OUT _____ TIME OUT _____ MECHANIC SIGN OFF REQUIRED *C/P MOVE					M		
26B	150	BAKE 4 HRS AT 350 TO 400F WITHIN 4 HRS OF CHROME DATE IN _____ TIME IN _____ DATE OUT _____ TIME OUT _____ *C/P MOVE							
8	160	FINISH GRIND LARGE DIAMETER O.D. 3.8105/3.8125. CONCENTRIC WITHIN .001 32 RMS (CONTINUED)					M		

21. FINAL DESTINATION		22. COORDINATION/INITIATING RCC SIGNATURE/DATE		23. DOCUMENT/SN	
DISPATCH	FUNCTIONAL CODE	A	C	19505N	
		B	D		

19505N WORK CONTROL DOCUMENT (MEDS)

1 DATE

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2. JOB ORDER NO.	3. QUANTITY	4. PRODUCTION SEC/RCC	5. DATE SCHED.	6. DATE COMPLETED
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7. PART NUMBER	8. TECH DATA	9. ITEM SERIAL NO.
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10. MODEL-DESIGN-SERIES	11. STOCK NUMBER	12. OPTIONAL
-------------------------	------------------	--------------

13. SERIAL NUMBER	14. NOUN TRUNNION PIN
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15. DISPATCH STATION	16. PERF RCC/OP NO.	17. WORK TO BE ACCOMPLISHED	18. MECHANIC	19. "P"	20. "Q"
----------------------	---------------------	-----------------------------	--------------	---------	---------

		RECORD WEAR DIM IF REWORK LIMITS ARE EXCEEDED RECORD REASON & CAUSE FOR EXCEEDING REWORK LIMITS *C/P MOVE			
--	--	---	--	--	--

B	170	FINISH GRIND SMALL DIAMETER D.D. 2.309 /2.311 , CONCENTRIC WITHIN .001. 32 RMS RECORD WEAR DIM IF REWORK LIMITS ARE EXCEEDED RECORD REASON & CAUSE FOR EXCEEDING REWORK LIMITS *C/P MOVE		M	
---	-----	---	--	---	--

26B	180	BAKE 4 HRS AT 350-400F DATE IN _____ TIME IN _____ DATE OUT _____ TIME OUT _____ *C/P MOVE			
-----	-----	---	--	--	--

BA	190	FMPI *C/P MOVE ***** NOTE ***** IF LAST NDI OPERATION IS COMPLETED* HERE, TAKE PRODUCTION COUNT. * *****	M	K	
----	-----	---	---	---	--

26	195	VAPOR DEGREASE *C/P MOVE			
----	-----	--------------------------	--	--	--

26A	200	FPI *C/P MOVE ***** NOTE ***** (CONTINUED)	M	K	
-----	-----	---	---	---	--

21. FINAL DESTINATION		22. COORDINATION/INITIATING RCC SIGNATURE/DATE		23. DOCUMENT/SN
DISPATCH	FUNCTIONAL CODE	A	C	19505N
		B	D	

19505N WORK CONTROL DOCUMENT (MEDS)

1 DATE 89177

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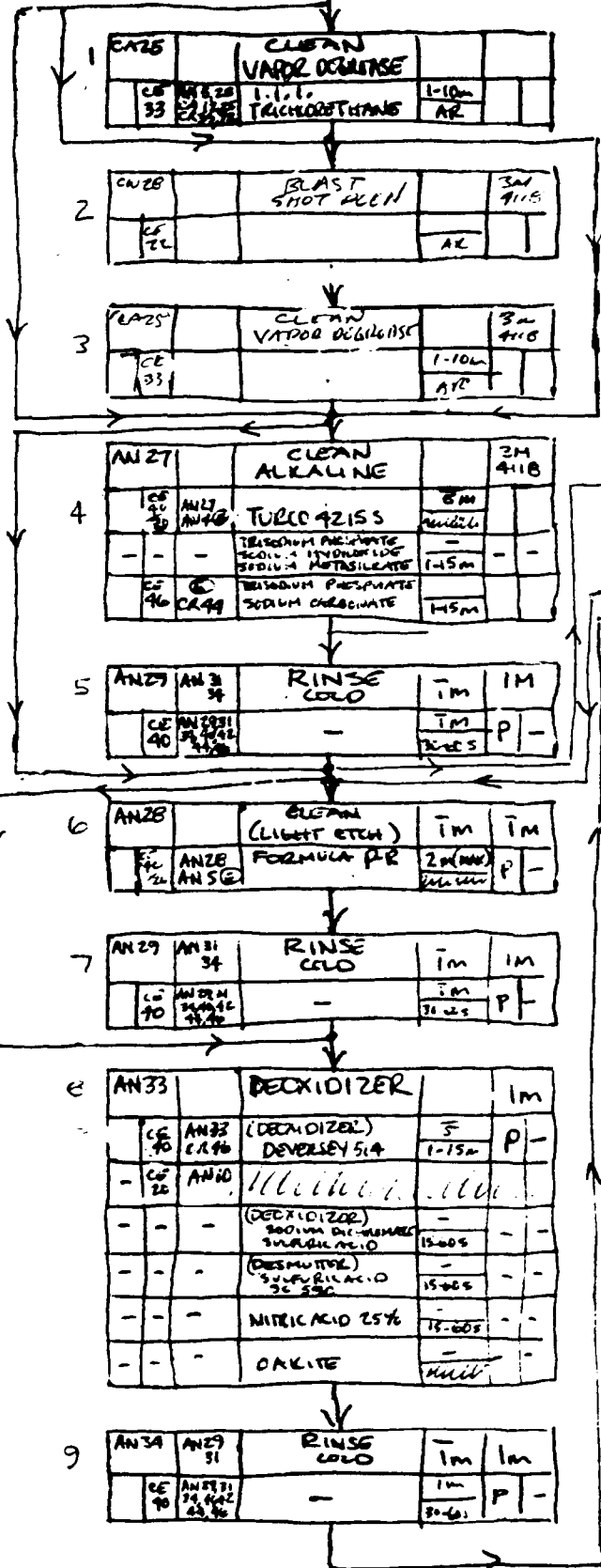
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7. PART NUMBER				8. TECH DATA				9. ITEM SERIAL NO.	
10. MODEL-DESIGN-SERIES			11. STOCK NUMBER			12. OPTIONAL			
13. SERIAL NUMBER			14. NOUN TRUNNION PIN						
15. DISPATCH STATION	16. PERF RCC/OP NO.	17. WORK TO BE ACCOMPLISHED				18. MECHANIC	19. "P"	20. "Q"	
		IF LAST NDI OPERATION IS COMPLETED* HERE, TAKE PRODUCTION COUNT. * *****							
26	205	PRIOR TO CAD PLATE, GRIT BLAST ALL AREAS TO BE CAD PLATED. *C/P MOVE					M		
26	210	CAD PLATE TYPE I CLASS II .5 SQ FT AT 25-35 AMPS TIME OUT _____ DATE OUT _____ *C/P MOVE					M		
26B	220	BAKE 24 HRS AT 350 TO 400F WITHIN 4 HRS OF CAD DATE IN _____ TIME IN _____ DATE OUT _____ TIME OUT _____ *C/P MOVE							
26	221	IRIDITE *C/P MOVE					M		
8A	223	FMPI *C/P MOVE ***** NOTE ***** IF LAST NDI OPERATION IS COMPLETED* HERE, TAKE PRODUCTION COUNT. * *****				M	K		
26	224	VAC I.V.D. ALUM OPTIONAL NOTE: 24 HR BAKE AND F.M.P.I. MUST BE ACCOMPLISH ED PRIOR TO THIS OPTION *C/P MOVE					M		
26	225	ALODINE I.V.D. ALUM *C/P MOVE					M		
21. FINAL DESTINATION		22. COORDINATION/INITIATING RCC SIGNATURE/DATE				23. DOCUMENT/SN			
DISPATCH	FUNCTIONAL CODE	A		C		19505N			
		B		D					



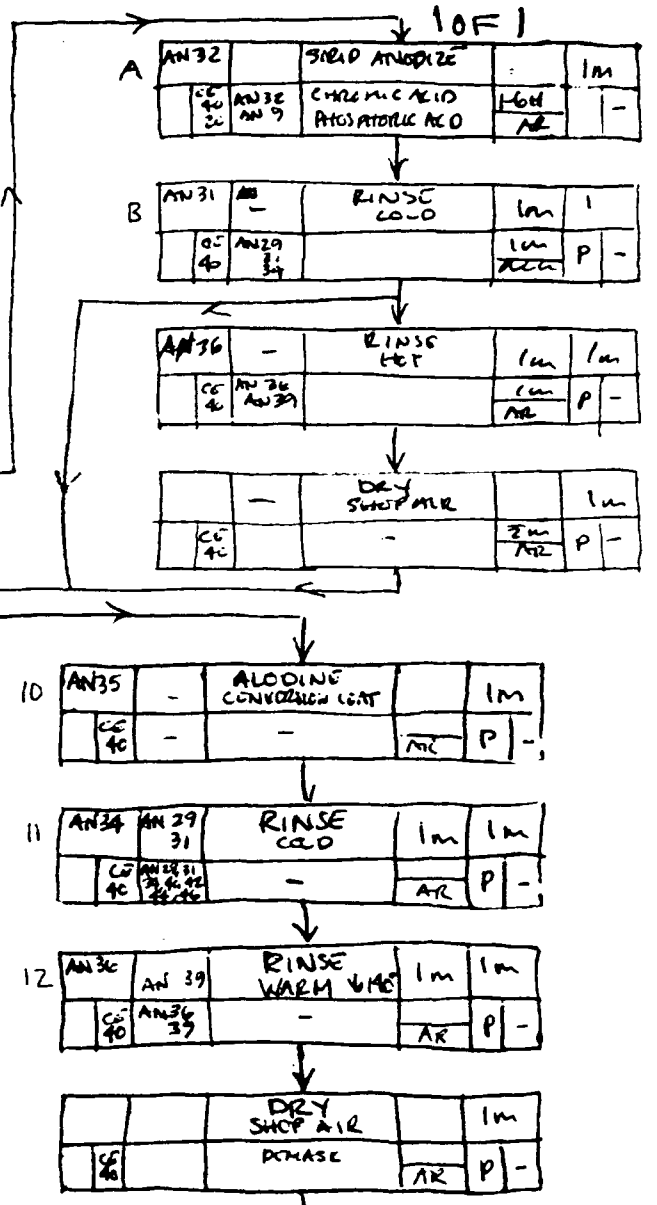


4:18	INTERNAL MOVE	10m	
REQUIRE TREATMENT 9:18	EXTERNAL MOVE	30m	

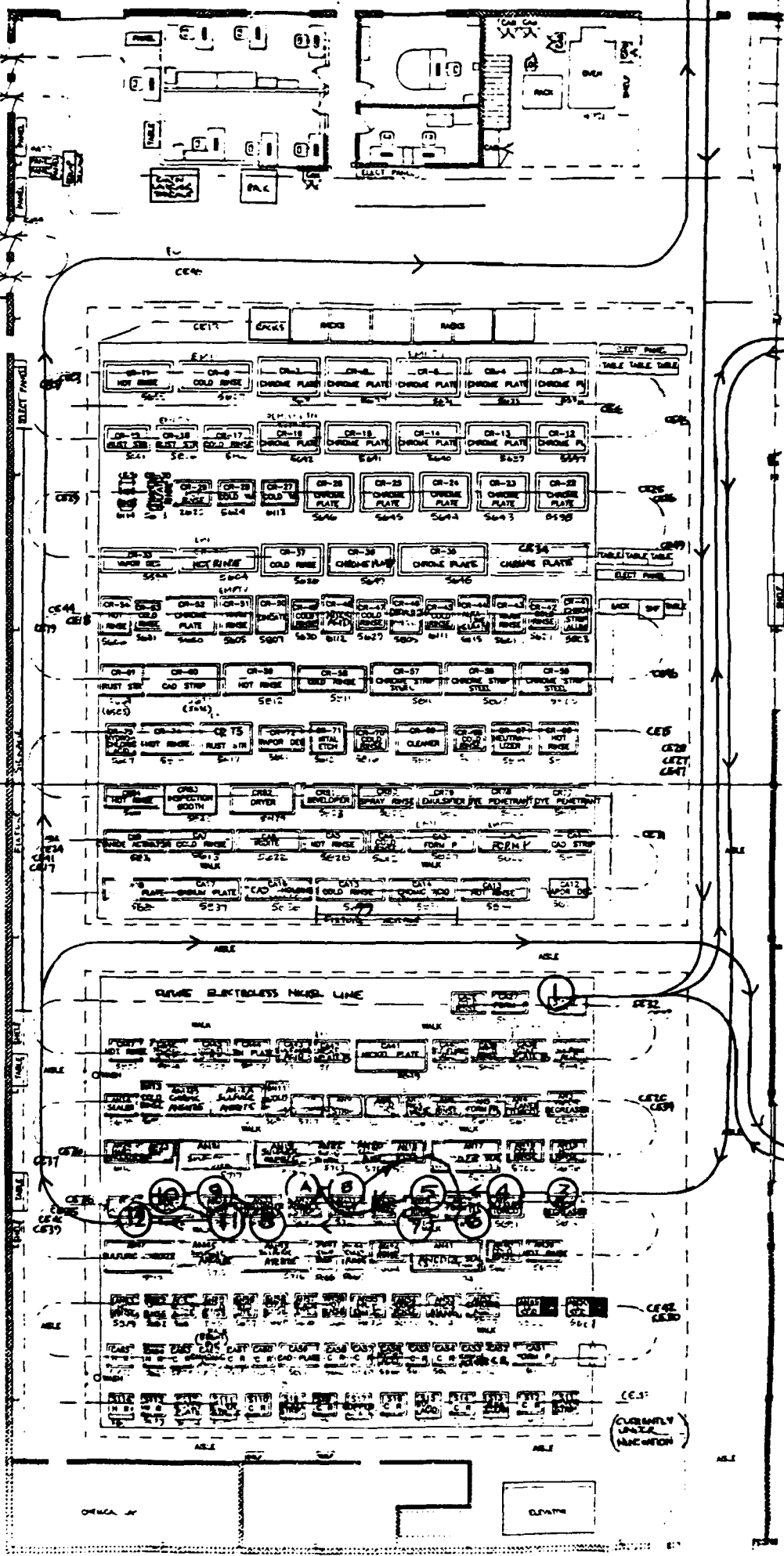
# ALODINE



IF NO "FORM P-R" THEN DECAPISE FOR 10-15M



14 CARRIERS  
CLEANING  
CUE 24 HS  
24 CARRIERS

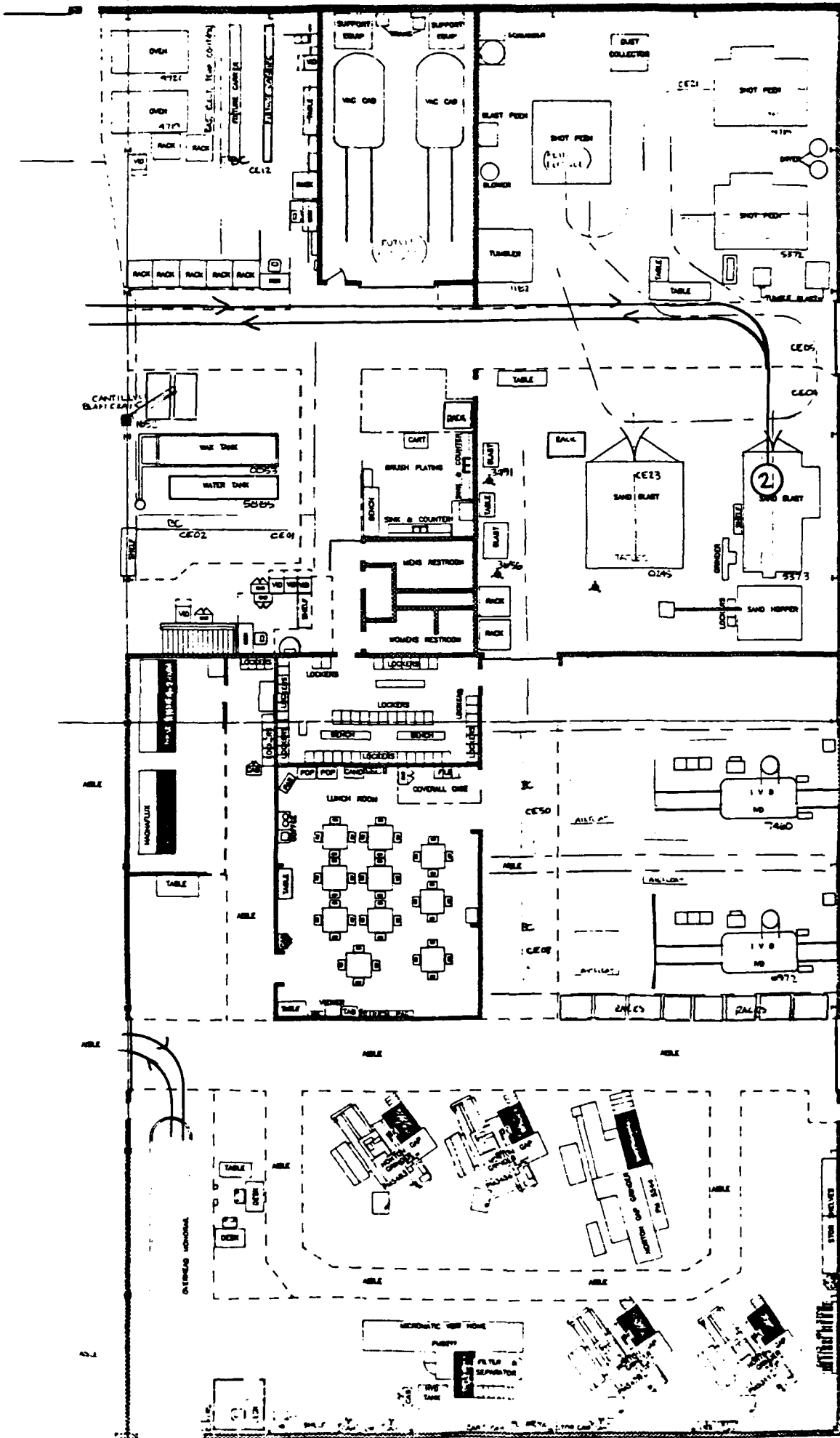


CRANE TRAC



ALODINI  
1 OF 2

CURRENTLY UNDER REVISION



ALDINE  
2 of 2

INTERNAL MOUSE FROM 50 T ONLY	10M
EXTERNAL MOUSE	30M

# ANODIZE 1 OF 2

1	CA25	-	CLEAN VAPOR DEGREASE		
	CE 33	AN 3 25	1.1:1 TRICHLOROETHANE	AR	
2	CW28	-	BLAST SHOT PEEN		3M 4118
	CW28	?	-		
3	CA25	-	CLEAN VAPOR DEGREASE		3M
	CE 33				

- (A) ALTERNATE PROCESS LINE (ENTIRE LINE MUST BE)
  - (E) EMERGENCY TANK (ADDITIONAL <sup>(TRANSFER)</sup> SET UP TIME REQUIRED)
- A SINGLE (A) TANK CAN BE USED AS AN EMERGENCY TANK IF ADDITIONAL SET UP TIME IS ADDED

4	ANA	-	CLEAN ALKALINE		3M 4118
	CE 40	AN 27	TURCO 42155	5m	
			SODIUM PHOSPHATE 300.0M HYDROXIDE SODIUM METASULFATE	1-15m	
	CE 46	CR 44	SODIUM CARBONATE	1-15m	

### NOTES:

- HARD ANODIZE USUALLY HAS A SULFURIC ANODIZE APPLIED TO THE SURFACE TO BE HARD ANODIZED IS HONED DOWN THEN CLEANED AND THEN HARD ANODIZED.
- STRUTS NORMALLY STRIPED IN 505 OTHERS IN 507

5	AN 6	AN 8	RINSE COLD		1m
	CE 40	AN 8, 11, 13	-	1m	P-
		AN 8, 11, 13		30-60 S	

6	ANS	-	CLEAN (LIGHT ETCH)	1m	1m
	CE 40	ANS	FORMULA P-R	2m (MAX)	P-
7	AN 6	AN 8	RINSE COLD	1m	1m
	CE 40	AN 8, 11, 13, 16, 18, 20, 22	-	1m	P-

A	AN 9	-	STRIP ANODIZE		1m
	CE 40	AN 9	CHROMIC ACID PHOSPHORIC ACID	1-6M AR	-
B	AN 8	AN 6	RINSE COLD	1m	1m
	CE 40	AN 8, 11, 13, 16, 18, 20, 22	-	1m	P-

IF NO  
"FORMULA P-R"  
THEN  
DEVELOP. OF  
10-15M

8	AN 10	-	DEOXIDIZER	1m	1m
	CE 40	AN 10	(DEOXIDIZER) DEVERSEY 544	1-15M 15-60s	P-
	CE 40	CR 46	(DEOXIDIZER) SODIUM DIOXIMATE SULFURIC ACID	15-60s	-
			(DESULFURIZER) SULFURIC ACID 20-500	15-60s	-
			NITRIC ACID 25%	15-60s	-
			CAKITE		-

9	AN 15	-	RINSE HOT	1m	1m
	CE 40	AN 15	-	1m AR	P-
	CE 40	?	DRY SHOP AIR	?	1m
	CE 40	?	-	2m AR	P-

9	AN 11	AN 6	RINSE COLD	1m	1m
	CE 40	AN 8, 11, 13, 16, 18, 20, 22	-	1m	P-

AUXILIARY OPERATION					

7/1/78  
III MASKED

ANDDIZE  
2 OF 2

				ANODIZE		1m
10		CE 20	AN 12B	I CHROMIC ANODIZE CHROMIC ACID	60-75m	P -
10	AN 23 33	CE 40	AN 12A	II SULFURIC ANODIZE SULFURIC ACID	35m	P -
10		CE 20	AN 23 24	III HARD ANODIZE SULFURIC ACID DETAILED ACID	AR	P -
				PHOSPHORIC ANODIZE PHOSPHORIC ACID	AR	- -

		?	?	RINSE COLD DEIONIZED	1m	1m
11	11			-	1m AR	P -

				DYE	5/CM	3M 41B
A	CE 20	AN 57		BLACK	AR	P
A	CE 20	AN 59		RED	AR	P

~~ANODIZE~~

\* BEST SOLUTION  
FOR PROCESS

12

12 III HARD  
ANODIZE  
SEAL

				SEAL	(UNDYED)	(DYED)
	CE 20	AN 17		SODIUM DICHROMATE *	15m P -	<del>3m P -</del>
	CE 40	AN 14		NICKEL ACETATE	15m P -	<del>3-20m P -</del>
				WARM DEIONIZED WATER	15m P -	<del>3-20m P -</del>

13

	AN 16	AN 18		RINSE COLD	1m	1m
	AN 31 33 40	CE 40	AN 18 19 20	-	1m	P -

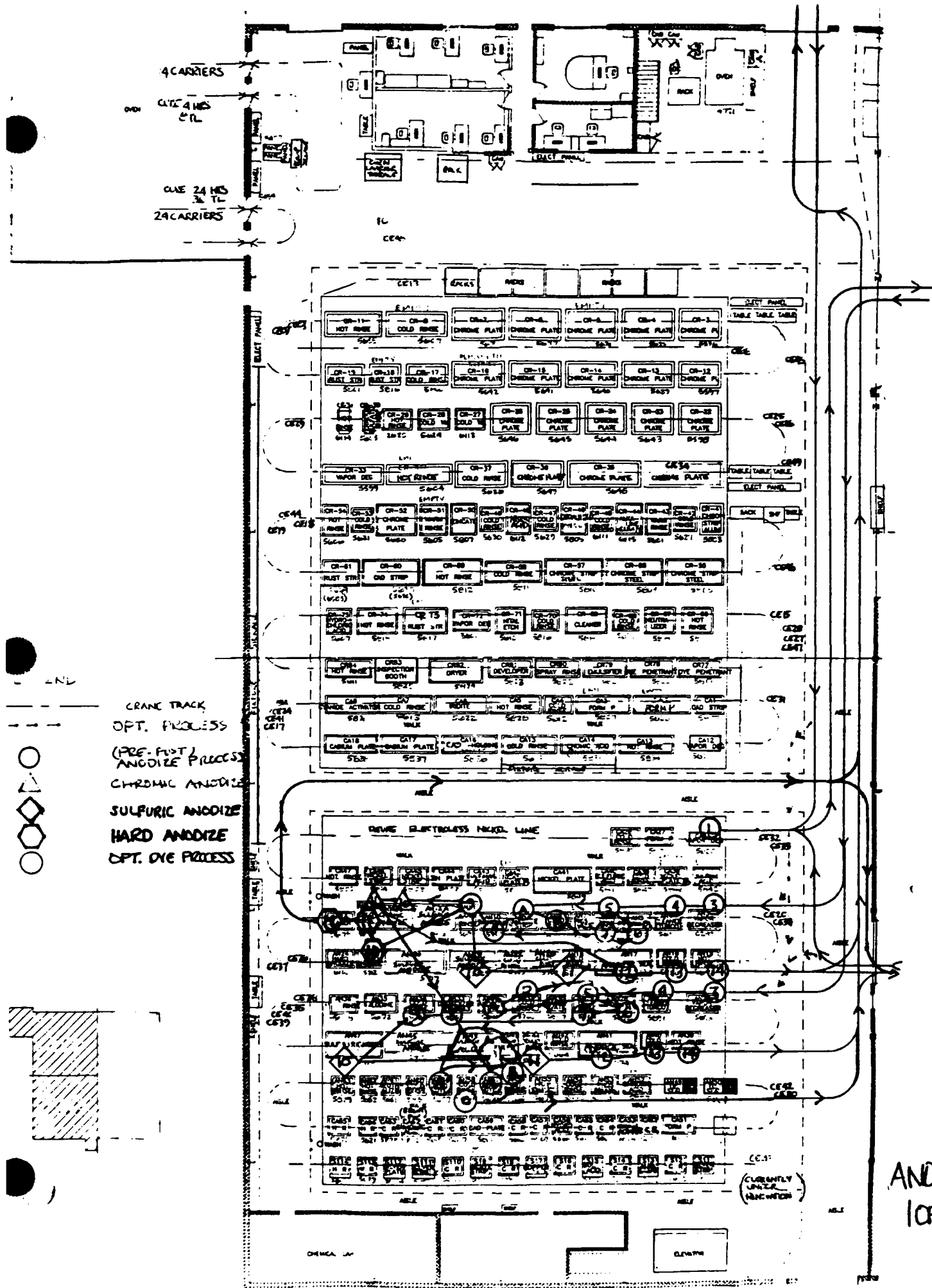
				RINSE COLD		
B						

14

	AN 37	CE 40	CE 20	AN 15	RINSE HOT	1m	1m
	AN 37 38	CE 40	CE 20	AN 15	-	1m AR	P -

				RINSE HOT		
C						

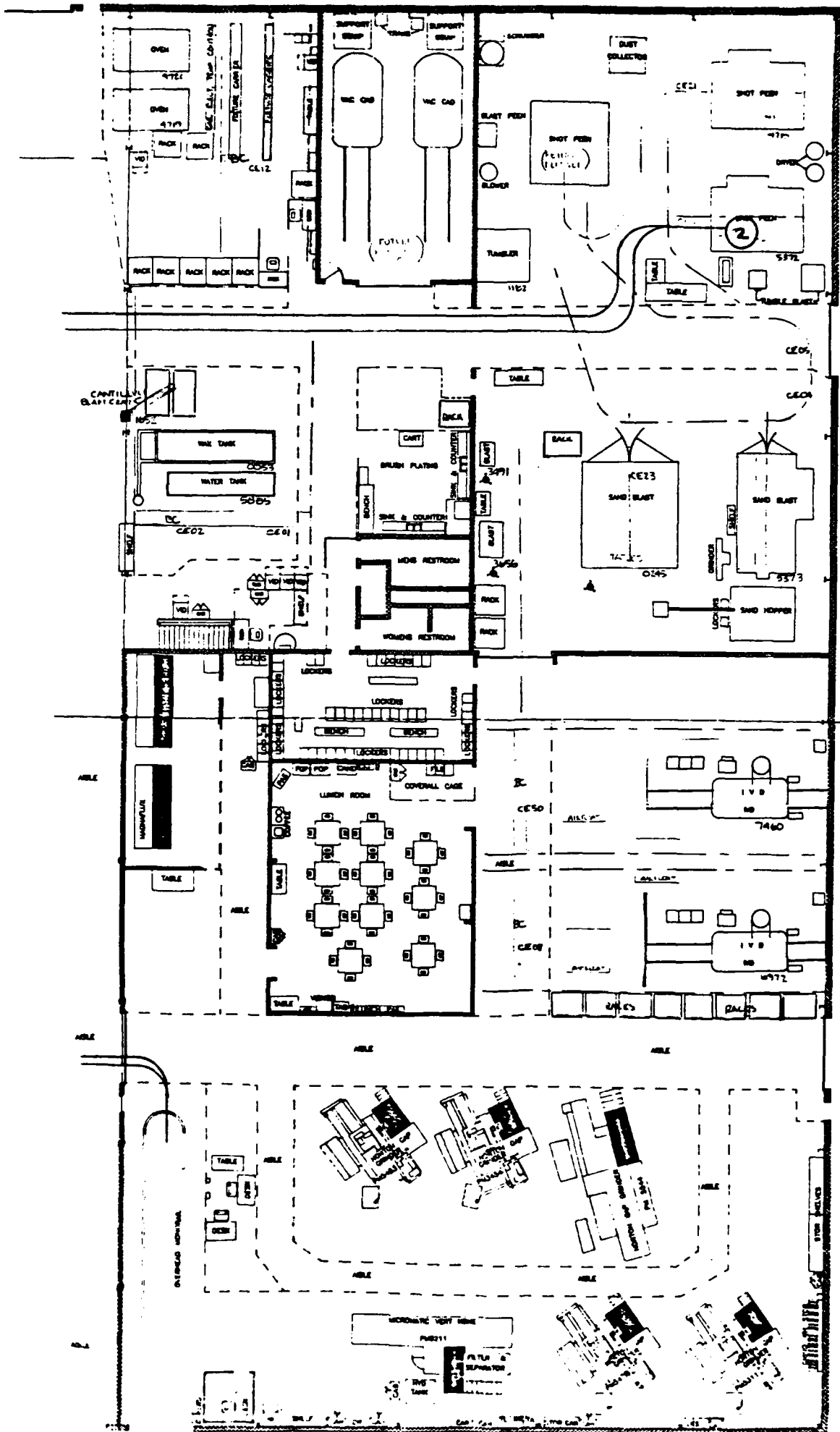
				DRY SHOP AIR	2m	1m
	?	CE 40	CE 20	PSHASK	3m 7/10/11	P -



CRANE TRACK  
 OPT. PROCESS  
 (PRE-FINISH) ANODIZE PROCESS  
 CHROMIC ANODIZE  
 SULFURIC ANODIZE  
 HARD ANODIZE  
 OPT. DYE PROCESS

ANODIZE  
 1 OF 2

(CURRENTLY UNDER REVISION)



ANODIZE  
2 OF 2



THIS PROCESS IS MAINLY USED IN MANPCRC BUT CAN BE MOBILE, IT IS NORMALLY USED AS A REPAIR OF NICKS, ETC, BUT IS ALSO USED IN EMERGENCIES INSTEAD OF IMMERSION PROCESSES. DO TO THE NATURE OF THE PROCESS A FLOW CHART CAN NOT ILLUSTRATE THE PROCESS,

## CAPABILITIES ARE:

ALUMINUM ANODES

BRASS

CADMIUM

COBALT

COPPER

GOLD

NICKEL

NICKEL COBALT

NICKEL TUNGSTEN

PLATINUM

SILVER

ESTIMATED  
WORKLOAD

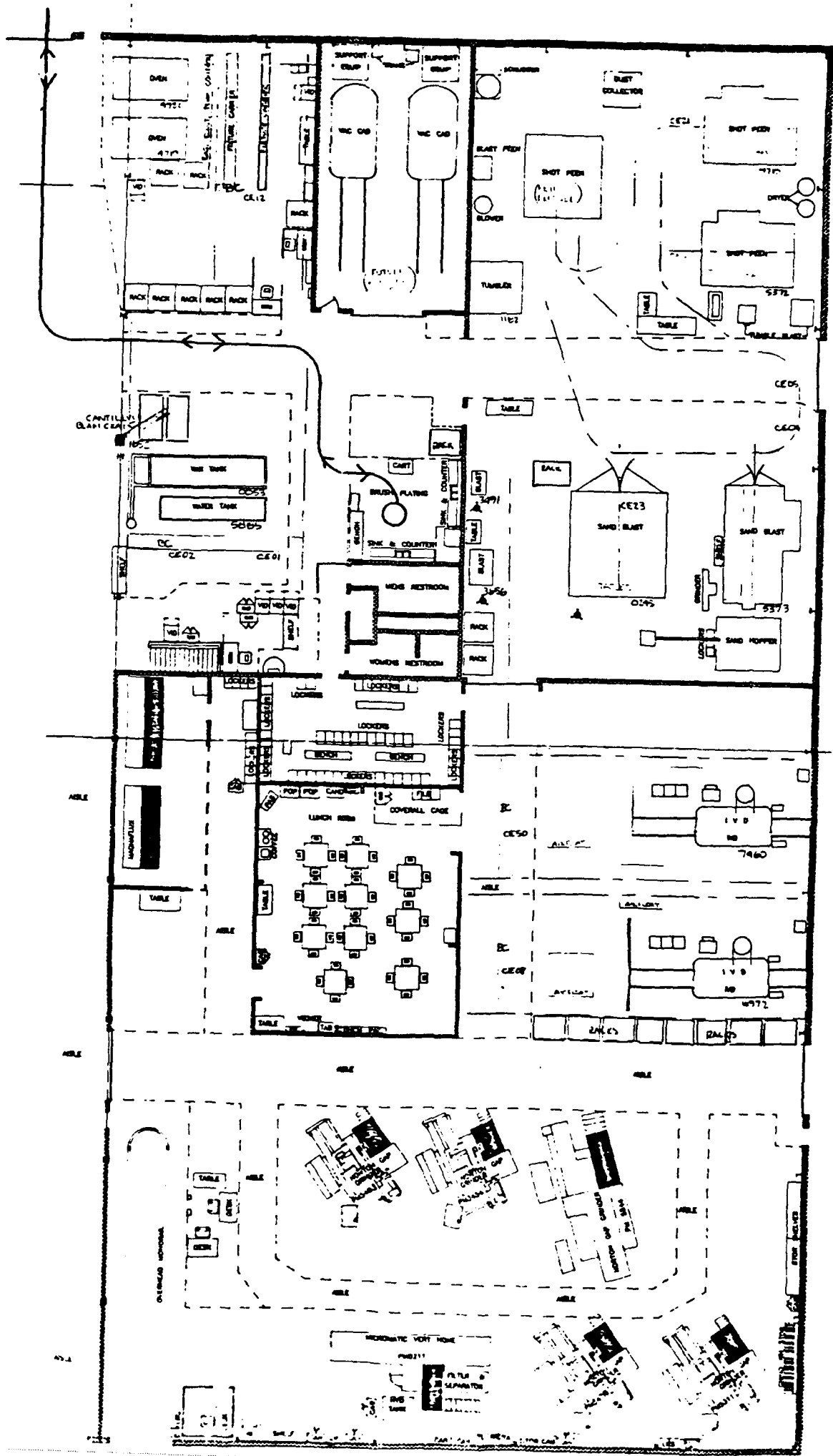
1/MO

50% OF ALL WORK

3/YR

3/YR

3/YR



INTERNAL MOUNT	10mm
EXTERNAL MOUNT	3mm

CADMIUM  
1 OF 2

1	CLEAN VAPOR DEGRASS	AR
---	---------------------	----

2 3	MASKING	AR
--------	---------	----

4	STEEL	
	4 HRS PERIODIC PURE	
	GRIT BLAST	AR
	MULTI-DIRTY STEEL	NO
	SODIUM HYDROXIDE	
	(BURN ALLOYS)	
	NITRIC ACID	AR
	(PLATES COOLING)	
	NITROGEN ACID	AR
	COOLING	
	(FORGING METALS)	
	PERMANENT	AR
	AMMONIUM	
	NITRATE	

5	RINSE D.O.	AR
---	------------	----

	COMBINE RINSE / DRY	AR
--	---------------------	----

6	STRESS RELIEF BAKE	
	FM	0 HR
	HS, HSLG	3 HR
		4 HR

7	CLEAN VAPOR DEGRASS	AR
---	---------------------	----

	MASKING	AR
--	---------	----

8	HEAT	
	SHOTBLOW	AR
	GRIT BLAST	AR
	HSLG	AR

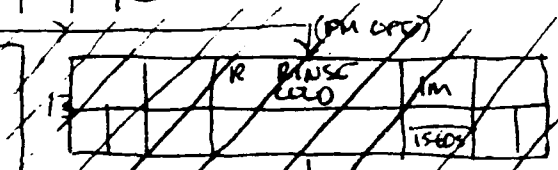
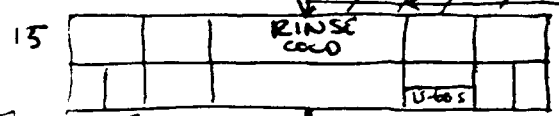
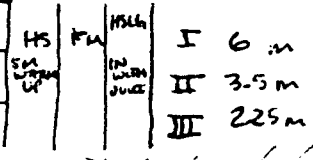
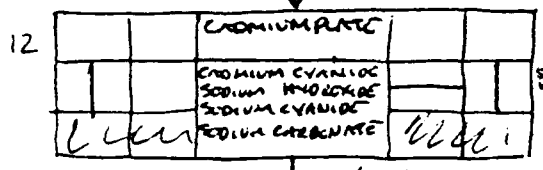
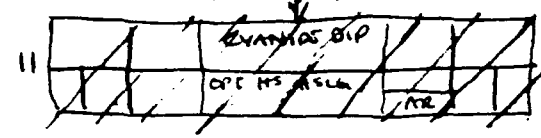
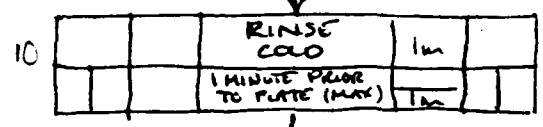
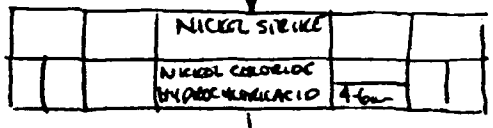
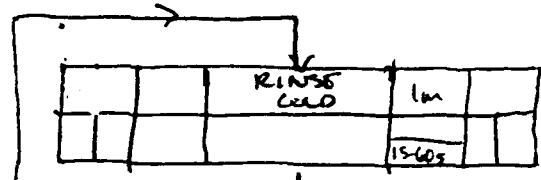
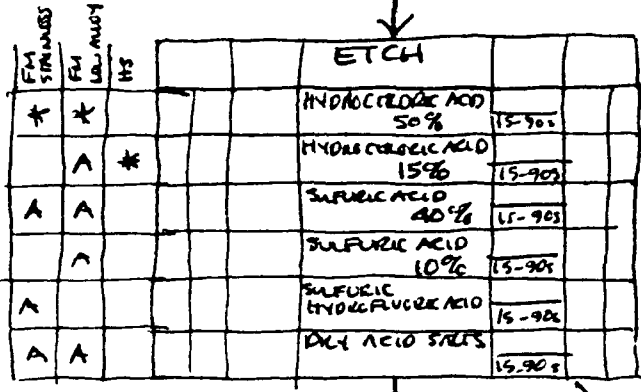
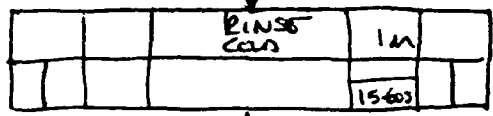
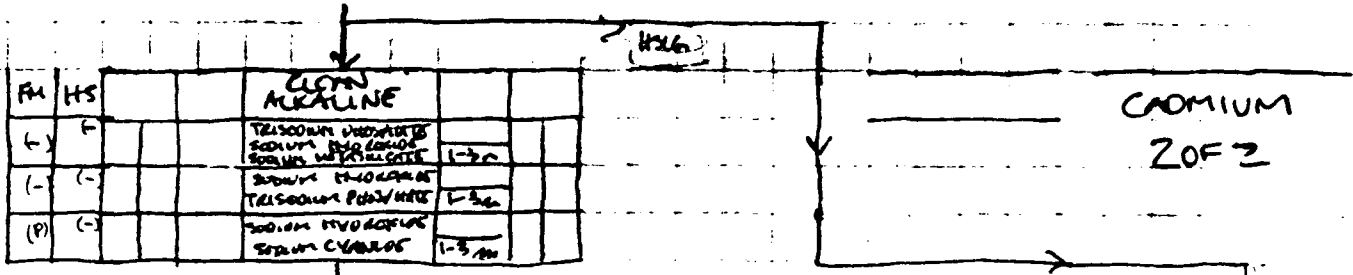
9	CLEAN VAPOR DEGRASS	
---	---------------------	--

	PROTECTIVE	
		AR
		AR
		AR

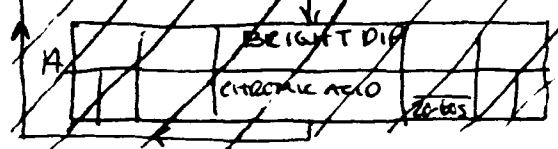
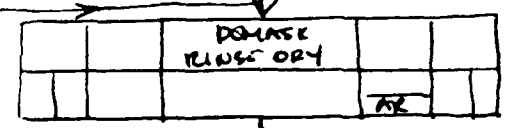
	DRY STOP AIR	AR
--	--------------	----

	AUXILIARY OPERATION	
--	---------------------	--

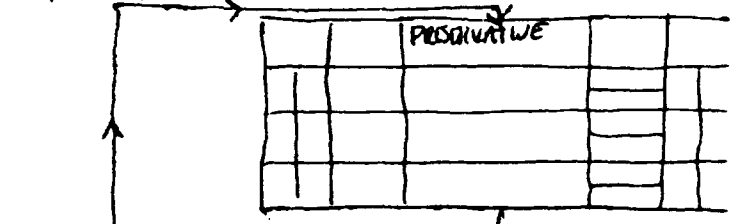
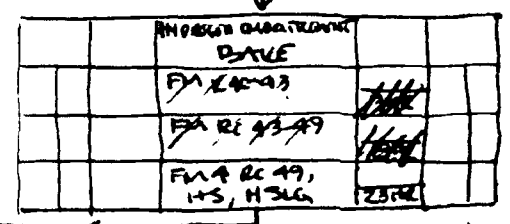
FM FERRUCIOUS METAL NOT LANDING GUTS  
(↑ 150,000)  
HS HIGH STRENGTH STEEL NOT LANDING GUTS  
(↑ 150,000)  
HSLG HIGH STRENGTH STEEL LANDING GUTS



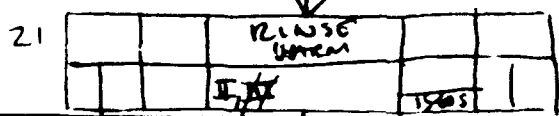
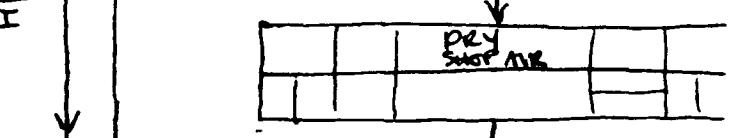
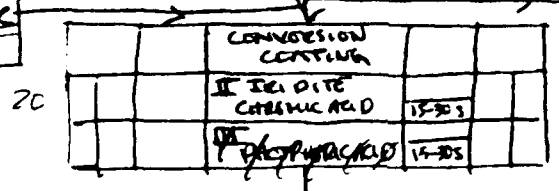
16 RINSE HOT

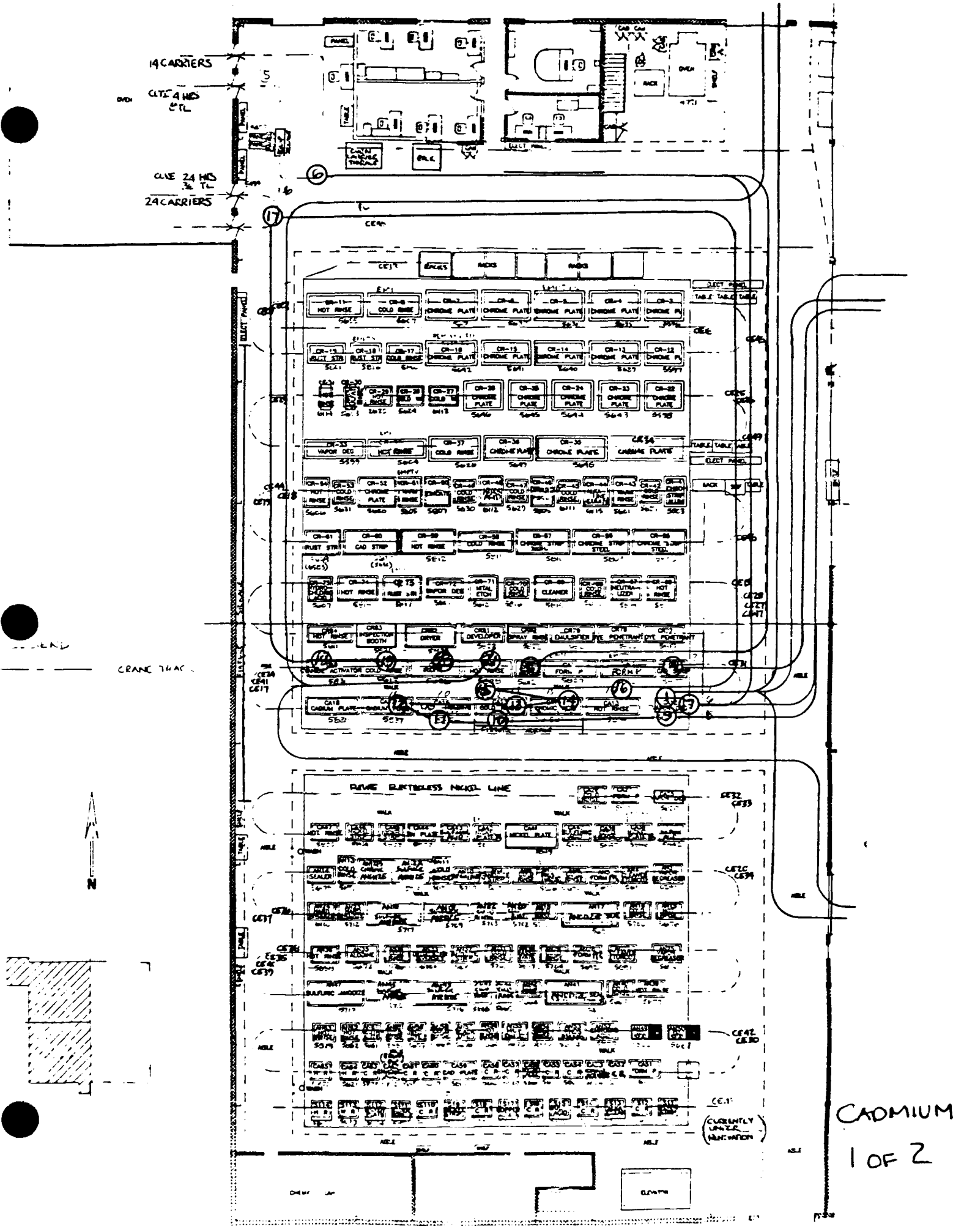


17 (MAX) 4 HRS AFTER PLATING



18 CYANIDE ACTIVATOR  
19 RINSE





14 CARRIERS

CE-4 HD  
CTL

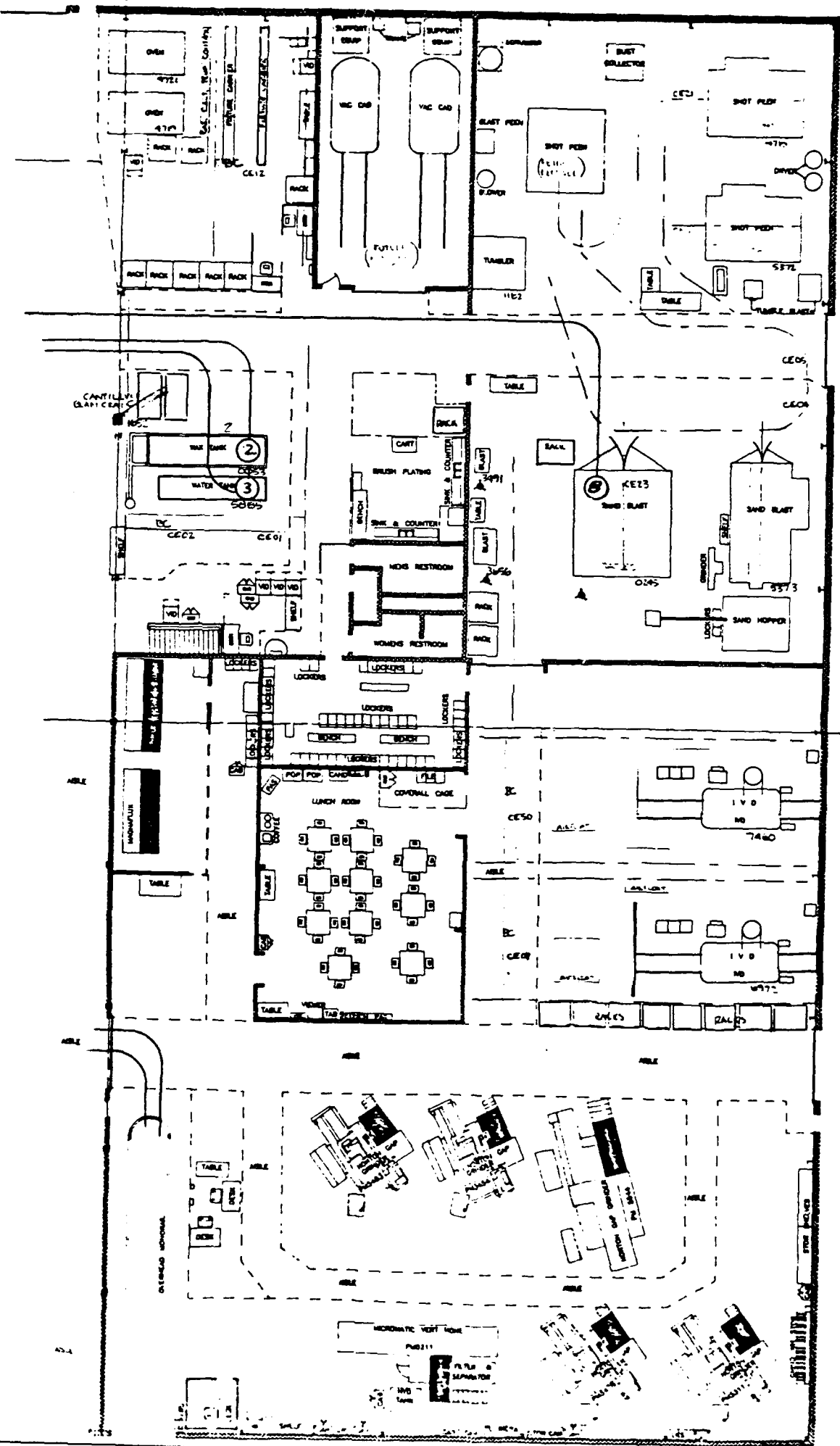
ONE 24 HD  
36 TL  
24 CARRIERS

CRANE TRAC

REVERSE BARTLESS NICKEL LINE

(CURRENTLY UNDER  
REVISION)

CADMIUM  
1 OF 2

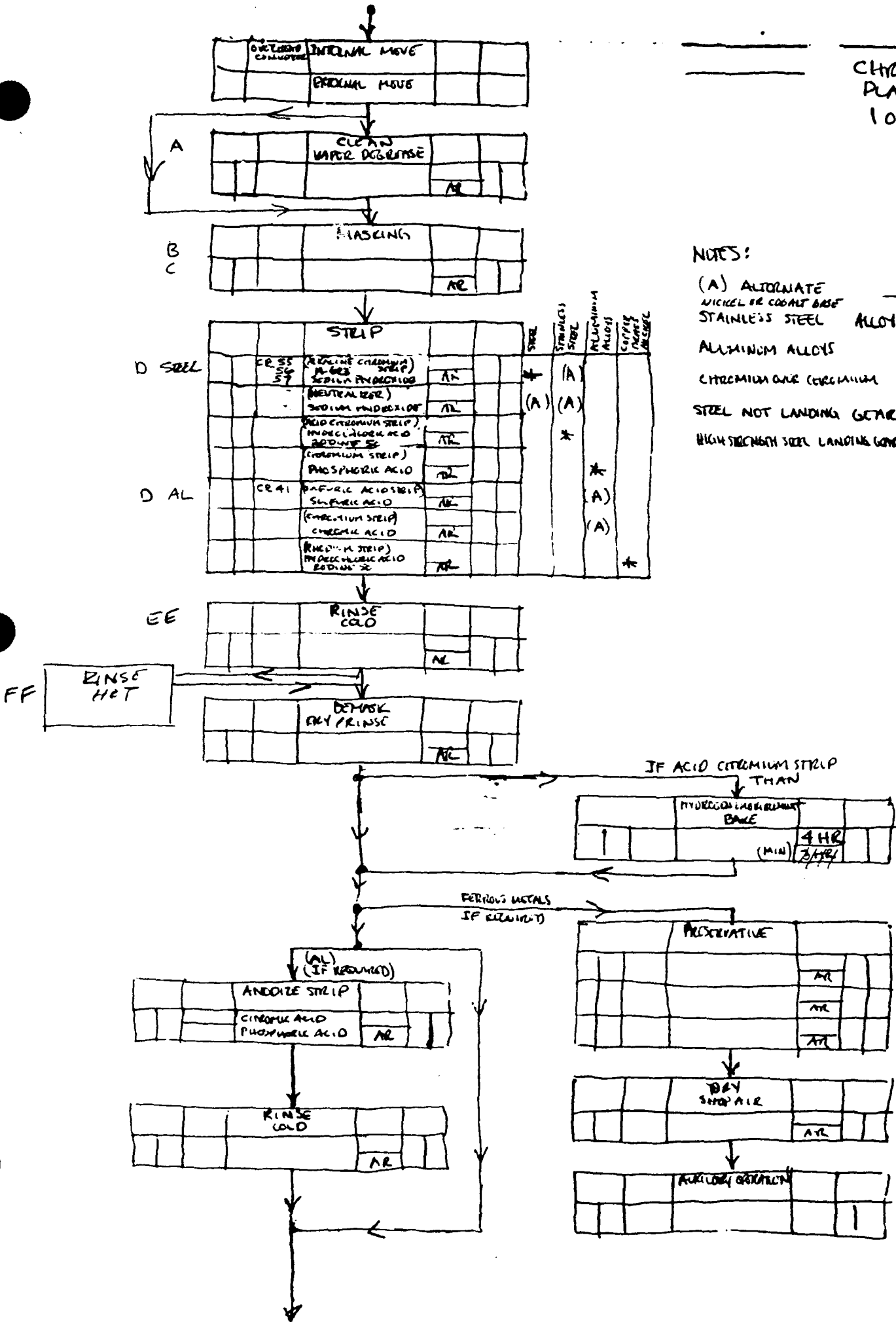


CADMIUM  
2 OF 2

# CHROMIUM PLATING 1 OF 3

## NOTES:

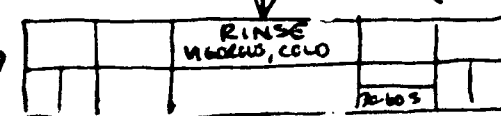
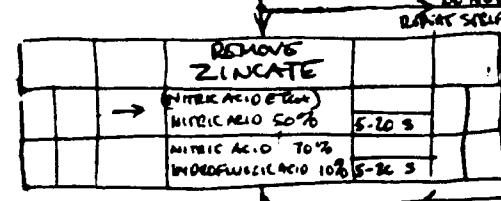
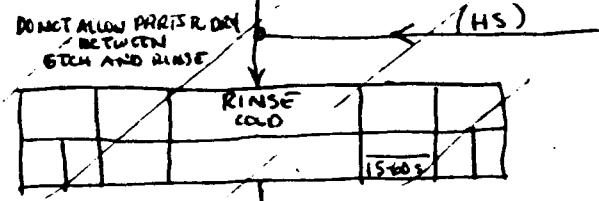
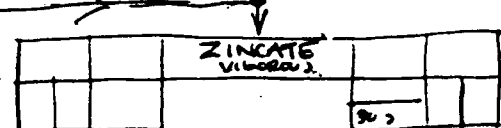
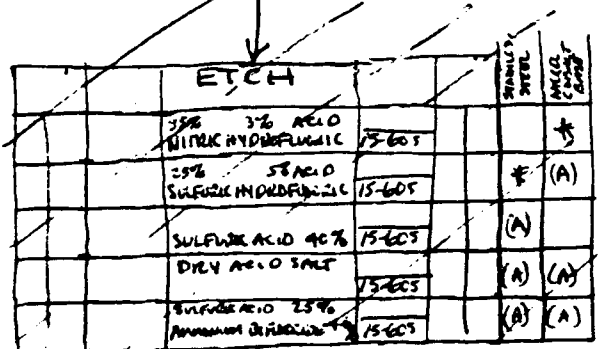
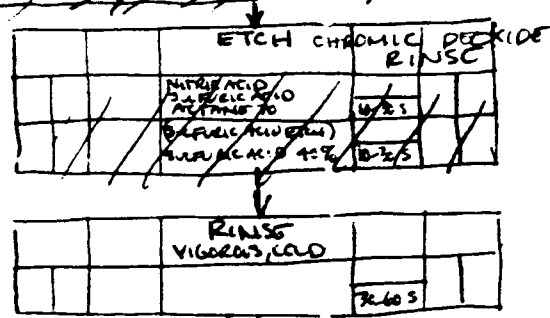
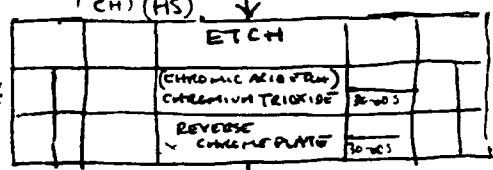
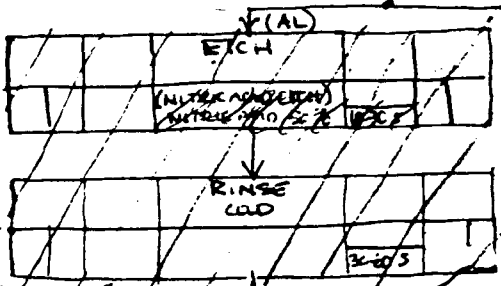
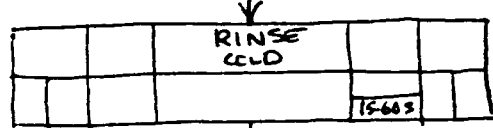
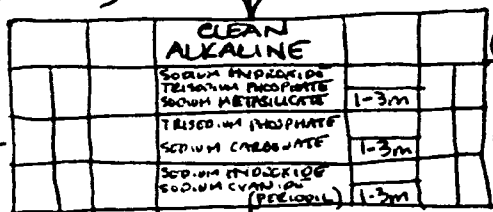
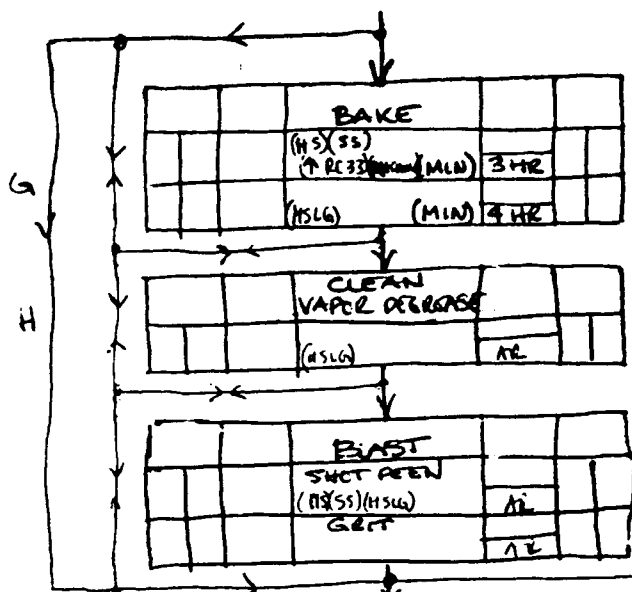
- (A) ALTERNATE NICKEL OR COBALT BASE STAINLESS STEEL ALLOYS (SS)
- ALUMINUM ALLOYS (AL)
- CHROMIUM OR COBALT CHROMIUM (CH)
- STEEL NOT LANDING GEAR (HS)
- HIGH STRENGTH STEEL LANDING GEAR (HSLG)



**CHROMIUM PLATING 2 OF 3**

DONE IN 507

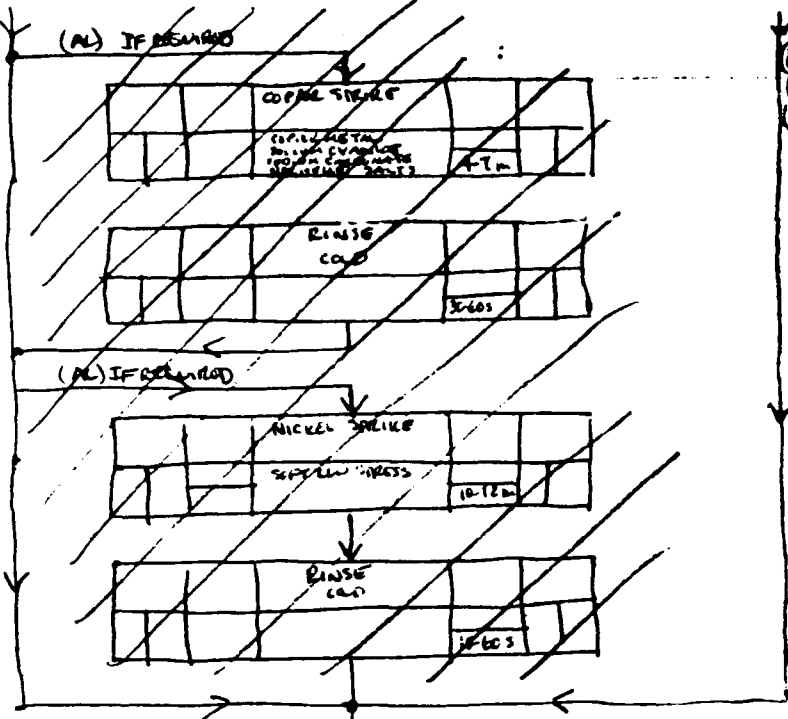
- 1 SHOT
- 2 VAP DEGREASE
- 3,4 MASK
- 5 BLAST
- 6 VAP DEGREASE



G  
H  
I AL  
2  
3  
4  
5  
6  
7

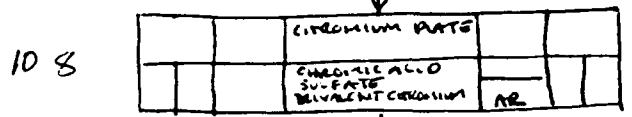
DON'T ALLOW PARTS TO DRY BETWEEN ETCH AND RINSE



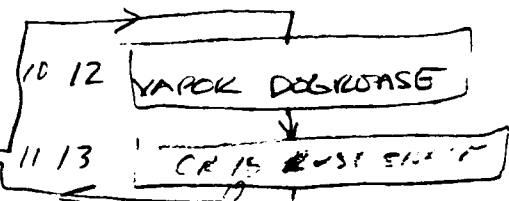
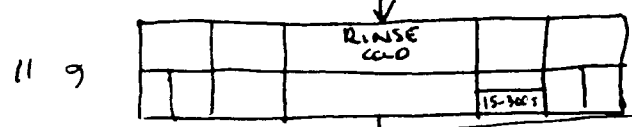


(H5)  
(SS)  
(HSLH)  
(CH)

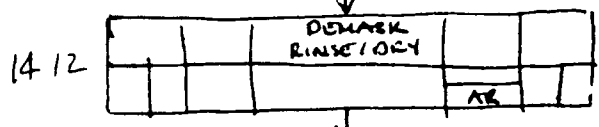
**CHROMIUM  
PLATING  
3 OF 3**



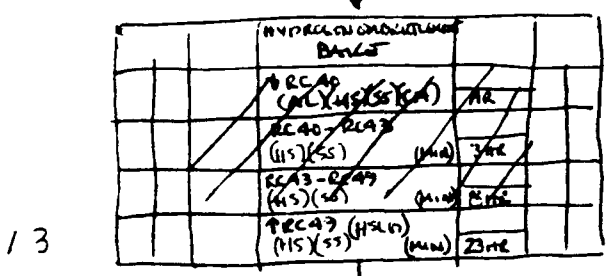
(CH) IMMEDIATE TO H NO. 2200  
TO M RAMP UP TO CASING  
AR AT RAMP



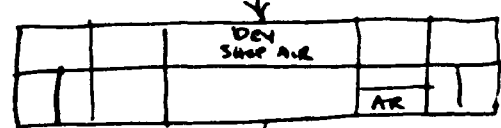
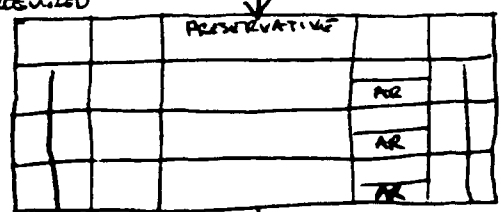
ALKALINE CORROSION REMOVAL  
SOLUTION

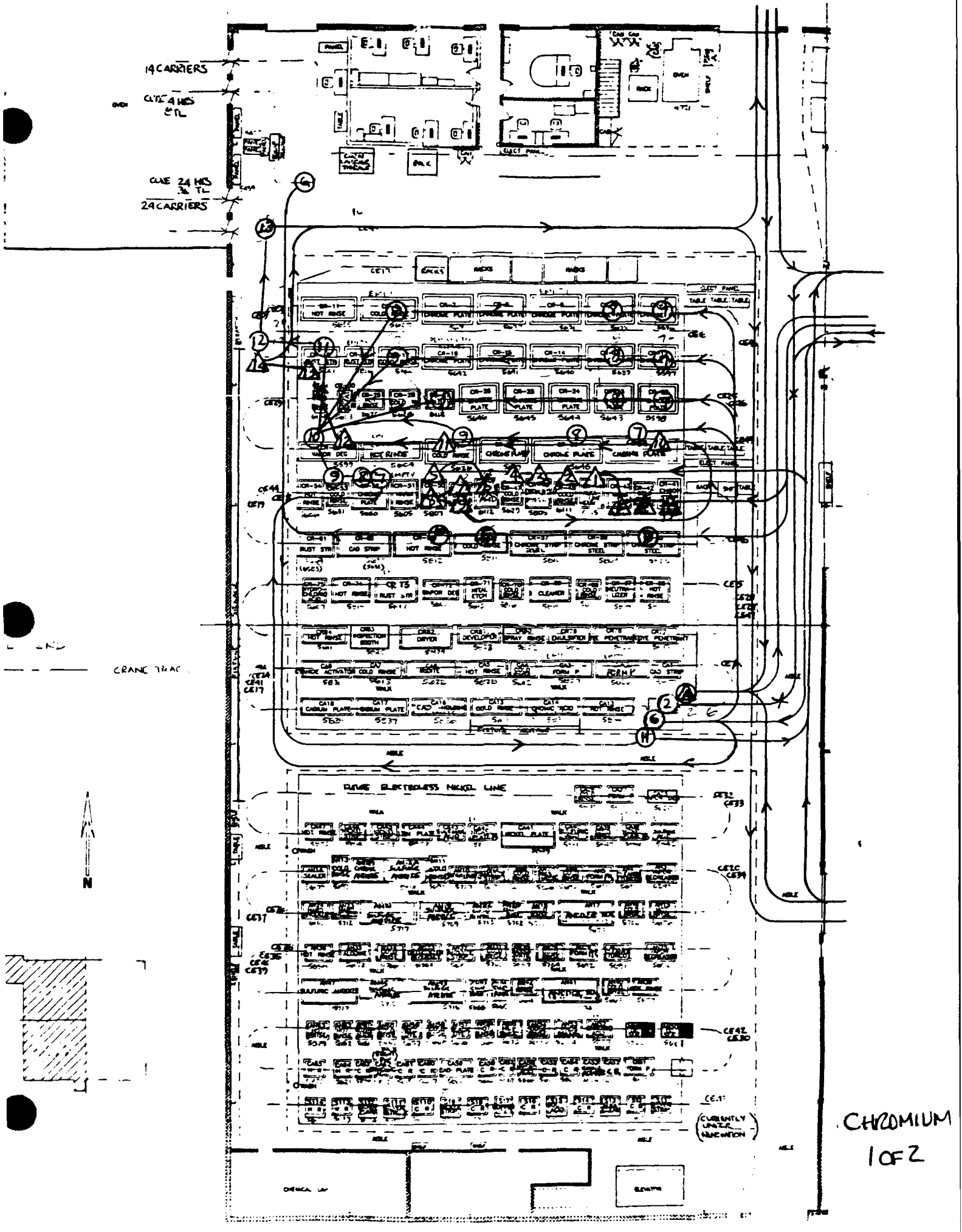


BAKE WITHIN 4 HRS (MAX)  
MULTIPLE PLATES REQ 4HR INTERMEDIATE BAKE



FORGERS METAL  
IF REQUIRED





14 CARRIERS  
C/AE 4 MS  
21L

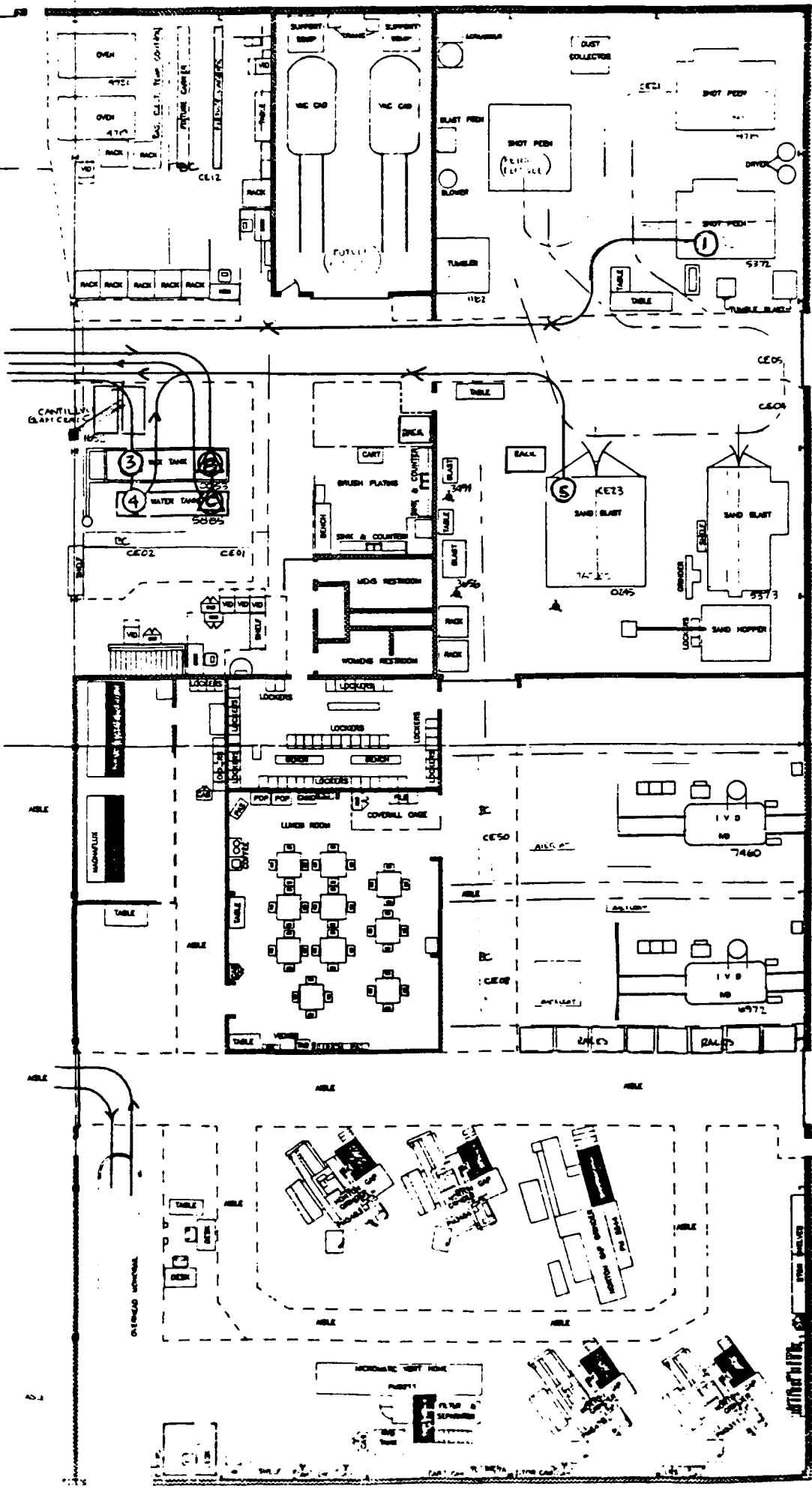
C/AE 24 MS  
24 CARRIERS

CRANE TRAC



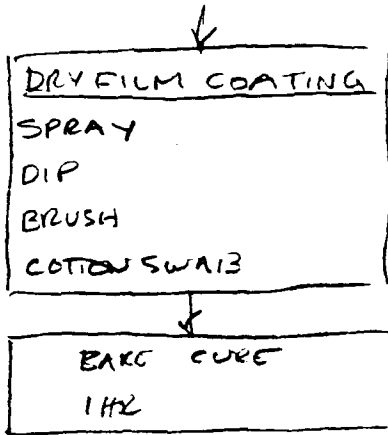
(CURRENTLY UNDER REVISION)

CHROMIUM  
1 OF 2



CHROMIUM  
20F2

DRY FILM  
COATING



IVD.  
(ION VAPOR DEPOSITION)

VAPOR DEGREASE



MASK



BLAST



DEMASK



CLEAN



MASK



IVD

45-65 MINUTE



DEMASK



? CONVERSION COAT ?



KLODINE



RINSE  
WARM

NICKEL

1 OF 2

OPENHAD CORROSION 4 11 B	INTERNAL MOWE	10M
FULLY TUMBLE 9 11 B	EXTERNAL MOWE	30M

CAZS	CLEAN VAPOR DEBENSE	
CE 33	1:1:1 TRICHOLOSTANE	AR

	MASKING	
		AR


	STRIP				
CAZS	(PROTECTIVE STRIP) WITH BLENDING SOLUTION TO PREVENT CORROSION DURING STRIPPING OF SULFURIC ACID	AR			
	(SULFURIC ACID STRIP)	AR			
	(NITRIC ACID STRIP)	AR			
	NITRIC ACID	AR			
	RINSE COLD				
		AR			

REPEAT IF REQUIRED

FEELUS MATL IF REQUIRED

	DEMASK RINSE / DRY	
		AR

	PRESCRIPTIVE	
		AR
		AR
		AR

	DRY SHK A.C.	
		AR

	ANILIN OXIDATION	

(NA)(EA)  
(RINSE DONG)

	STRIP ANODIZE	
	CITRIC ACID PHOSPHORIC ACID	AR

	RINSE COLD	
		AR

	CLEAN ALKALINE	
	SODIUM PHOSPHATE SODIUM HYDROXIDE SODIUM METACRYLATE	1-2m
	TREBOLIN PHOSPHATE SODIUM CYANIDE	1-2m

	RINSE COLD	
		30-65

NICKEL PLATE	
NA	ALUMINUM
NS	STEEL STAINLESS STEEL
NC	EDDALT NICKEL
NHS	HIGH STRENGTH STEEL
ELECTROLESS NICKEL	
EA	ALUMINUM
ES	STEEL
ENS	CORROSION RESISTANT HIGH STRENGTH STEEL NICKOL COALT

	DEMASK RINSE / DRY	
		AR

	STRESS BAKE	
	(ES) (NS) (NC) (ES)	3HR
	(NHS)	4HR

	MASKING	
		AR

	BLAST	
	SHOT PEARL (NHS)	AR

ENS	NHS	NC			
*	*	*			
A	A	A	CAZT		
	A	A			
A (1)	A (2)	A (3)			

FORMULA P  
7

	CLEAN ALKALINE	
	TREBOLIN PHOSPHATE SODIUM HYDROXIDE SODIUM METACRYLATE	1-3(-)
	TREBOLIN PHOSPHATE SODIUM HYDROXIDE	1-3(-)
	SODIUM PHOSPHATE SODIUM HYDROXIDE TREBOLIN PHOSPHATE	65 (-)
	SODIUM PHOSPHATE SODIUM CYANIDE	65

ETCH VIGOROUS	
NITRIC ACID 67%	
NITRIC ACID 50% 10-20s	

RINSE VIGOROUS, COLD	
30-60s	

ETCH VIGOROUS	
NITRIC ACID	
SULFURIC ACID	
ACETIC ACID 7%	
10-30s	
(SULFURIC ACID 10%)	
SULFURIC ACID 40% 10-20s	

RINSE VIGOROUS, COLD	
30-60s	

ZINCATE VIGOROUS	
30s	

STRIP ZINCATE VIGOROUS	
NITRIC ACID 67%	
NITRIC ACID 50%	
5-10s	
NITRIC ACID 70%	
HYDROFLUORIC ACID 8%	
5-20s	

RINSE VIGOROUS, COLD	
30-60s	

NICKEL - NICKEL  
CA 37 SULFURIC ACID

NICKEL	
20F2	
RINSE COLD	
15-60s	

ETCH	
Sulfuric Acid 25%	
HYDROFLUORIC ACID 5%	
50%	
HYDROCHLORIC ACID .5-2m	
15%	
HYDROCHLORIC ACID .5-2m	
DRY S ACID SALTS (-) .5-2m	
CA 40 SULFURIC ACID 40% .5-2m	
SULFURIC ACID 40% (-)	

RINSE COLD	
15-60s	

HS (HS W)  
IF LEAKS OCCUR  
A HR REBARE  
STRIP OVER

<del>COPPER STRIKE</del>	
<del>OPF. NA (BA) 4-7m</del>	
<del>RINSE COLD</del>	
<del>30-60s</del>	

<del>NICKEL STRIKE</del>	
<del>(NICKEL)</del>	
<del>OPF/BA NICKEL CLEANING STRIKE 4-7m</del>	
<del>RINSE COLD</del>	
<del>15-60s</del>	

NICKEL PLATE	
(SOFT LOW STRESS)	
CA 41	AR
HARD COMPRESSIVE STRESS	
AL	A
(WATTS) BRIGHT	
AR	A
ELECTROLESS NICKEL	
AR	*

RINSE COLD	
AR	

DEMASK RINSE/DRY	
AR	

HYDROCHLORIC ACID BAKE	
(+ RE 40, NC, NS) (ES)	
1-1.5M	
(+ RE 40, NC, NS) (NA)	
3M	
NHS	
23M	

PRESERVATIVE	
AR	
AR	
AR	
RINSE COLD	
AR	

REPORT ONCE

11

11

12

13

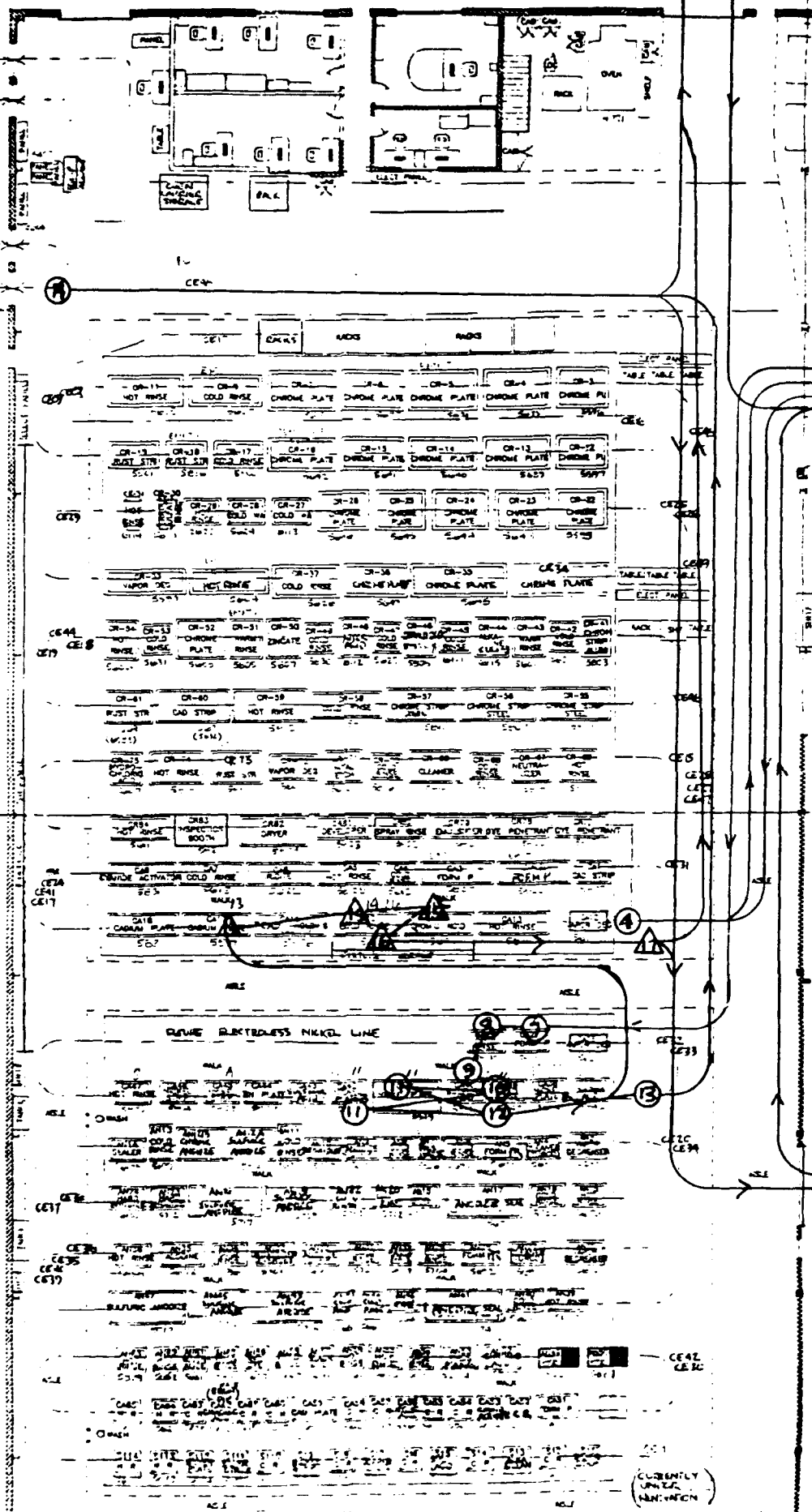
14

9

10

8

14 CARRIERS  
 CWC 3 HD  
 2 TL  
 CWC 24 HD  
 3 TL  
 24 CARRIERS

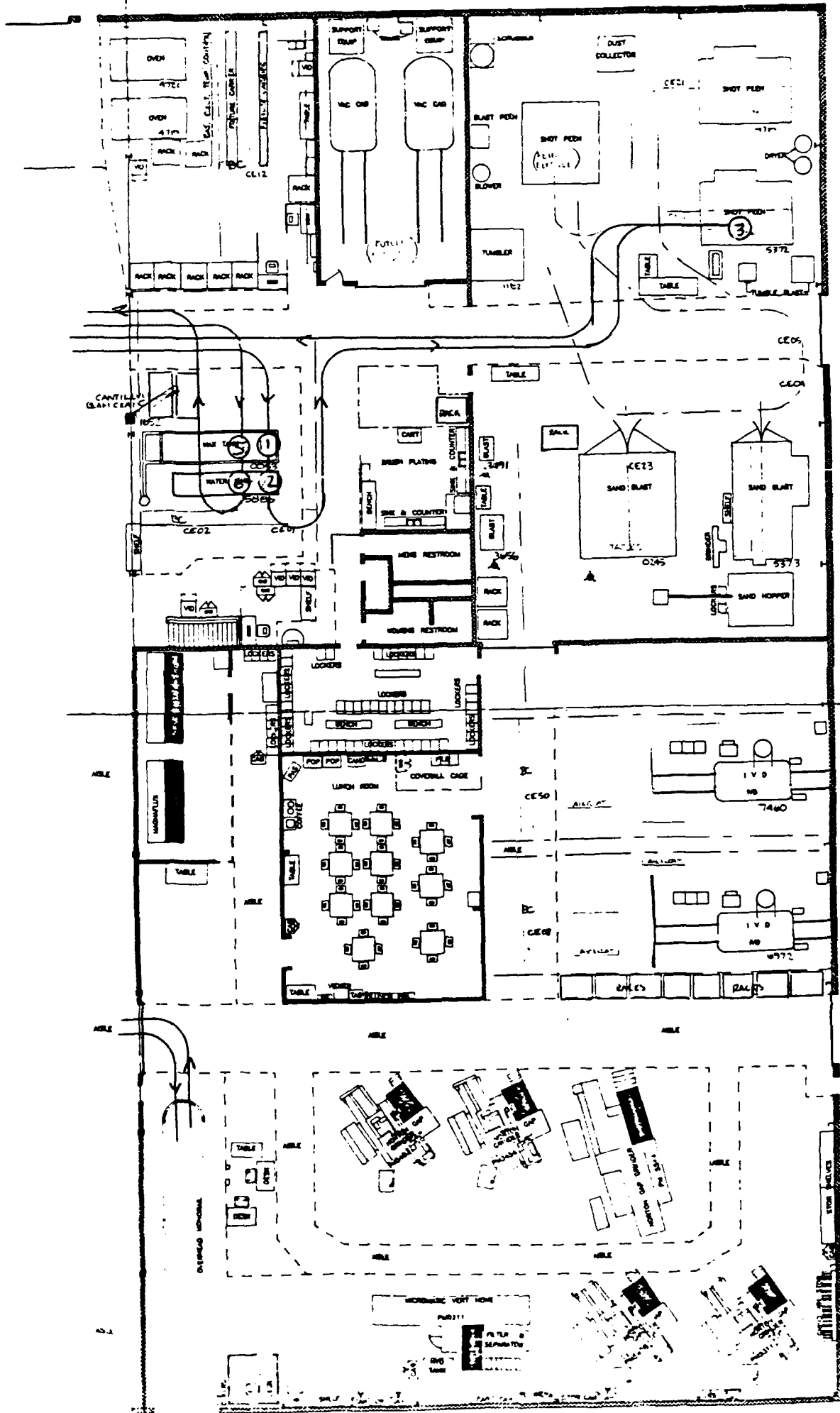


CLEANING  
 NICKEL  
 NICKEL-CADMIUM



NICKEL  
 1 of 2





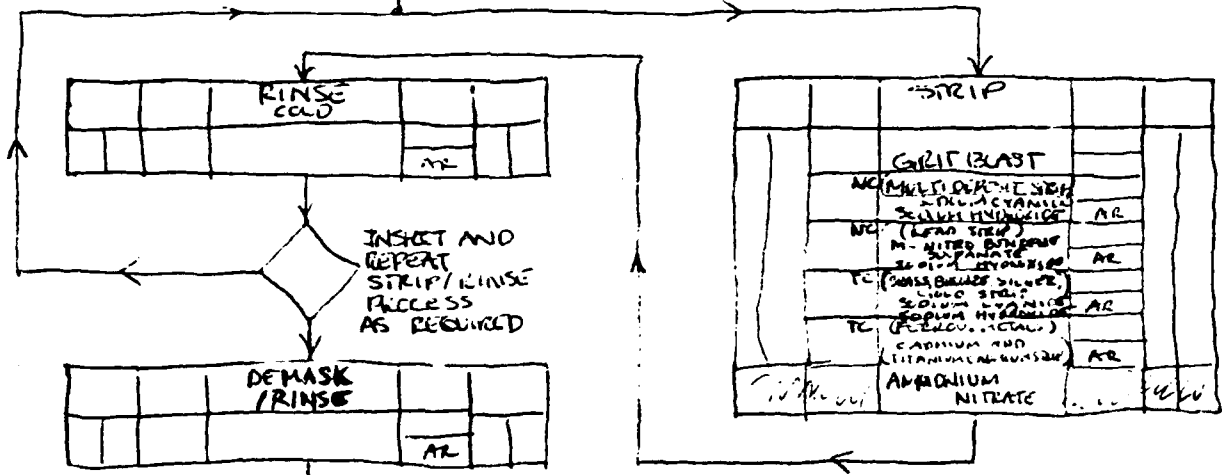
NICKEL  
2 OF 2

EXTERNAL MOVE HUB	INTERNAL MOVE	10M	
EXTERNAL MOVE HUB	INTERNAL MOVE	36M	

NICKEL CADMIUM (NC)  
TITANIUM CADMIUM (TC)  
1 OF 3  
(STRIP)

FRESH FACE DEGRASS			AR
-----------------------	--	--	----

MASKING			AR
---------	--	--	----



RINSE COLD			AR
---------------	--	--	----

INSERT AND  
REPEAT  
STRIP/RINSE  
PROCESS  
AS REQUIRED

DEMASK /RINSE			AR
------------------	--	--	----

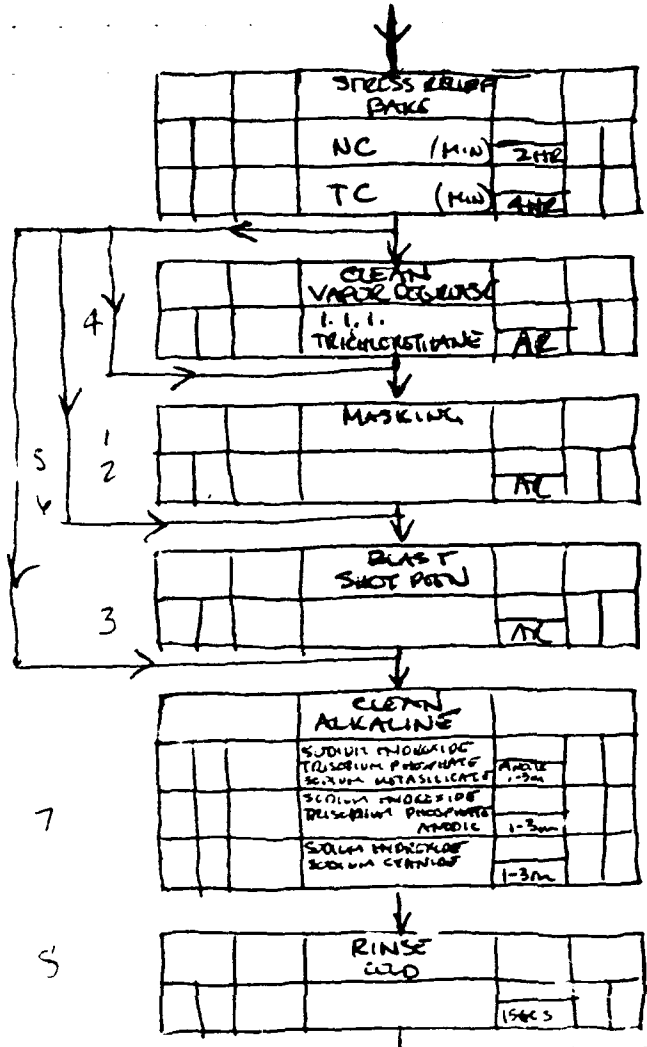
PRESERVE  
PERICULOUS METALS  
WITH CORROSION  
PROTECTION COMPOUND  
IF NECESSARY

DRY STOP AIR			AR
-----------------	--	--	----

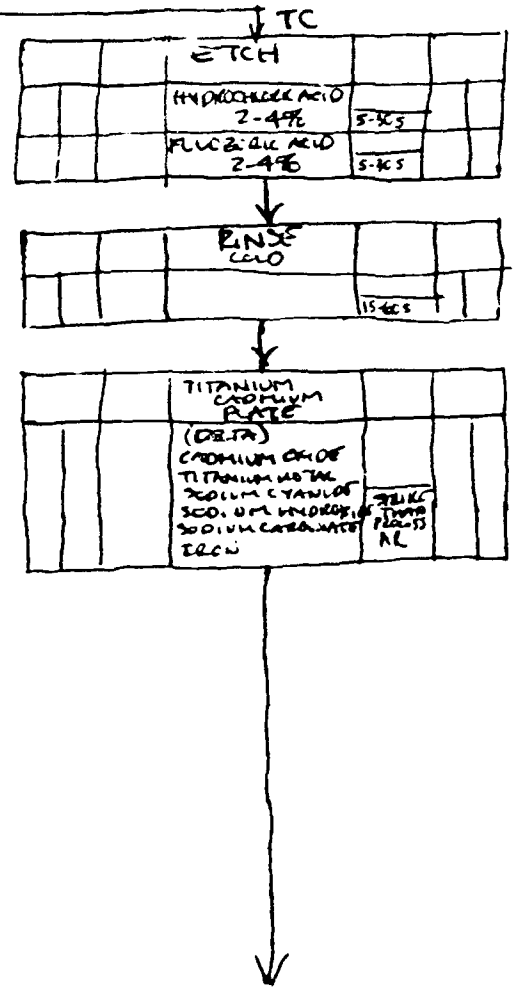
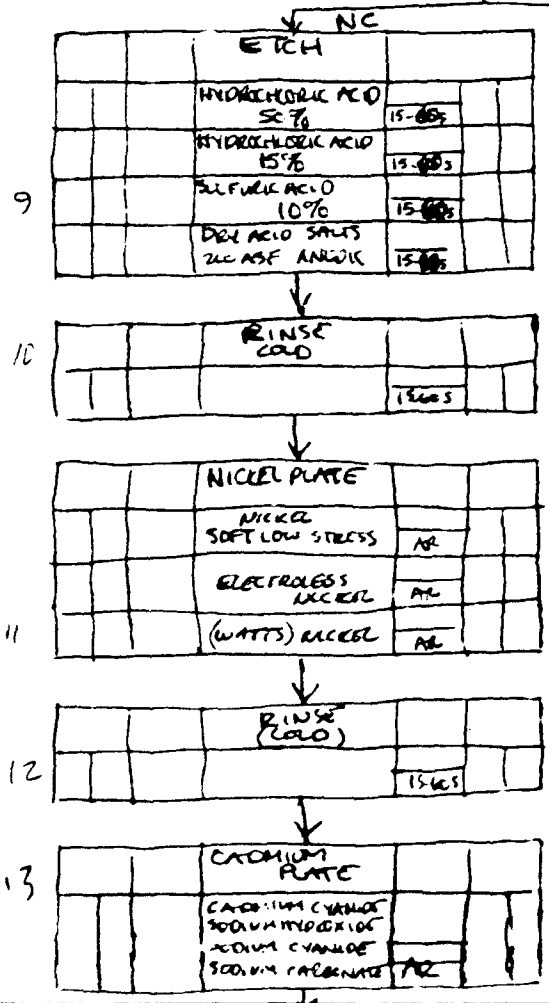
PRESERVATIVE			NR
			NR
			NR

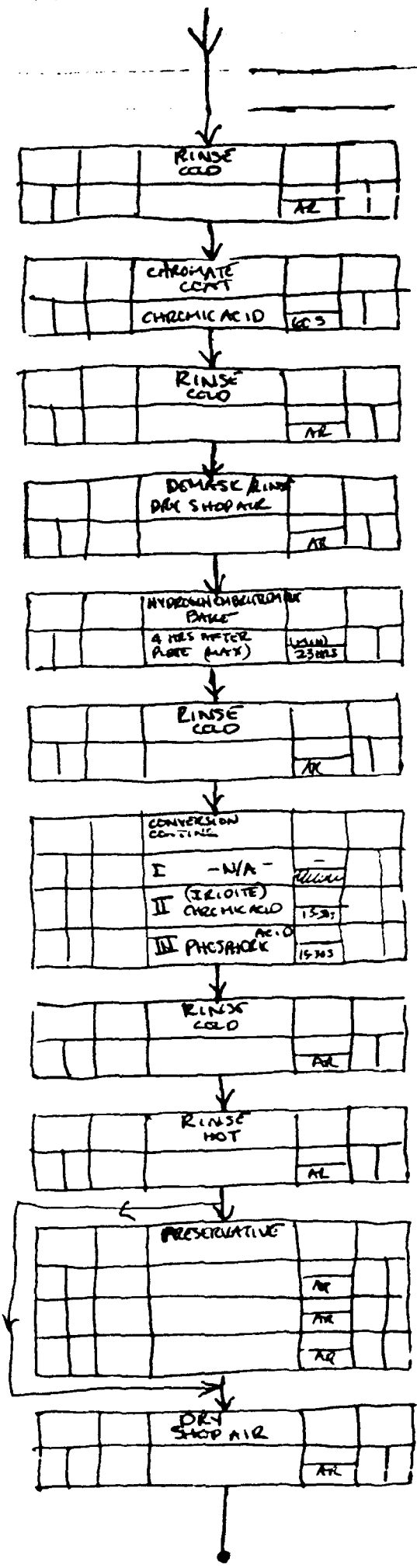
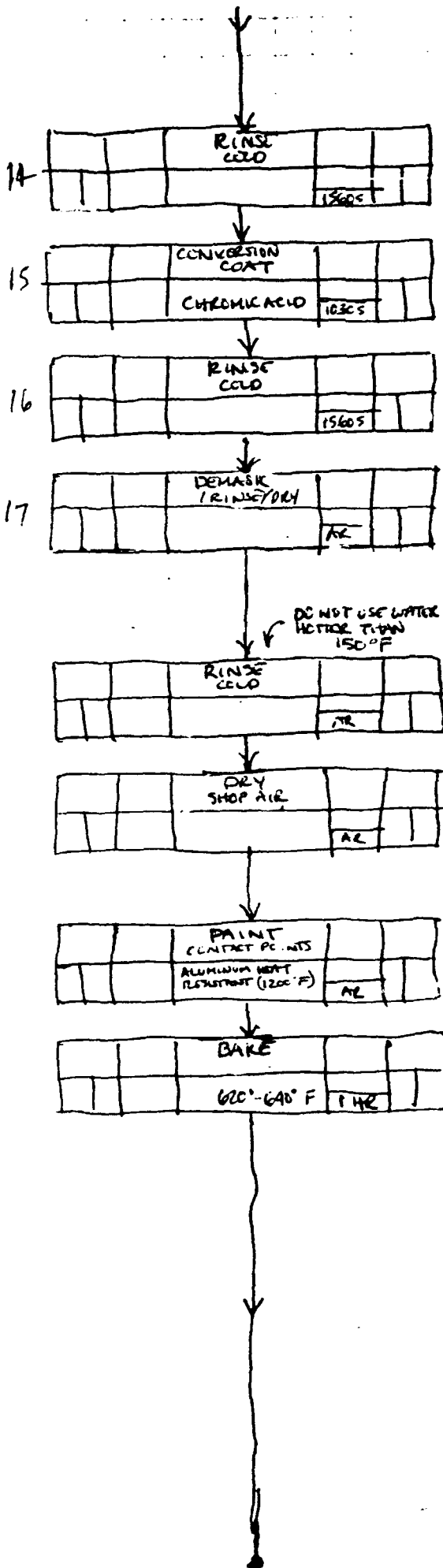
DRY STOP AIR			AR
-----------------	--	--	----

AUXILIARY CREATIN			
-------------------	--	--	--



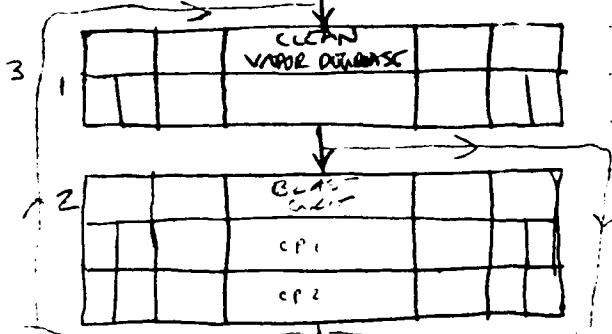
TO HOLD BEFORE PLATING  
 IMMERSE IN CYANIDE HOLDING TANK  
 4 HRS (MAX)





INTERNAL MOVE	10m
EXTERNAL MOVE	30m

PASSIVATION  
1 OF 1



VAP  
P.A.T  
VAP

AN 211 1/2

4

CLEAN ALKALINE	
AV20	AV20 4755
	MIL C 14400
	SODIUM HYDROXIDE
	TRISODIUM PHOSPHATE

5

RINSE COLD	
	NR

6

PASSIVATE	
AV3	I NITRIC ACID
	SODIUM DICHROMATE
	30M
AV7	II "
	20M
AV10	III "
	10M
-	IV "
	30M
-	V "
	2M
-	VI NITRIC ACID
	20%
	30M

7

RINSE HOT	
	NR

(FERRITIC, MARTENSITIC ONLY)  
WITH 10% OF PASSIVATION

A

CHROMATE DIP	
AV17	91 SODIUM DICHROMATE
	30M

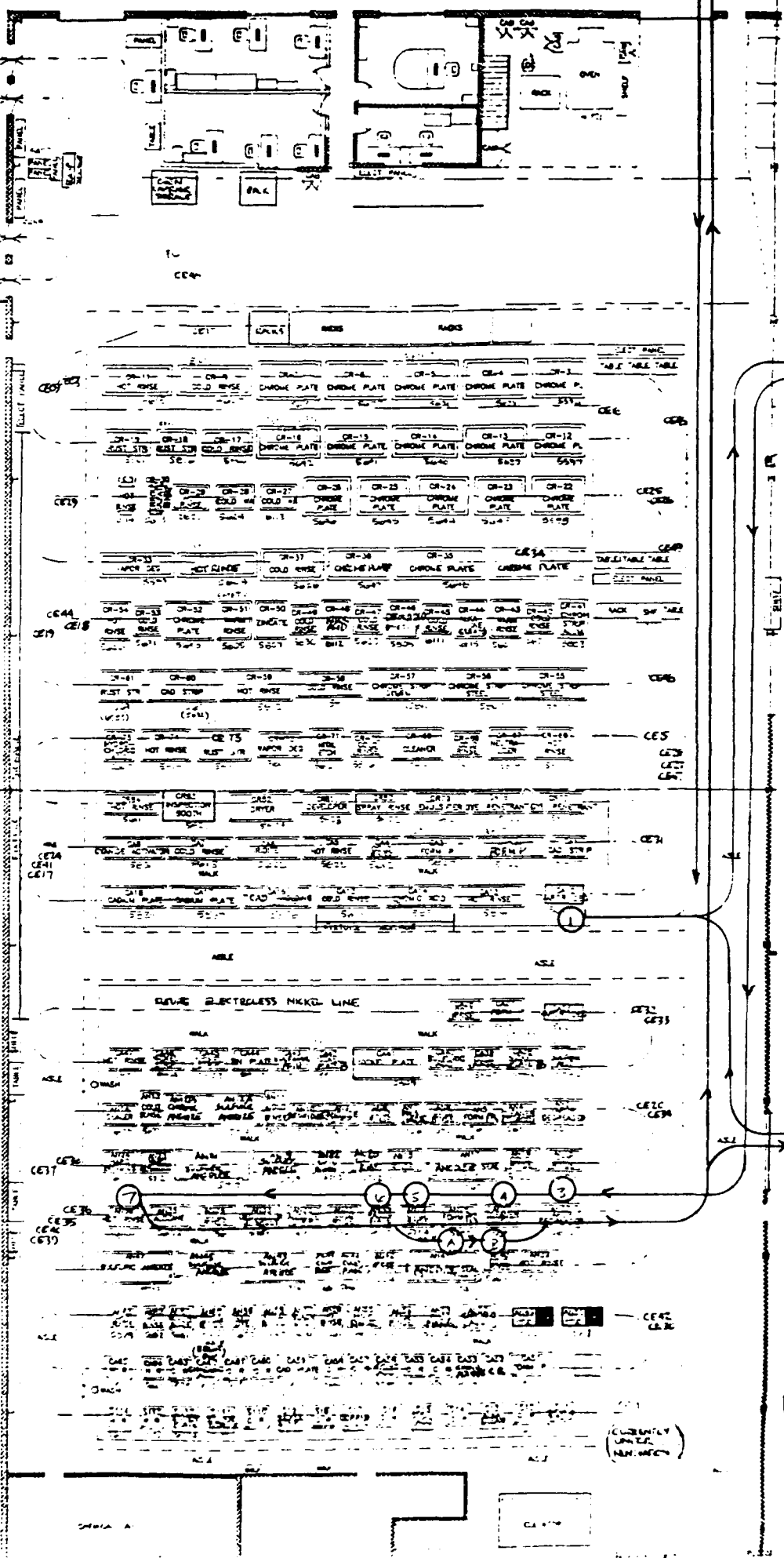
AV17, 91

B

RINSE COLD	
	NR

DRY SHOP AIR	
	NR

14 CARRIERS  
CITE 4 HD  
CITL  
ONE 24 HD  
24 CARRIERS

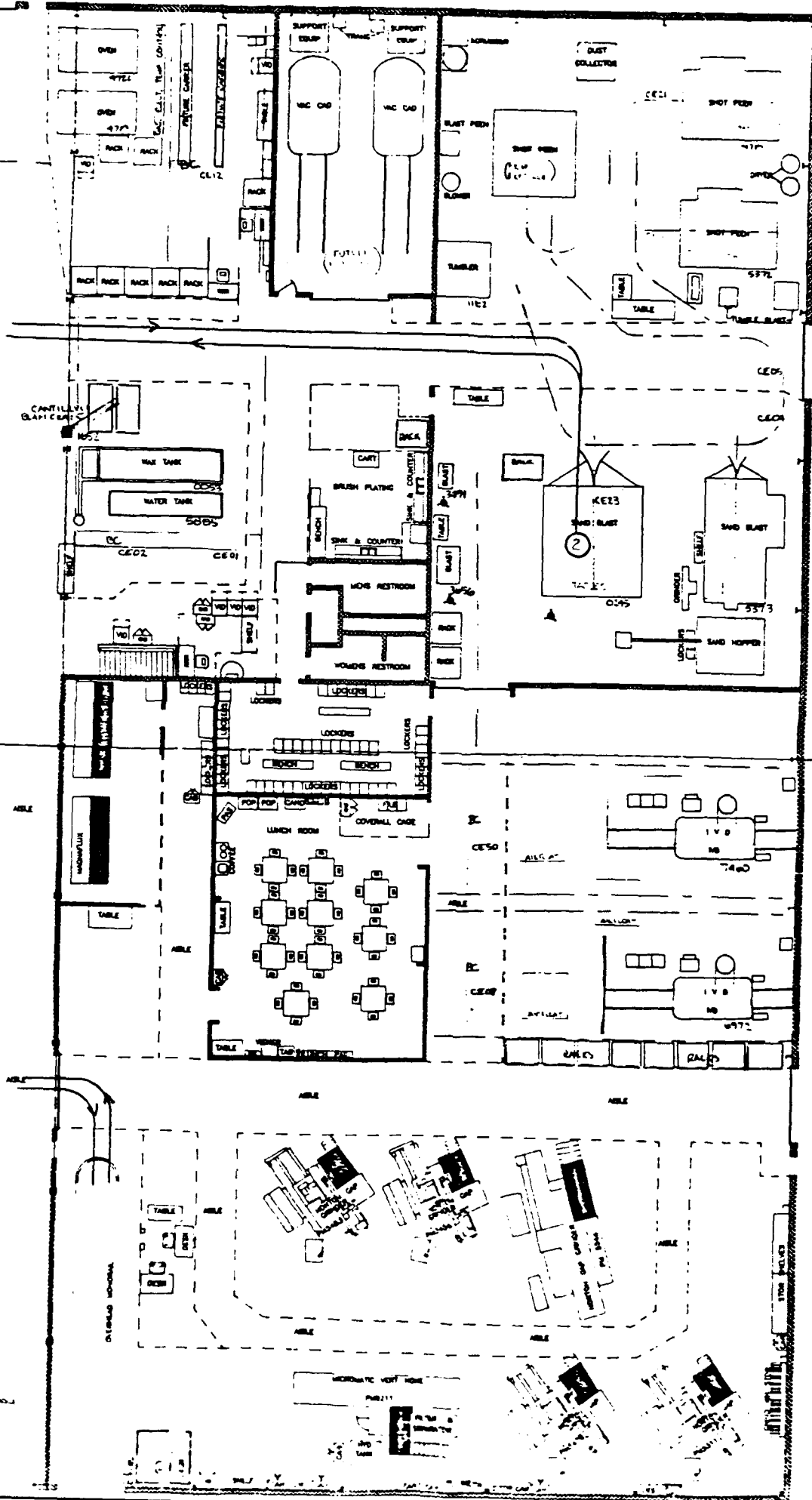


PASSIVATION  
10F2

(CURRENTLY UNDER MAINTENANCE)

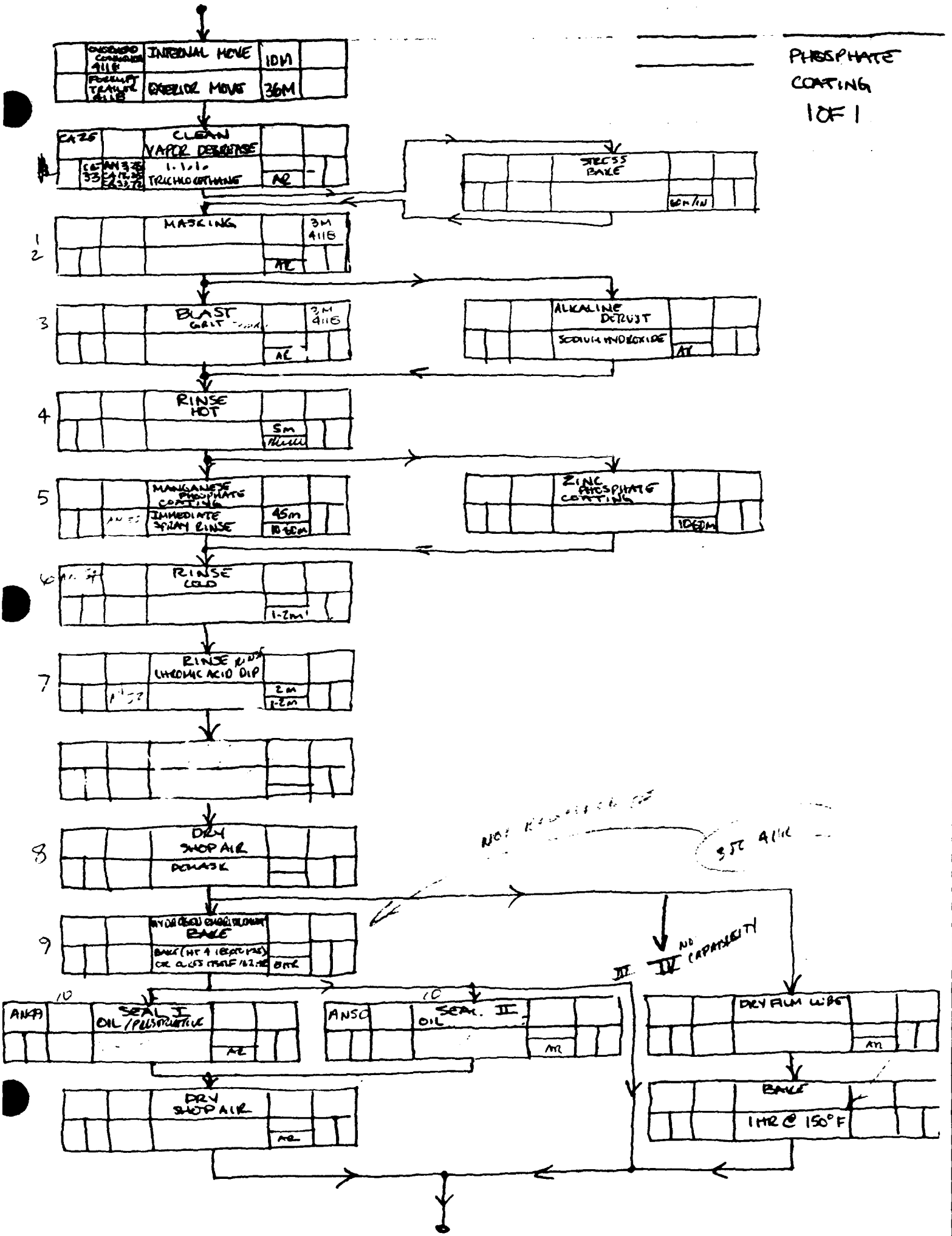
CHINA A

CA 879



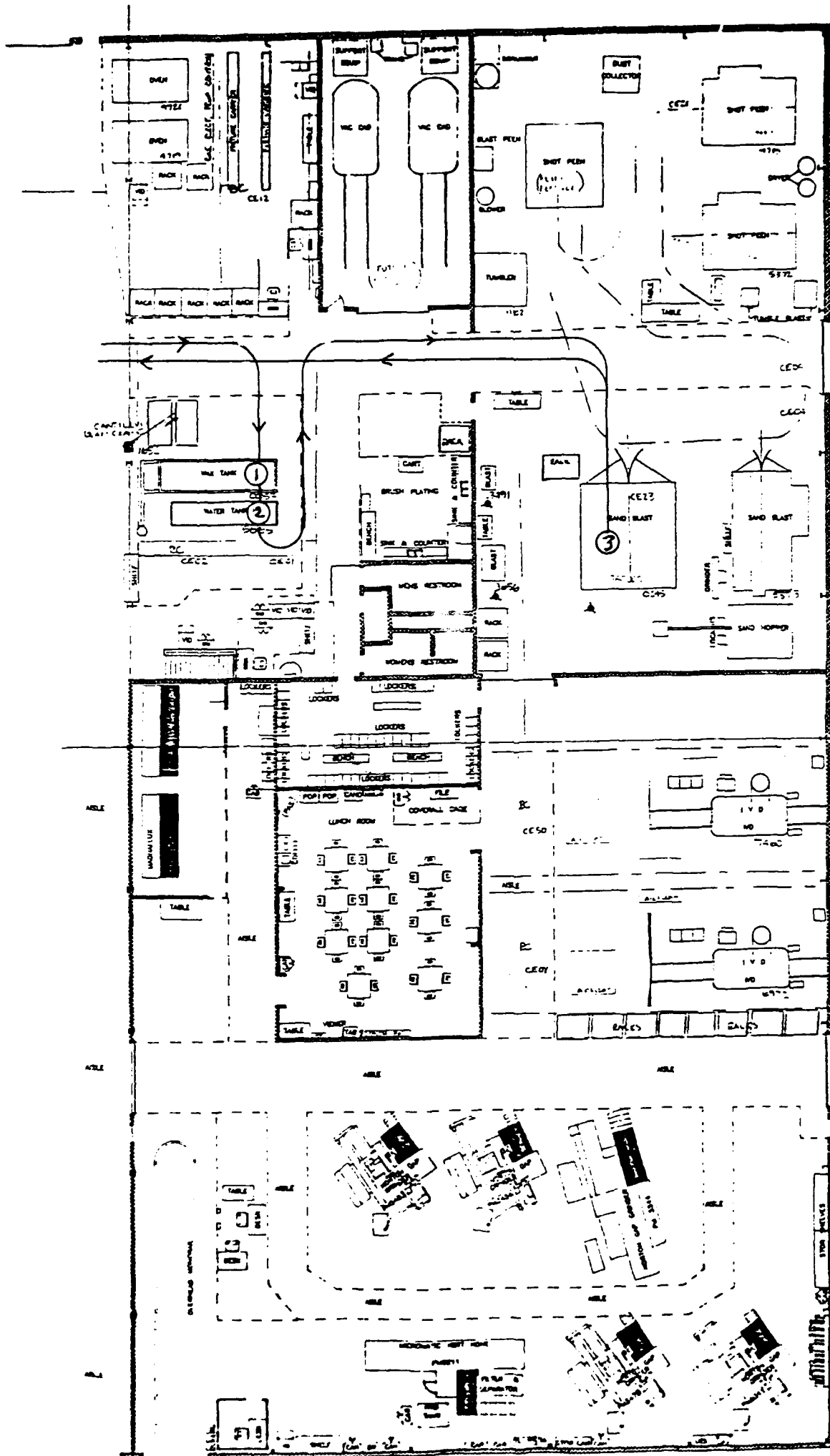
PASSIVATION  
20F2

PHOSPHATE  
COATING  
10F1









EXTERNAL MOVES	INTERNAL MOVES	10M
EXTERNAL MOVES	INTERNAL MOVES	30M

CLEAN		
VAPOR DEGREASER		
1-1-1		NR
TRICHLOROETHANE		

MASKING		
		NR

1  
2  
A

STEEL	ALUMINUM	COPPER	SI 1	STRIP	
*			SI 1	SODIUM CYANIDE	NR
A <sub>0</sub>				SODIUM HYDROXIDE	NR
A <sub>1</sub>				(MULTI-PHASE STRIP)	NR
				ALUMINUM OXIDE	NR
				ALUMINUM HYDROXIDE	NR
				SILICATE STRIP	NR
				SILICATE STRIP	NR
				PHOSPHORIC ACID	NR
				SULFURIC ACID	NR
				NITRIC ACID	NR

RINSE COLD		
		NR

B

REPEAT IF REQUIRED

REWORK METAL IF REQUIRED

ALUMINUM		
STRIP ANODIZE		
CHROMIC ACID		NR
PHOSPHORIC ACID		NR

RINSE COLD		
		NR

CLEAN ALKALINE		
DISODIUM PHOSPHATE		
SODIUM HYDROXIDE	1-2m	
SODIUM METASILICATE		
DISODIUM PHOSPHATE		
SODIUM CARBONATE	1-2m	

SI 3  
1-3m

RINSE VIGOROUS, COLD		
		15-60S

ETCH VIGOROUS, COLD		
SI 5	NITRIC ACID 50%	20-60S
		10-30M

RINSE VIGOROUS, COLD		
		15-60S

SILVER

1 OF 2

DEMASK		
RINSE / DRY		
		NR

PRESERVATIVE		
		NR
		NR
		NR

DRY SHOP AIR		
		NR

DEMASK		
RINSE / DRY		
		NR

STRESS BAKE		
		3HR

MASKING		
		NR

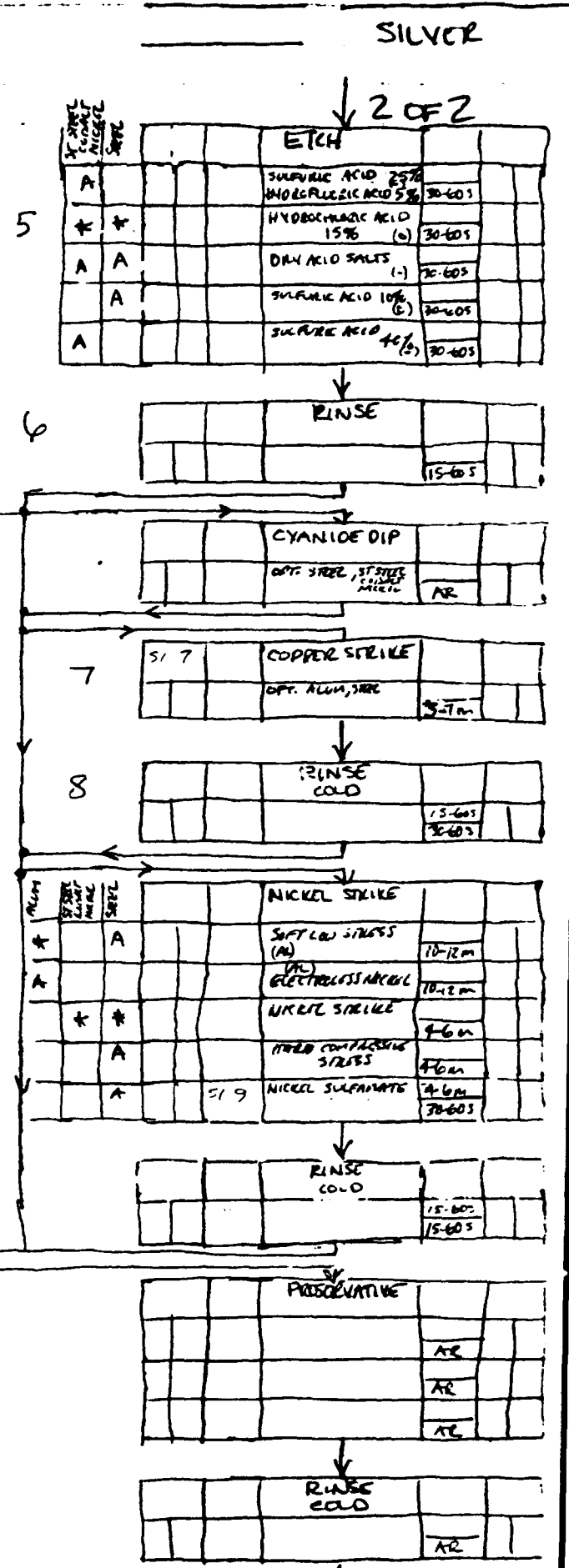
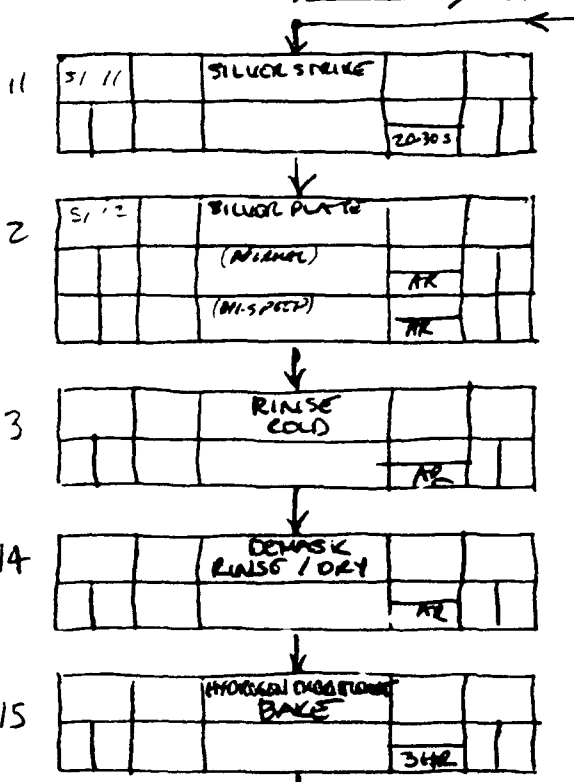
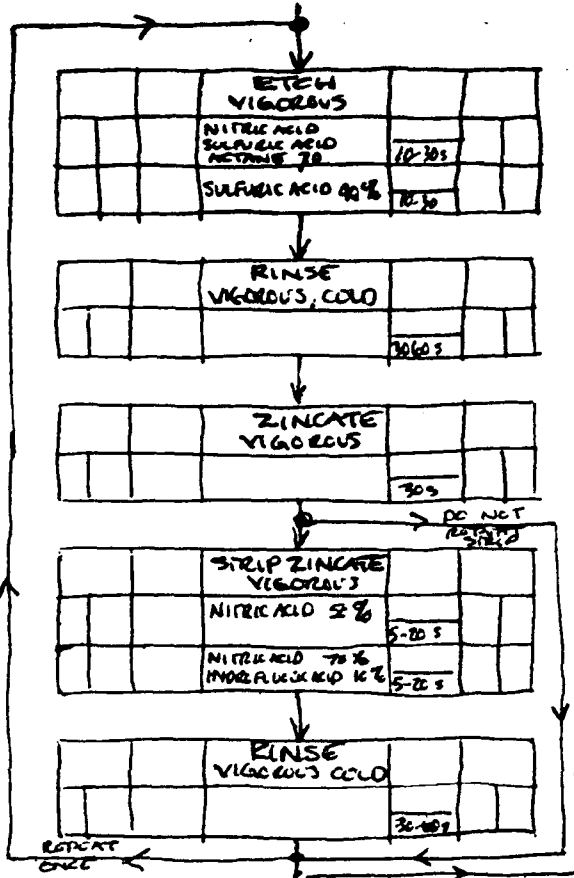

CLEAN ALKALINE		
TRISODIUM PHOSPHATE		
SODIUM HYDROXIDE	1-3m	
SODIUM METASILICATE		
SODIUM HYDROXIDE	1-5m	
DISODIUM PHOSPHATE		
SODIUM HYDROXIDE (P)	1-3m	
SODIUM CYANIDE		

RINSE COLD		
		15-60S

3

4

STEEL  
STAINLESS STEEL  
COPPER  
NICKEL

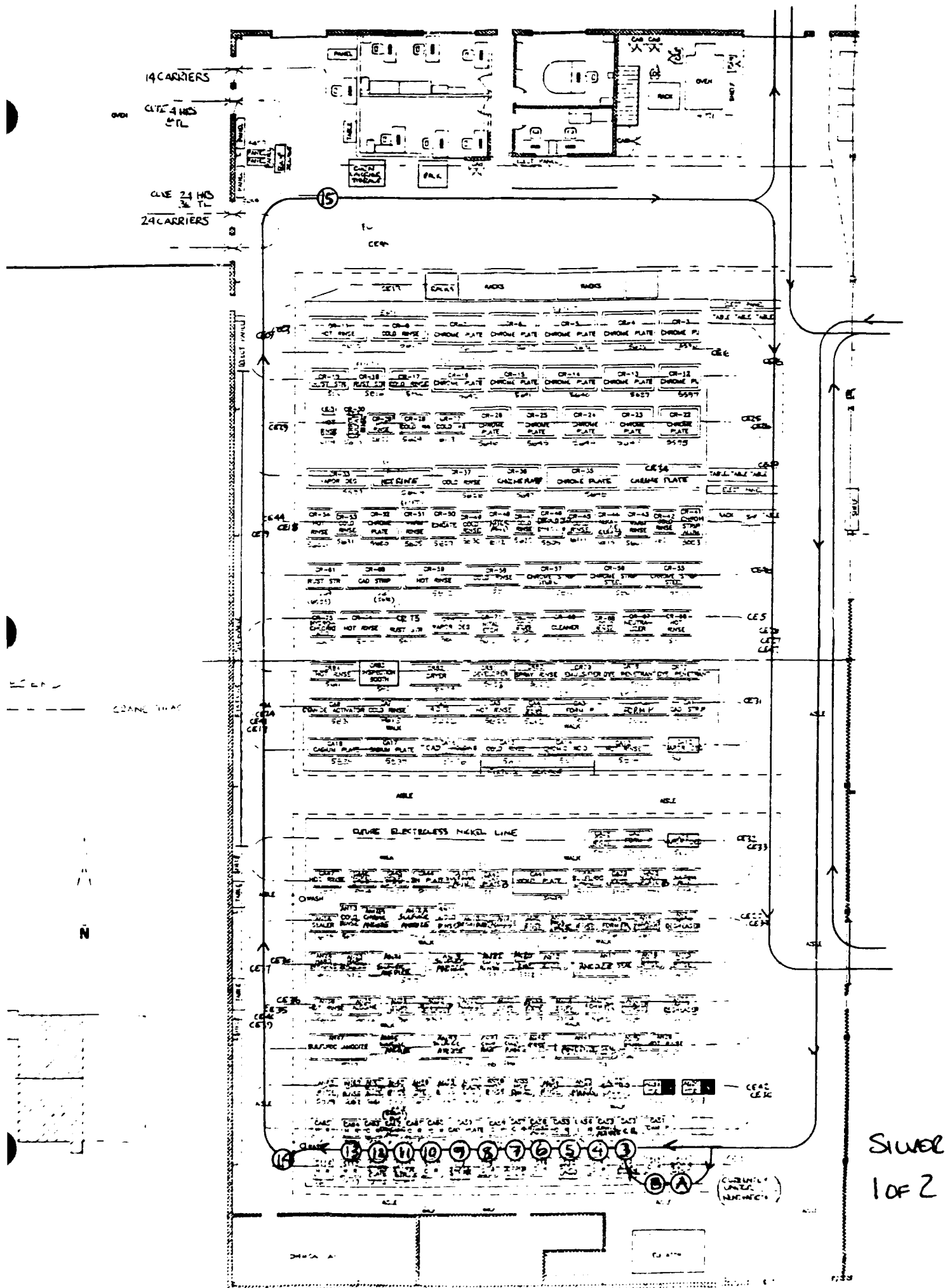


11  
12  
13  
14  
15

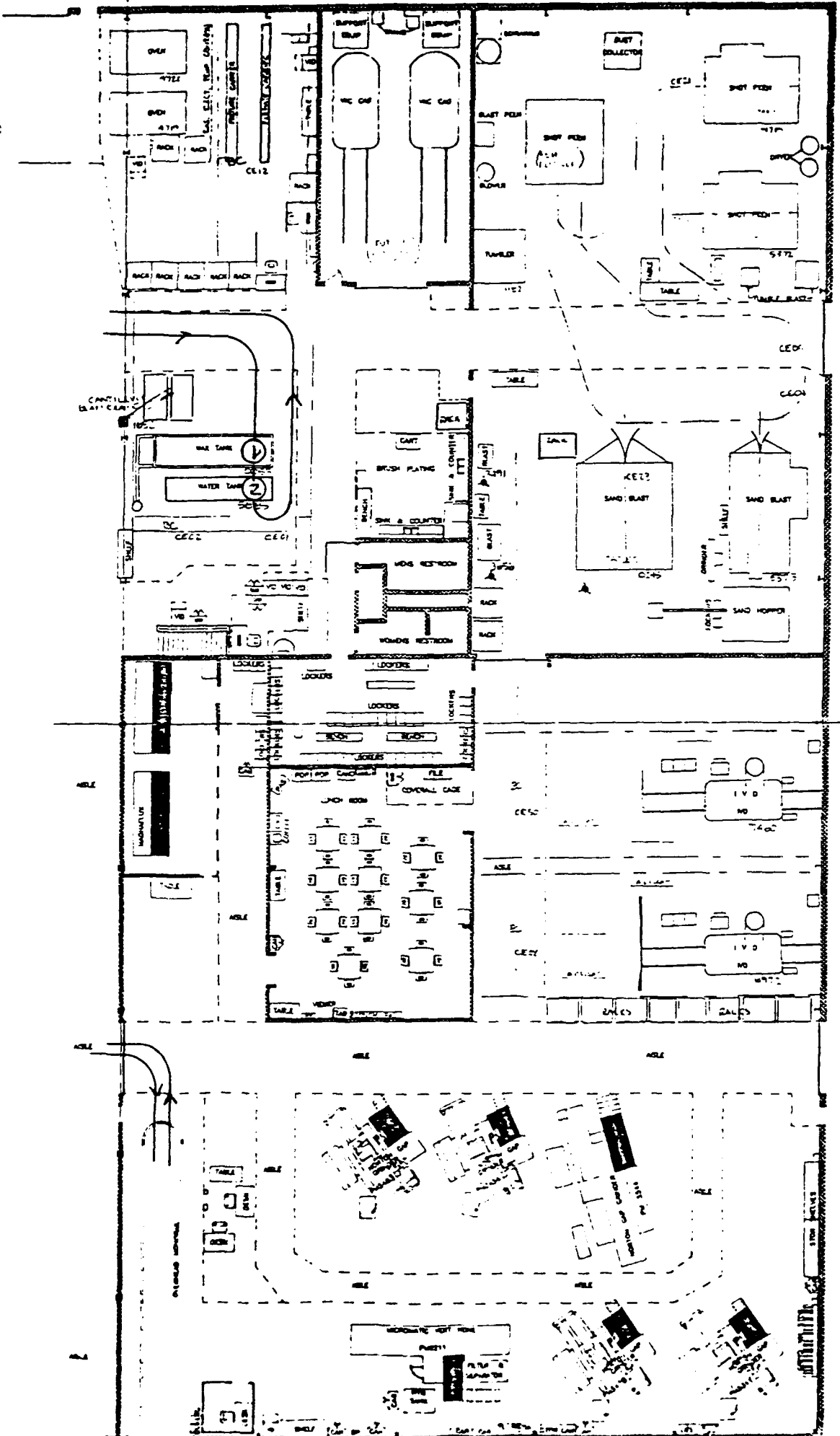
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6  
7  
8  
9  
10

DO NOT REVERSE STRIKE

REPEAT CYCLE



Sheet  
1 of 2



SILVER  
20FZ

INTERNAL MINE	10M
EXTERNAL MINE	36M

CLEAN VAPOR DE-ROUSE	1.1.1.1	TRICHLOROETHYLENE	AR
----------------------	---------	-------------------	----

MASKING	AR
---------	----

STRIP	(TIN STRIP) (-)	SCUMM HYDROXIDE	AR
	(MILK BURN-OUT STRIP)	HYDROCHLORIC ACID	AR
	(SODIUM HYDROXIDE)	TRICHLOROETHYLENE	AR
	(SODIUM HYDROXIDE)	TRICHLOROETHYLENE	AR
	(NITRIC ACID STRIP)	NITRIC ACID	AR

RINSE COLD	AR
------------	----

ALUM  
COPPER  
STEEL

REPEAT IF ABOVE  
IF ABOVE

TIN

1 OF 2

DEMASK RINSE / DRY	AR
--------------------	----

PRESERVATIVE	AR
--------------	----

DRY SWEEP AIR	AR
---------------	----

STEEL

DEMASK RINSE / DRY	AR
--------------------	----

STRESS BAKE	30-60
-------------	-------

MASKING	AR
---------	----

CLEAN ALKALINE	TRISODIUM PHOSPHATE	1-3m
	SODIUM HYDROXIDE	1-3m
	SODIUM METASILICATE	1-3m
	SODIUM HYDROXIDE	1-3m
	SODIUM HYDROXIDE	1-3m
	TRISODIUM PHOSPHATE	1-3m

RINSE COLD	15-65
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STRIP ANALYZE	CITRIC ACID	PHOSPHORIC ACID	AR
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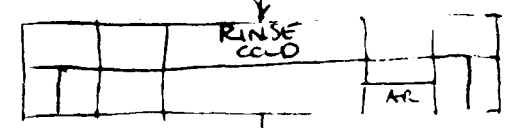
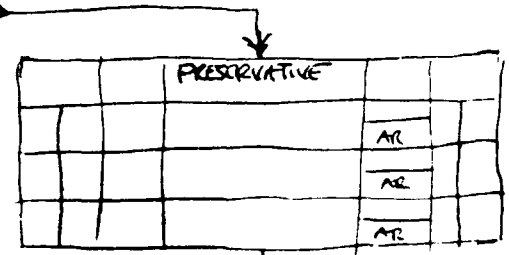
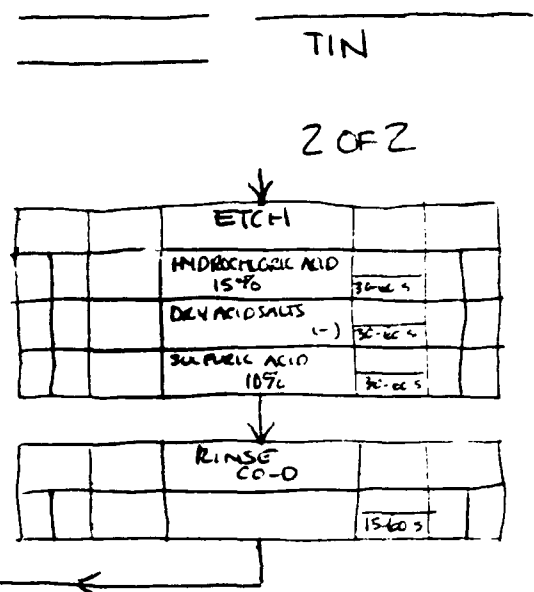
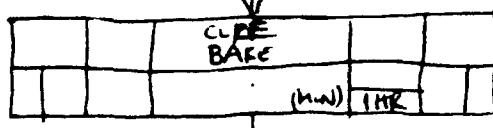
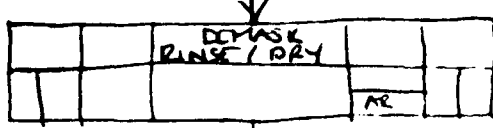
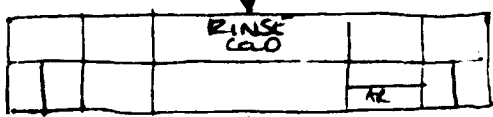
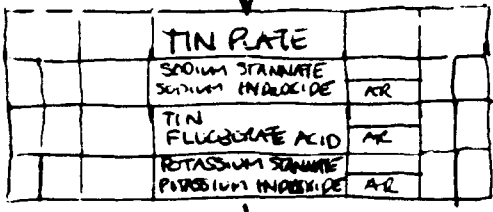
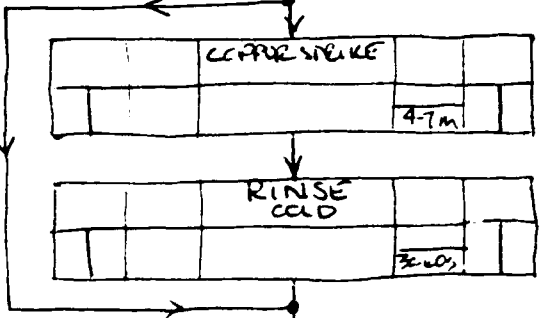
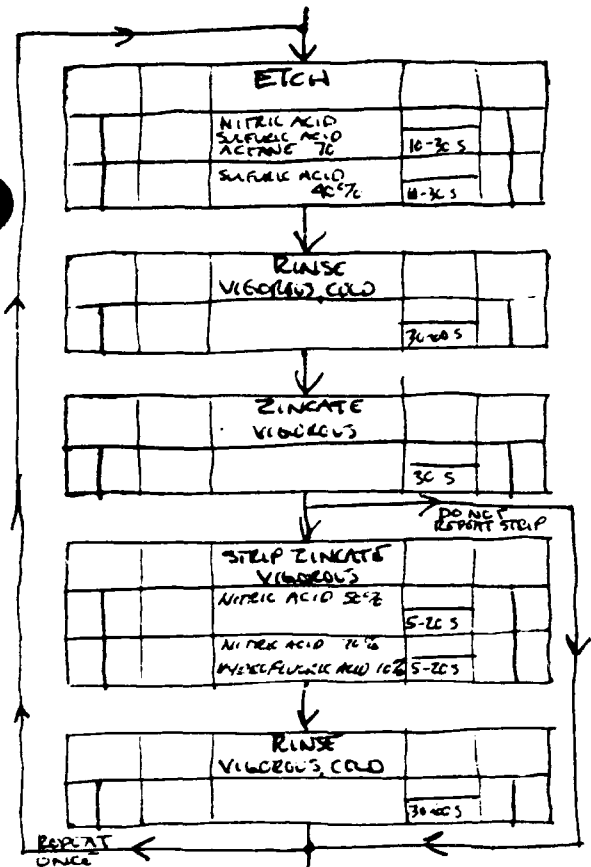
RINSE COLD	AR
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CLEAN ALKALINE	TRISODIUM PHOSPHATE	1-2m
	SODIUM HYDROXIDE	1-2m
	TRISODIUM PHOSPHATE	1-2m
	SODIUM CARBONATE	1-2m

RINSE VIGOROUS, COLD	30-65
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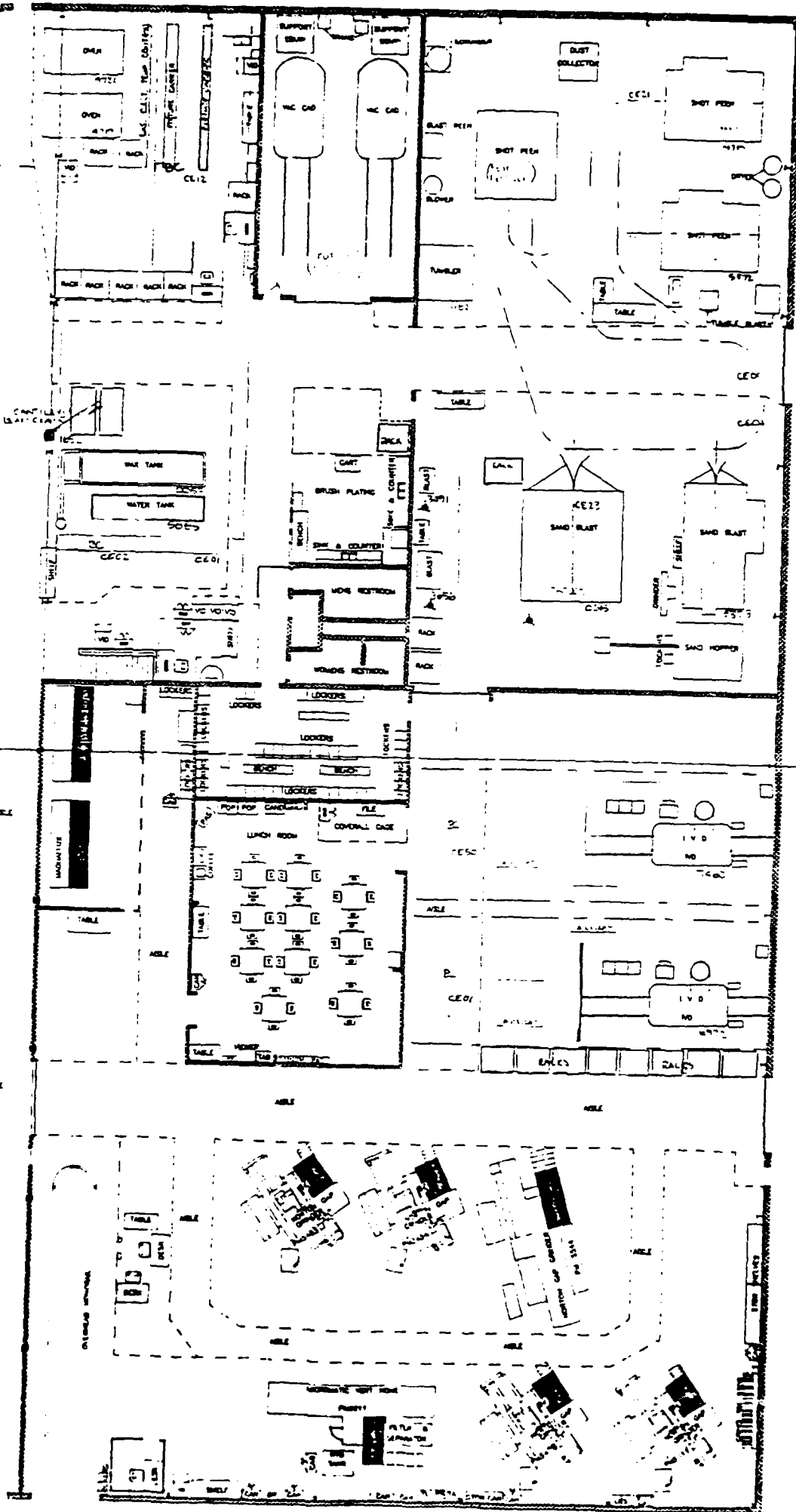
RINSE VIGOROUS, COLD	NITRIC ACID 5-10%	10-30S
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RINSE VIGOROUS, COLD	20-65
----------------------	-------









## — INTERVIEWS —

\* REFERENCE SOURCE INITIALS

(SCHEDULER) RAY GALLANT

(MANUFACTURING WORKER) ED KELLER, DENNIS COPEHAYER, JIM MCATEE

(LINE FOREMAN) SHARON BILLMIRE, RON FIELDS, ROBERT SIMONS, IGNACIO OLIVERA

(ENGINEERING) ANAHN SHAH, MARK CHILD

(EXPEDITOR) NONE EXISTING CURRENTLY

## WORKLOAD:

FLUCTUATIONS USUALLY OCCUR NEAR THE BEGINNING OF THE QUARTER WITH THIRTY PERCENT OF THE TOTAL WORKLOAD FOR THE QUARTER. FIFTY PERCENT NEAR THE END OF THE QUARTER AND TWENTY PERCENT IN THE MIDDLE.

\*RS,

THESE FLUCTUATIONS ARE DUE TO OTHER AREAS CLEANING UP THE INVENTORY LEVEL IN THEIR AREA AND SCHEDULING PUSHING ITEMS THRU. OTHER REASONS ARE DUE TO IMPROPER SCHEDULING OF PRIORITY AND ALLOWING ENOUGH TIME FOR ENTIRE PROCESS

\*RS, SB

THE WORKLOAD WITHIN MANPRC CONSISTS OF  
MISTR AT 92%, PDM AT 5%, TEMPORARY AT 3%  
" " 85%, " " 5% " " 10%

\*ES

\*RG

## REPAIR PROCESS:

THE PROCESSES WITHIN MANPRC CONSIST OF BAKING (RELIEF OF HYDROGEN EMBRITTLEMENT, STRESS, AND CURING); GILT BLAST, SHOT PEEN (SURFACE COMPRESSION STRESS RELIEF, CLEANING); VAPOR DEGREASE, PLATING, COATING, STRIPPING (CHROME, CADMIUM, SILVER, COPPER, TIN, NICKEL PLATING, ANODIZE, ALDINE, PHOSPHATE, PASSIVATION COATINGS; ION VAPOR DEPOSITION, CADMIUM, CHROME, RUST, NICKEL STRIPPING)

THERE ARE SEVERAL BASIC REASONS FOR CONDOMING PARTS: ARC-BURN THE PART (CAUSED BY IMPROPER FIXTURE SETUP, PART STICKING OUT OF SOLUTION, AND TOUCHING <sup>PART</sup> TANK WALL, ANODE OR OTHER PARTS), MATERIAL HANDLING (DAMAGED WHEN MOVING/STORING PARTS), REVERSE ETCHING (ELECTRICAL CONTROL INCORRECTLY SET), RUN OUT (CHEMICALS ARE TRAPPED DURING CLEANING PROCESS THEN ETCH AWAY PART). THE MAJORITY OF THE REWORK IS DUE TO ARC-BURN OR MATERIAL HANDLING DAMAGE WITH ONE PART PER YEAR UNREPAIRABLE (CONDOMINED).

\*RS, MC

STAFF:

THE WORKFORCE IS FAIRLY STABLE. EMPLOYEE EXPERIENCE LEVEL IS ADEQUATE FOR ASSIGNMENT, AS EMPLOYEES GAIN MORE EXPERIENCE THE FOREMAN MOVES THEM TO A HIGHER WORK STATION. AFTORWARDS THEY GO THRU A TRAINING/APPRENTICE PERIOD.

\*SB, RF

SOMETIMES TRAINING OCCURS LONG BEFORE HANDS ON EXPERIENCE. I WAS GIVEN TWO EXAMPLES WHERE CLASSES WERE 8 MO, AND 18 MO. PRIOR TO ACTUAL HANDS ON EXPERIENCE, BY THIS TIME TRAINING IS FORGOTTEN.

\*RS

OTHER DEPARTMENTS ARE CYCLE SCHEDULING, EXPEDITING, TOOL DESIGN & BUIL, EQUIPMENT RENOVATION, MATERIAL SUPPLIES, CHEMICAL ANALYSIS OF TANKS, MOVEMENT OF PARTS TO/FROM BLDG.

# DIRECT EMPLOYEES	SKILL (UP) LEVEL/LOG#	WORKSTATIONS QUALIFIED FOR	AVG YRS EXPERIENCE
1	WG05/6910	FORKLIFT DRIVERS	5
6	WG05/3711	PLATING/GRITBLAST TRAINERS	1
2	WG17/4749	PUMPS (EQUIPMENT SUPPORT)	4
8	WG07/3711	ASSOCIATE JOURNEYMAN (HANDLIZE CHEMICAL, CAD, FIDUC)	4
7	WG08/3769	JOURNEYMAN (SHOT PEEN, GRIT BLAST)	9
34	WG09/3711	JOURNEYMAN (ALL EXCEPT SHOT PEEN, GRIT BLAST)	11
6	WS09/3711	FOREMAN/TRAINOR	13
<u>64</u>			

\*IO

EQUIPMENT:

EQUIPMENT IS MAINLY COMPRISED OF CLEANING & PLATING TANKS, WITH VARIOUS SUPPORT EQUIPMENT SUCH AS AN OVERHEAD CRANE SYSTEM (TRACK LINE LOOPED ON LINES 1&2, 3&4, ...) VENTILATION SYSTEM, RECTIFIERS, SOLUTION PUMP/HOLDING TANKS, AIR AGITATION, FIXTURES (RACK), STORAGE RACKS. OTHER EQUIPMENT INCLUDES OVENS, GRITBLAST, SHOT PEEN, ION VAPOR DEPOSITION, MASKING STATION, EACH WITH SUPPORATE CRANE SYSTEM.

PROBLEM AREAS INCLUDE: PROCEDURE TO OBTAIN PARTS/SUPPLIES THAT COULD POSSIBLE STOP THE LINE ARE TOO TIME CONSUMING AND COMPLEX. REPLACEMENT PART SUPPORT STOCKING SYSTEM HAS INADEQUATE WORKING STOCK ON HAND. PROCESS LINE CHEMICALS AREN'T READILY AVAILABLE. MECHANICAL PREVENTATIVE MAINTENANCE ON SOLUTION TANKS SHOULD BE BETTER, SEVERAL ARE OUT OF COMMISSION. ELECTRIC SURGES CAN TEMPORARILY DAMAGE RECTIFIERS FOR TANK. AN AIR OUTAGE COULD STOP AIR AGITATION ON CRITICAL PROCESSES. FIXTURES BUILD TIME TAKE TO LONG. SEVERAL TIMES A PROJECT HAS BEEN FINISHED BEFORE THE FIXTURE IS DESIGNED BUILT AND COMES IN FOR USE. (PRODUCTION IMPRISED TO MEET SCHEDULING DEMAND).

\*RS

### ENGINEERING SUPPORT:

The process engineer is actively working on problems with process facility and makes himself available. However the foremen have the tendency to leave him out of line problems. They need another engineer that can spend more <sup>time</sup> on the floor solving little problems. The level engineer is almost never available and then it takes forever before the problem is fixed. \*RZS

### WORK SCHEDULE:

There are three shifts with half of the work force on day shift. Currently they are remodeling in ONE THIRD OF THE SHOP AT A TIME. This has caused an excessive amount of O/T <sup>alternately</sup> to meet production schedule. They normal can meet scheduling demands without working <sup>many</sup> WEEKENDS. \*RFR

RG

## CHANGES THEY WANT:

The ~~three~~ largest problems are storage, and flow, scheduling.  
Because of the lack of storage space their staging area <sup>used as</sup> warehouse  
by them and other departments. They have little room to walk  
in many places. Scheduling part flow between processes and  
completion dates.

Miscellaneous problems are lack of lighting to see work.  
The intercom is cranked up but not understandable. Employees waste  
time walking to/from phone in office at end of plant. Temperature is too  
high during summer months. It smells horrible at times.

\* RS

## MISCELLANEOUS:

A BETTER SELECTION OF FIXTURE. There are times that they  
don't have enough to work on the SCHEDULED WORKLOAD \* DC, EL, JM  
They use forklifts and trailers to move 75% of work between  
bldg 507 and 505 they should use overhead conveyor system more <sup>to</sup> ~~for~~ ~~use~~  
damaged parts \* RF, RS

THE FOLLOWING PAGES CONTAIN  
INFORMATION WHICH WAS USED BY  
RON LEE TO SUPPORT HIS ANALYSIS  
OF MAN PRC.

to get as good conductivity as possible, along with good current efficiency, satisfactory deposits, and stable solution composition. The specific gravity of the baths provides a rough measure of the concentration of chromic acid, especially if due allowance is made for other salts known to be present.

#### THEORY

As pointed out by Blum and Hogaboom [13], no satisfactory theory of chromium plating from chromic acid baths has been proposed beyond the principles stated. The theories to date lack comprehensiveness both in the investigations on which they are based and in the explanations proposed. The purity of the chromic acid used is often not specified or established, and yet the nature of the results depends on it. Many workers continue to report some reduction and chromium deposition in "pure" chromic acid solution, but in the writer's experience, confirmed by Vagramyan and Usachev [16], this is not possible: In the electrolysis of pure chromic acid solutions only hydrogen evolution is obtained under most conditions.

Even the simplest questions cannot be answered with our present knowledge. Why is it possible to deposit chromium from chromic acid solutions when small amounts of various anions are added? Why does the current efficiency vary so widely with the temperature, the current density, the concentration of chromic acid, and the proportion of catalyst anion? Why do different anions give such widely different results? Why do fluoride additions give only dark, dull deposits if no sulfate is present [17-19]? These are only a few of the questions which any satisfactory theory should answer.

The author has reviewed older work on the theory of chromium deposition in the previous edition of this volume [7]. This related largely to the study of the film formed at the cathode during plating. Such work now seems partly rather irrelevant and redundant since the commercial use of such films on extremely thin chromium plate to produce tin-free steel (TFS) for "tin cans" has resulted in a highly developed new art which is discussed in a later section.

No film is visible ordinarily. On the other hand, irregular etching of chromium deposits in the production of porous chromium has been noted by Dubpernell [20]; the type of etching is probably due to the presence of such an invisible film. This irregular, patchy etching was avoided by reducing the current density for a few minutes at the end of the chromium plating operation to, or below, the region where chromium deposition begins.

Kasper [21] concluded that chromium deposited from the hexavalent state. This was confirmed by the use of radioactive chromium compounds as tracers [22]. Although it seems somewhat anomalous that it should be easier to deposit the metal from the higher valence state, such behavior is not unknown and can be confirmed thermodynamically in some instances. In

the present case, the free energies of formation of  $\text{Cr}_2\text{O}_3$  and  $\frac{1}{2}\text{Cr}_2\text{O}_3$  have been given by Coughlin [23] as  $-121,000$  and  $-126,575$  cal, respectively, an indication of slightly easier decomposability for chromic acid than for trivalent salts.

Similarly, Levitan [24] selects the reduction potential of chromium(VI) (bichromate) to metal as  $+0.4$  V from Udy [25], chromium(III) to metal as  $-0.74$  V from Latimer [26], and chromium(II) to metal as  $-0.91$  V, also from Latimer. This would indicate that chromous salts are the most difficult to reduce to metal, in agreement with the findings of many workers. Pourbaix [27] is in agreement with these figures and calculates the reduction potential of chromium from bichromate as  $+0.3$  V, making chromium theoretically easier to deposit than hydrogen from such solutions.

It should be noted that Udy [25] considered chromium(III) more difficult to reduce than chromium(II), and calculated a reduction potential of  $-0.9$  V for chromium(III) and  $-0.5$  V for chromium(II). This too is in agreement with the experience of many others, the findings being about equally divided.

Pourbaix [27] emphasizes the importance of impurities as affecting the electrodeposition of chromium, particularly from bivalent and trivalent salt solutions. Blum and Hogaboom [13] also call attention to the powerful effect of low-overvoltage metal impurities to decrease the efficiency in chromium (III) and chromium(II) salt solutions especially. The favorable conditions for chromium deposition in hexavalent solutions may be due to an ability of chromate to combine with and mask such low-overvoltage metal impurities so that they do not interfere with the deposition of chromium.

Workers occupied with chromium(II) and chromium(III) salt solutions have paid insufficient attention to what might be called the principle of maximum purity for maximum cathode potential or maximum overvoltage. Mercury is a useful cathode for the electrodeposition of almost all metals because of an overvoltage of 1 V or more. However, Harrison and Thirsk [28] have shown that the deposition of little more than a monolayer of platinum or ruthenium on the mercury is sufficient to decrease the overvoltage by 0.4 or 0.5 V or even more. Thus almost infinitesimal quantities of many metal impurities are probably sufficient to cause the deposition of a black smut instead of solid metal, and this creates a low-overvoltage surface on which it is easy to evolve hydrogen and difficult or impossible to deposit chromium. Even iron, which is omnipresent in chromium ore and all through most of the salts, may be such an impurity (catalyst for hydrogen production). Such impurities have to be identified and eliminated, or else masked or combined in a complex compound which renders them harmless. Even with chromic acid solution, Bedi and Dubpernell [29] have shown that chromium deposition can be prevented



# CHROMIUM PLATING

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**ROBERT DRAPER LTD.**

83/85 UDNEY PARK ROAD, TEDDINGTON, MIDDLESEX.

ENGLAND

1954

100:1; different workers have recommended values ranging from 86:1 to 116:1.

Fig. 10 shows the variation of cathode efficiency with sulphate content at temperatures of 113°F. and 140°F. within a range of current density from 185-465 amp./sq. ft.

### Effect of Secondary Variables

#### (a) Trivalent Chromium and Ferric Iron

The trivalent chromium concentration of the solution increases gradually and then becomes constant as a result of the opposing reactions at the two electrodes. If iron anodes are used, the iron concentration also increases.

The cathode efficiency is almost independent of the concentration of trivalent chromium and iron as demonstrated in Fig. 11.

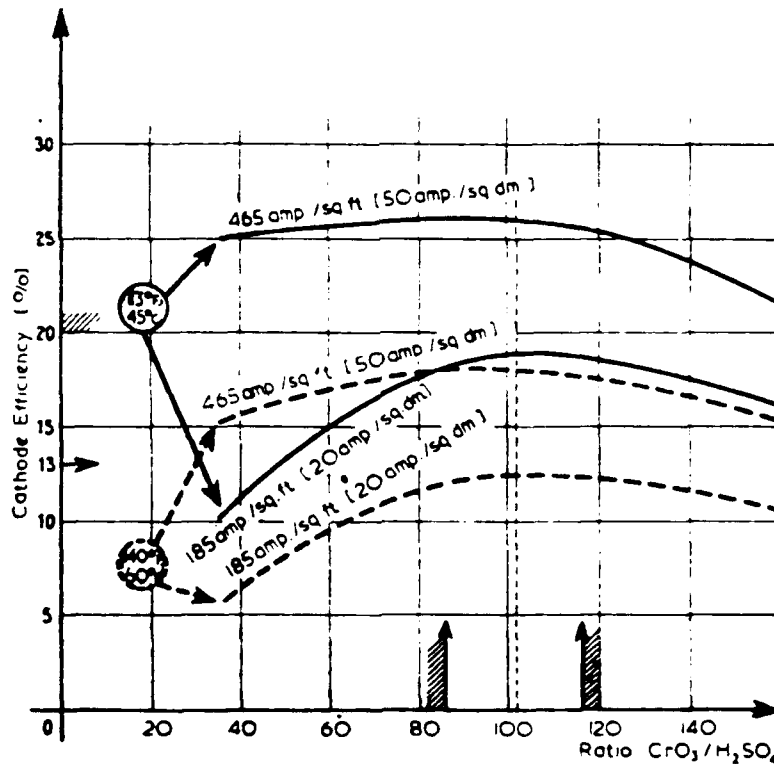


Fig. 10. Relation between cathode efficiency and sulphate content at different current densities and temperatures (SCHNEIDEWIND).

However, if the total concentration of trivalent chromium and iron exceeds approximately 3 oz./gal., sudden changes in electrical properties take place and the resistance of the solution is greatly increased. The total concentration should, therefore, be maintained

at less than 3 oz./gal. although for some purposes good deposits are obtained above this limit.

Whilst normal concentrations of trivalent chromium have rela-

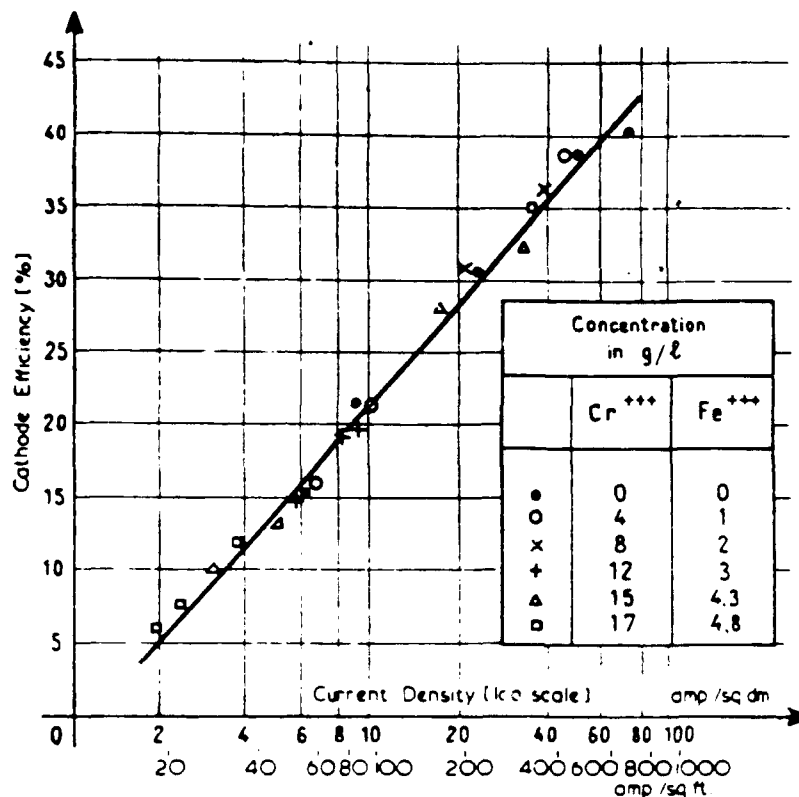


Fig. 11. Effect of trivalent chromium and iron on cathode efficiency. Bath temperature 25°C. (SCHNEIDEWIND, URBAN AND ADAMS).

tively little effect on current efficiency, it should be noted, however, that deposition commences at a lower current density in solutions containing trivalent chromium than in those which do not (Ollard and Smith<sup>24</sup>). Fig. 12 shows the relation between current density and current efficiency for two solutions, one containing trivalent chromium and the other containing only chromic acid and sulphate. It can be seen that, in the former solution, deposition commences with a current density  $d_1$ , whilst in the second it only starts when the higher current density  $d_2$  is reached. On the other hand, for current density  $d_1$ , the current efficiency is higher for the unreduced solution. This consideration is of practical value when it is necessary to use low current densities for deposition. In such cases, the presence of trivalent chromium is an advantage.

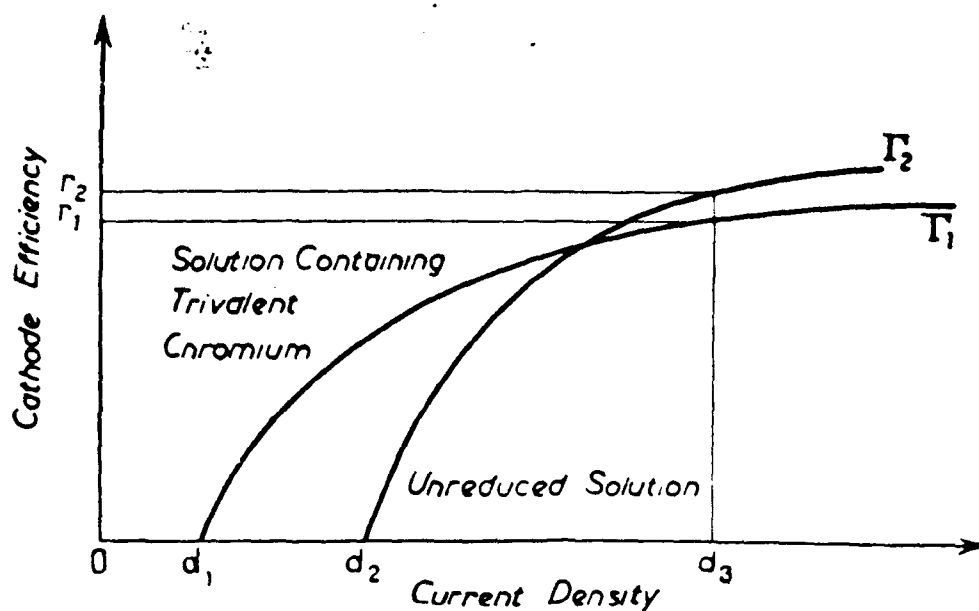


Fig. 12. Relation between cathode efficiency and current density for solutions with and without trivalent chromium (OLLARD AND SMITH).

(b) Anions other than Sulphate

Various anions have been proposed for replacing  $\text{SO}_4^{2-}$ , e.g.,  $\text{Cl}^-$ ,  $\text{NO}_3^-$ ,  $\text{B}_2\text{O}_3^{2-}$ , but these have no significant effect in increasing the cathode efficiency. The anions  $\text{SiF}_6^{2-}$  and  $\text{F}^-$  give some increase in cathode efficiency as shown in Fig. 13 (Bilfinger<sup>28</sup>). This graph

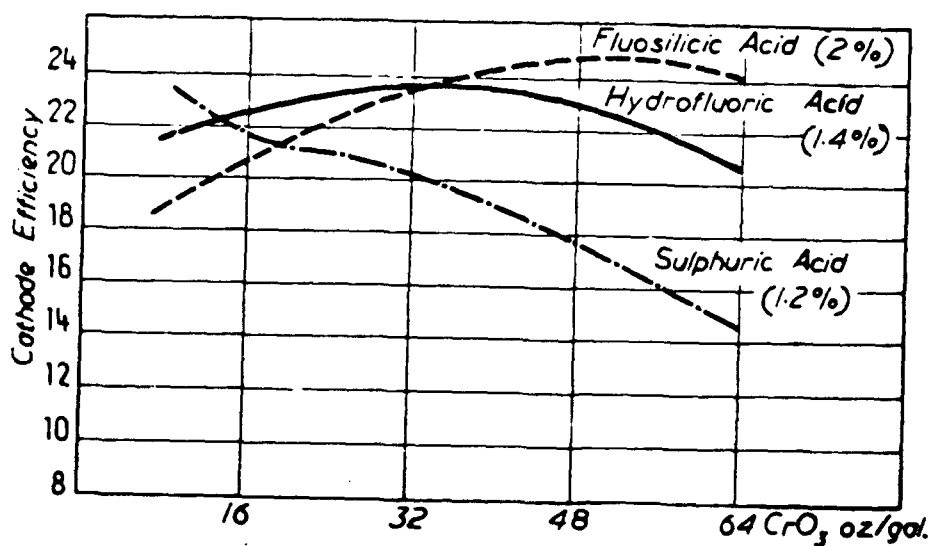


Fig. 13. Effect of nature of anion added to chromic acid solutions on cathode efficiency (BILFINGER).  
16 oz./gal.  $\equiv$  100 g./l.

quantity of barium hydroxide into a bag woven from plastic (P.V.C.) yarn. To prevent clogging, it is advisable to make alternate layers of barium hydroxide and glass wool. Such a bag can be hung in the solution and the sulphate content reduced in a reasonable time. In addition, the insoluble material is removed and does not remain in the vat.

### *Iron*

Iron occurs as an impurity in chromium plating solutions, the main sources of contamination being the use of iron anodes in place of lead and reverse current etching of steel parts in the solution. The presence of iron is usually considered to be a serious defect as there is no practical method for eliminating it. However, by using lead anodes and avoiding over-etching, loss of solution by drag-out is usually sufficient to keep the iron content below the danger level and it is very seldom in practice that a chromium plating solution has to be scrapped because of iron contamination. The effect of high iron concentration is to cause brittleness in hard chrome deposits, loss of brilliance in bright chrome, and reduction in throwing power.

### *Frequency of Analysis of Chromium Plating Solutions*

The rate of variation in the concentration of the constituents depends on the type of work being treated, the volume of solution, and the way the bath is handled. The recommendations given in Table LI are, therefore, only intended to be in the nature of a guide; local conditions will determine the exact requirements.

Table LI. Guide to Frequency of Analysis of Chromium Plating Solutions.

Density Measurement	Weekly, daily in some plants
Analysis for Chromic acid	Weekly
"    " Sulphuric acid	Each time chromic acid is added
"    " Trivalent chromium	As necessary
"    " Iron	As necessary, but not more than once every three months
"    " Mixed "chromates"	ditto.
"    " Nickel, copper and zinc	ditto.
"    " Fluorides and Silico- fluorides	ditto.

# 5.

## Chromium

GEORGE DUBPERNELL

There are two principal classes of chromium plating: "decorative," in which thin coatings serve as a nontarnishing, durable surface finish; and industrial or "hard" chromium, where heavy coatings are used to take advantage of the special properties of chromium, including resistance to heat, wear, corrosion and erosion, and low coefficient of friction. In these steadily increasing industrial applications, the chromium is usually deposited directly on the basis metal without intermediate coatings. Sometimes, especially on cutting tools, the thickness of these hard chromium coatings is no greater than that of decorative ones.

The commercial process of chromium plating resulted principally from the work of Fink and Eldridge, in 1923 and 1924 [1, 2]. Liebreich [3] made similar discoveries more or less simultaneously in Germany, but confused them by overemphasis on the supposed importance of the trivalent chromium also present in the chromic acid-sulfate bath.

A noteworthy improvement in chromium plating from chromic acid solutions came with the introduction of the SRHS\* (self-regulating high-speed) baths in 1949 [4]. These baths, using a double catalyst system, generally sulfate and silicofluoride, are simple to operate and control and offer advantages discussed later.

For more details of the history of chromium plating see references 1 and 5-12. Blum and Hogaboom [13] emphasize the effect of the introduction of chromium plating on other electroplating processes.

### PRINCIPLES

Chromium cannot be deposited from a solution containing only chromic acid ( $\text{CrO}_3$ ) and water. There must also be present in the bath one or more

\*Trademark of M & T Chemicals Inc.

acid radicals which act as catalysts to bring about or aid in the cathodic deposition of chromium. Those most commonly used are sulfate and fluoride, the latter generally in the form of a complex fluoride such as silicofluoride ( $\text{SiF}_6^{2-}$ ) [14], since simple fluorides are effective in such small quantities that control becomes difficult. For successful continuous operation, the ratio (by weight) of chromic acid to total catalyst acid radicals must be maintained within definite limits: preferably about 100-1 in the case of sulfate [2, 3].

It is generally immaterial what other substances the catalyst is combined with when it enters the bath or from what sources it may be derived, but the material must be soluble. Some sulfate is ordinarily present in all chromium plating baths, since it is contained in even the best commercial grades of chromic acid. Sulfuric acid and sodium sulfate are the most common sources of sulfate; fluosilicic acid and silicofluorides [14] are the most common sources of fluoride. References to the amount of catalytic agent or acid radical in a bath usually mean the total of such agents, although the method of totaling them varies and needs to be indicated.

Although the current efficiency in chromium plating baths is low (generally in the range 10-25% for bright plate), a fairly high rate of deposition is obtained owing to the relatively high current densities used. The voltages required are higher than in most other electroplating processes: generally 4 to 10 V, depending on operating conditions. Consequently, the generator capacity required for chromium plating is higher than that for most other metal plating, but this disadvantage has not seriously hindered the widespread use of the process.

The throwing power of chromium plating baths is relatively poor. Nevertheless, remarkable coverage is achieved, even in the plating of articles of irregular shape, if the optimum ratio of chromic acid to total catalyst acid radicals is carefully maintained. Special auxiliary anodes are sometimes used in order to cover deep hollows or recessed portions, and especially to obtain uniform thickness in hard chromium plating (or even in thicker decorative plating to produce more uniform microcracking). Such auxiliary anodes are similar to those used in other types of plating and are designed in accord with well-known and long-established principles of ample size for current-carrying requirements and proper spacing for uniform distribution of current.

The conductivity and density of pure chromic acid solutions are shown in Figure 1, based on the measurements made at the National Bureau of Standards [15]. Small amounts of chromium(III) and other cations decrease conductivity. It should be noted that the maximum conductivity is not achieved until a concentration of 400 to 500 g/l is reached. Commercial chromium plating generally uses baths containing 200 to 400 g/l chromic acid

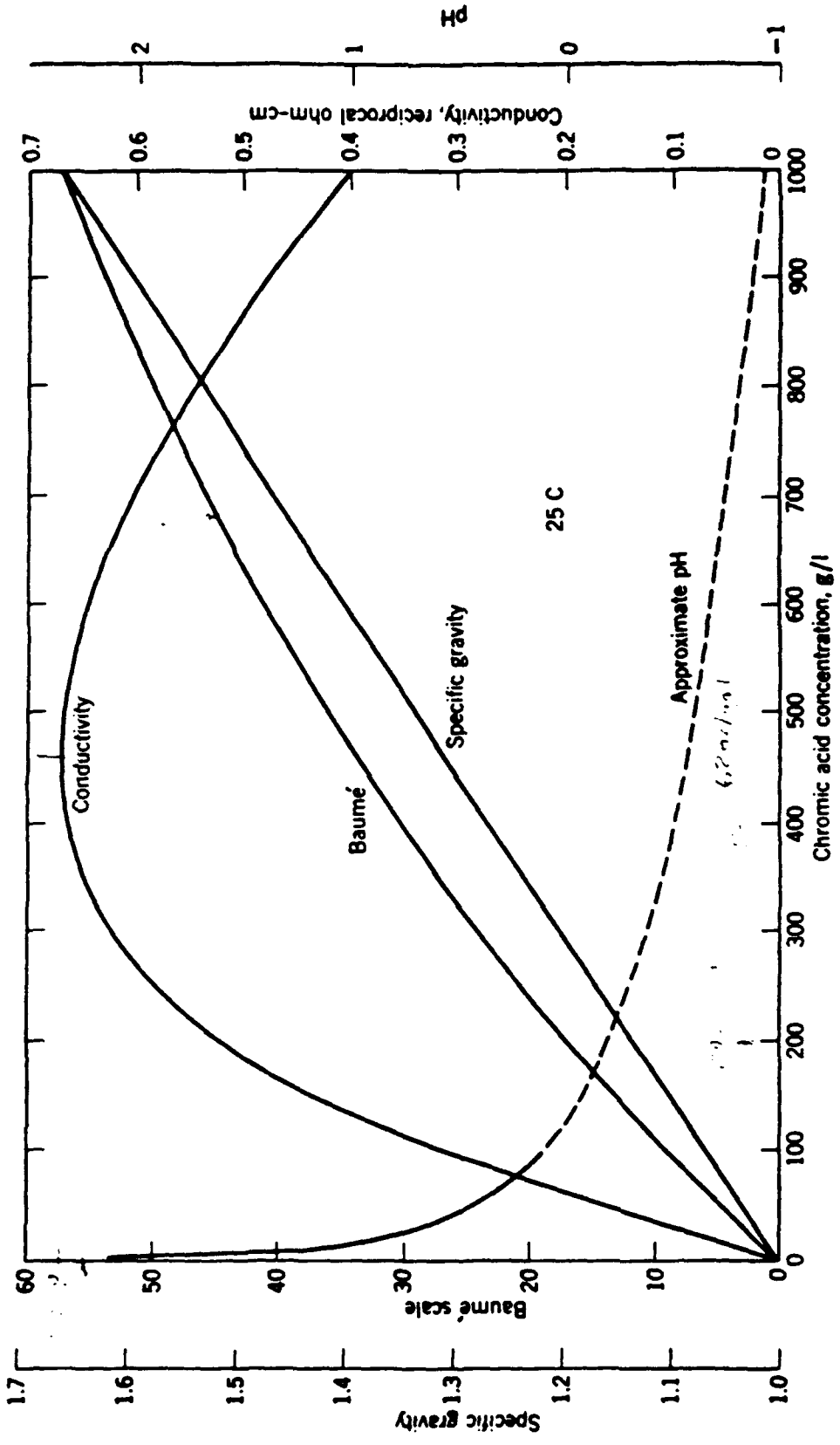


Fig. 1 Some physical properties of chromic acid solutions.



to get as good conductivity as possible, along with good current efficiency, satisfactory deposits, and stable solution composition. The specific gravity of the baths provides a rough measure of the concentration of chromic acid, especially if due allowance is made for other salts known to be present.

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The author has reviewed older work on the theory of chromium deposition in the previous edition of this volume [7]. This related largely to the study of the film formed at the cathode during plating. Such work now seems partly rather irrelevant and redundant since the commercial use of such films on extremely thin chromium plate to produce tin-free steel (TFS) for "tin cans" has resulted in a highly developed new art which is discussed in a later section.

No film is visible ordinarily. On the other hand, irregular etching of chromium deposits in the production of porous chromium has been noted by Dubpernell [20]; the type of etching is probably due to the presence of such an invisible film. This irregular, patchy etching was avoided by reducing the current density for a few minutes at the end of the chromium plating operation to, or below, the region where chromium deposition begins.

Kasper [21] concluded that chromium deposited from the hexavalent state. This was confirmed by the use of radioactive chromium compounds as tracers [22]. Although it seems somewhat anomalous that it should be easier to deposit the metal from the higher valence state, such behavior is not unknown and can be confirmed thermodynamically in some instances. In

the present case, the free energies of formation of  $\text{CrO}_3$  and  $\frac{1}{2}\text{Cr}_2\text{O}_3$  have been given by Coughlin [23] as  $-121,000$  and  $-126,575$  cal, respectively, an indication of slightly easier decomposability for chromic acid than for trivalent salts.

Similarly, Levitan [24] selects the reduction potential of chromium(VI) (bichromate) to metal as  $+0.4$  V from Udy [25], chromium(III) to metal as  $-0.74$  V from Latimer [26], and chromium(II) to metal as  $-0.91$  V, also from Latimer. This would indicate that chromous salts are the most difficult to reduce to metal, in agreement with the findings of many workers. Pourbaix [27] is in agreement with these figures and calculates the reduction potential of chromium from bichromate as  $+0.3$  V, making chromium theoretically easier to deposit than hydrogen from such solutions.

It should be noted that Udy [25] considered chromium(III) more difficult to reduce than chromium(II), and calculated a reduction potential of  $-0.9$  V for chromium(III) and  $-0.5$  V for chromium(II). This too is in agreement with the experience of many others, the findings being about equally divided.

Pourbaix [27] emphasizes the importance of impurities as affecting the electrodeposition of chromium, particularly from bivalent and trivalent salt solutions. Blum and Hogaboom [13] also call attention to the powerful effect of low-overvoltage metal impurities to decrease the efficiency in chromium (III) and chromium(II) salt solutions especially. The favorable conditions for chromium deposition in hexavalent solutions may be due to an ability of chromate to combine with and mask such low-overvoltage metal impurities so that they do not interfere with the deposition of chromium.

Workers occupied with chromium(II) and chromium(III) salt solutions have paid insufficient attention to what might be called the principle of maximum purity for maximum cathode potential or maximum overvoltage. Mercury is a useful cathode for the electrodeposition of almost all metals because of an overvoltage of 1 V or more. However, Harrison and Thirsk [28] have shown that the deposition of little more than a monolayer of platinum or ruthenium on the mercury is sufficient to decrease the overvoltage by 0.4 or 0.5 V or even more. Thus almost infinitesimal quantities of many metal impurities are probably sufficient to cause the deposition of a black smut instead of solid metal, and this creates a low-overvoltage surface on which it is easy to evolve hydrogen and difficult or impossible to deposit chromium. Even iron, which is omnipresent in chromium ore and all through most of the salts, may be such an impurity (catalyst for hydrogen production). Such impurities have to be identified and eliminated, or else masked or combined in a complex compound which renders them harmless. Even with chromic acid solution, Bedi and Dubpernell [29] have shown that chromium deposition can be prevented

entirely on steel by a small amount of an immersion deposit of platinum or palladium. Whittaker [30] found a decrease in current efficiency from 41 to 13% when using a palladium anode instead of lead.

Gerischer and Kappel (30a) emphasize that the film of chromium(III) chromate on the cathode must have semiconducting properties, and they feel that it can be reduced directly to metal. They further consider that the catalyst anions keep the film from growing too thick, and also inhibit hydrogen evolution, thus favoring chromium deposition.

It would seem that the deposition of chromium from chromic acid involves the reduction of some intermediate compound with the added anion, at the cathode, in the chromic acid medium of low or negative pH, and mixed activating and passivating tendencies. Thus, if the chromium deposit were too active, it would tend to redissolve in the strongly acid electrolyte. This may be a reason for the low current efficiency in high catalyst or "oversulfated" baths. Conversely, if the chromium deposit were too passive, it would tend to plate dull and in the form of nonadherent layers flaking from each other, as frequently occurs when there are current interruptions. Such current interruptions become less harmful or not harmful at all as the catalyst concentration and the temperature are increased, probably owing to greater activating power of the hot acid solution. While the tests were made only at 20°C, the investigation of the composition of the cathode film by Shluger and Mikhailova [31] seems significant. The film dissolves in the solution very rapidly when the current is interrupted, but by withdrawing the cathode with the current on and rinsing in distilled water, and repeating the operation 30 to 50 times, these workers were able to arrive at the approximate composition of the film by ordinary chemical analysis. This was done by subtracting a blank in each case found by using the same number of dips with the current off, giving a dragout representing the composition of the original solution. The results are given in Table 1, and it is evident that there is a film of fixed composition

TABLE 1 CATHODE FILM COMPOSITION

Number of Dips	Composition of Solution, g/l			Composition of Film, %			Weight of Film, g
	CrO <sub>3</sub>	H <sub>2</sub> SO <sub>4</sub>	CrO <sub>3</sub> /H <sub>2</sub> SO <sub>4</sub>	Cr <sup>6+</sup>	Cr <sup>3+</sup>	SO <sub>4</sub> <sup>2-</sup>	
30	300	3	100	67.4	20.0	12.6	1.06
50	316.7	4	80	67.6	22.4	10.0	2.63
30	300	5	60	70.6	16.3	13.1	2.49
50	316.7	6	53	68.5	20.0	11.5	4.93
50	316.7	11	29	66.6	23.4	10.0	10.36
30	300	12	25	61.0	28.4	10.6	6.01

regardless of the ratio of the chromium bath, and that it has a much higher sulfate content than the bath. The total weight of the film on the 22-cm<sup>2</sup> cathode is given in the last column, and shows that the film thickness increases with increasing sulfate content of the bath, using 40 A/dm<sup>2</sup>.

Similar determinations of the film composition were reported by Solov'eva et al. [32], who found the cathode film to contain from 2.1 to 13.7 times as much sulfate as was present in the solution, with reference to the chromic acid concentration. The work was also done at 20°C, but under a wider range of conditions, ranging from 25 to 250 g/l CrO<sub>3</sub>, 0.5 to 12.5 g/l H<sub>2</sub>SO<sub>4</sub> (ratios 10–100), and at 250 and 500 mA/cm<sup>2</sup>.

Solutions with fluoride or complex fluoride catalysts apparently permit the deposition of chromium with very little cathode film, or else the film redissolves in the solution rapidly, and this is probably a reason for the radically different results often obtained with such solutions as compared to those with a sulfate catalyst alone. Thus Shluger and Osbenkova [33] could see no cathodic film at all in 250 g/l CrO<sub>3</sub> solutions at 20°C with up to 30 g/l KF, while chloride and bromide additions gave visible cathodic films.

There seems to be some connection between the electrochemical behavior of chromium(III) salts and the properties of the corresponding anions as catalysts for chromium deposition from chromic acid solutions. Thus sulfate is the most complete and satisfactory single catalyst for chromic acid baths, and likewise chromium is being commercially deposited from chromium(III) sulfate-based baths for large-scale production of metal [34, 35].

Similarly, chromium(III) chloride can give good chromium deposition by itself [36], and chloride is an effective catalyst for chromium deposition from chromic acid, although the deposits are generally not bright. Unfortunately, chlorides break down at the anode with evolution of chlorine.

Levitan [24] showed that a chromium(II) compound is the primary reduction product at the cathode during chromium deposition, and investigated the further reaction products with chromic acid. He tried chromium deposition with 0.6 M chromous perchlorate solution added to sulfate-free, pure chromic acid solution, but no chromium deposit was obtained. Falicheva [37] attempted chromium deposition from chromium(III) perchlorate solutions, but only very thin coatings could be obtained.

Russian research [38, 39] shows that there is still disagreement regarding the mechanism of the electrodeposition of chromium, that the nature of the film formed at the cathode still needs to be determined, and that the connection between theory and practice is still inadequate. Other reviews cover deposition of both chromium and chromium alloys from chromic acid solutions [40] and from trivalent baths [41].

An unfortunate defect in much of the Russian work on the theory of

upper limit of current density for this bright plate range, the optimum throwing power will be attained.

In the conventional throwing power box, cyanide copper plating baths with good throwing power generally have a rating of around 20 to 40%, whereas most nickel plating and acid copper plating baths have a rating near zero. The throwing power in chromium plating has been found to vary from around -13% under the best conditions to -100% and even lower [13, 49, 52]. The relative throwing power of chromium plating baths is often estimated by an empirical test such as the Hull cell test, described in the next section.

#### HIGH THROW BATHS

High-ratio baths containing relatively high concentrations of organic acids have been developed [53, 54] which exhibit remarkable throwing power or covering power over bright nickel, almost as good as that of bright nickel baths themselves. These solutions operate at lower current efficiencies to produce thin bright plates of good decorative value. It is a characteristic that the coverage increases with time and the plate continues to spread into the low-current-density areas with longer plating. Thus plating times as long as 5 to 10 min are recommended instead of the 2 to 3 min often used for decorative plating.

#### METALLIC IMPURITIES

Cations that may commonly be present in chromium plating baths include chromium(III), iron, copper, nickel, zinc, and sodium. Chromium(III) usually results when baths are operated with too large a cathode area and too small an anode area, or when organic matter is introduced. The chromium(III) content can be kept down by increasing the area of the lead anodes used relative to the cathode area, or, where this is not practical, by electrolyzing the solution for a time with a relatively large anode area and a small cathode area.

Iron, copper, nickel, zinc and other metallic impurities may be introduced into the bath in various ways; if permitted to accumulate, they cause an increase in the resistivity of the bath. None of the cations discussed has any noteworthy beneficial effect on the operating characteristics of the bath.

Chromium(III) particularly is detrimental, although contrary statements have appeared [55]. The tradition that a small amount of chromium(III) is beneficial when added to a new bath may have grown up due to making such additions in the early days in the form of chromic sulfate or chromium hydroxide precipitated from chromic sulfate and containing some sulfate, thus affecting the catalyst content of the bath. A number of very painstaking investigations have failed to indicate any improvement in new baths with the

addition of small amounts of chromium(III) and there is no need to electrolyze a properly made up new bath for this purpose.

### MAINTENANCE AND CONTROL

Chromium plating baths are seldom filtered, although filtering has been recommended [56, 119]. If some clarification is desired, it can be accomplished by settling overnight and decanting. If desired, a chromium solution may be filtered through a pad of glass wool or through fiber glass filter cloth. Filtering cloths of Vinylite (Vinyon) and Saran are also available and have substantially complete resistance to chromic acid.

Chromium plating baths are very stable in use, and their composition can be readily maintained by physical or chemical analysis. Some of the chromic acid is reduced to chromium(III) whenever chromium is being plated, but this is continually reoxidized to chromic acid on the lead dioxide surface of the lead anodes commonly used. This automatically maintains the chromium(III) concentration at a relatively low figure under usual operating conditions, especially if the area of the lead anodes is sufficient [57]. If iron or other anodes are used for special purposes, they do not reoxidize the chromium(III) to chromic acid as well as do lead anodes, and a higher equilibrium concentration of chromium(III) is reached after the bath has been used for some time. Furthermore, these other anodes, unless highly insoluble like lead, introduce contaminating metals such as iron into the solution, and therefore should generally be avoided.

Wetting agents are frequently used to suppress the mist of solution carried into the atmosphere by the hydrogen evolution at the cathode, rather than to prevent pitting as in other plating baths. A great variety of wetting agents have been developed to minimize the fumes evolved during plating; the prospective user of such compounds should satisfy himself about their stability under his particular conditions. If they are used, surface tension measurements may become desirable for control, although visual observation of the fume suppression or amount of foaming may be sufficient.

Special physical measurements or plating tests are frequently made to check the condition of a bath or to determine the total catalytic effect of all the acid radicals present. Many plants use physical instead of chemical analysis as the basis for adjustments. Pinner and Baker [58] proposed a bent-cathode test to determine the ratio of chromic acid to total catalyst acid radicals. This was a modification of the strip test first used by Fink, described below.

Pfanhauser [59] developed a so-called potentiometric method of checking the approximate catalyst content. This consists of an ammeter and voltmeter connected to a small plating cell with a 4- or 5-V source of direct current and

a rheostat. The solution to be tested is placed in the cell with lead anodes and a brass cathode. The current is slowly raised until there is a sudden increase in voltage and a deposit of chromium appears. The current density at which this occurs is noted, and the catalyst content of the bath in terms of sulfate is estimated from current-voltage reference curves plotted for solutions of known composition. A special instrument for making these measurements has been marketed in Germany under the name L. P. W. Sulfometer [60]; the ammeter of this instrument is sometimes calibrated to read the ratio directly. Stalzer reviewed the use of this instrument in 1968 [61].

Perhaps the most important plating test used with chromium plating baths is the determination of the current efficiency under known conditions, as first used by Fink as part of his strip test. When carefully carried out, this measurement gives a great deal of information regarding the characteristics of a given bath and its total catalyst content. The appearance and distribution of the resultant plate under the test conditions can also be studied when data on current efficiency are being obtained. If the current efficiency is not required, the appearance of the plate at different current densities can be observed to better advantage in a single measurement by means of a Hull cell or other similar test [62, 63].

The specific gravity is a good indication of the chromic acid content with new baths, but may show considerable deviation as the bath is used and accumulates metallic impurities. Sulfate is often determined centrifugally, but this method is not always reliable. Excess sulfate is commonly precipitated by the addition of barium carbonate, but it can also be counterbalanced by the addition of chromic acid, if convenient.

Silicofluoride-containing chromium plating baths were found difficult to analyze and control. Many methods were proposed, but they were not generally dependable or accurate. Branciaroli and Coleman [64] give a better method for the total fluorine content. There is considerable confusion and inaccuracy in the literature about fluoride- and silicofluoride-containing chromium baths. Nevertheless, and in spite of the difficulties, present-day silicofluoride-containing baths with or without self-regulating features have more than compensating advantages.

### SELF-REGULATING BATHS

An important development was the introduction of chromium plating bath systems called self-regulating high-speed, or simply SRHS,\* baths. These are chromic acid solutions containing mixed and cooperating catalyst acid radicals (generally sulfate and silicofluoride) in concentrations controlled

\*Trademark M & T Chemicals Inc.

PLATING, CHROMIUM ELECTRO

1. APPLICATION

1.1 This specification covers the requirements for the application of a wear resistant chromium deposit on steel, stainless steel, copper alloy, and nickel-plated parts. Chromium plating covered by this specification shall be of the following classes.

Class A - Parts plated to a dimension-plating thickness to a maximum of 0.002 inch.

Class B - Parts plated to dimension or ground to dimension after plating. Minimum plating thickness on finished parts to be 0.002 inch.

1.2 This specification covers the procedures and requirements for high-speed chromium baths. Other plating baths may be used, provided the requirements of this specification meets the performance requirements of QQ-C-320.

1.3 This specification shall be applicable when referenced on Engineering drawings, or when called out in applicable finish specifications.

1.4 This Revision H supersedes and includes Amendment Nos. 2, 2A, and 2B. Items marked [ ] are new or revised with this issue.

1.5 This revised specification is effective upon issue. It may be implemented at once but it must be implemented by 28 October 1987. Subcontractors or vendors performing processing in accordance with the requirements of the previous issue of this specification shall implement the changes defined herein with 90 days after receiving this document. If compliance with these changes cannot be effected within the designated lead time, a request for deviation must be submitted in compliance with P.S. 10000.

2. APPLICABLE DOCUMENTS

2.1 The following McDonnell Douglas (St. Louis) Specifications form a part of this specification to the extent referenced herein:

P.S. 10000	P.S. 12010	P.S. 12020
P.S. 12030	P.S. 12040	P.S. 12045
P.S. 12050	P.S. 13101	P.S. 14023
P.S. 15063	P.S. 20002	P.S. 21201
P.S. 21202	P.S. 23401	P.S. 23405

Refer to the Process Specification Index for a complete title and the latest revision information on each specification.

QQ-C-320 - Chromium Plating (Electrodeposited)

ASTM E292 - Conducting Time-Por-Rupture Notch Tension Tests on Materials

3. MATERIALS AND/OR SOLUTIONS

3.1 Materials for solvent cleaning and/or vapor degreasing, P.S. 12010 and/or P.S. 12020.

3.2 Materials for abrasive cleaning and/or liquid honing, P.S. 12040 and/or P.S. 12045.

3.3 Materials for Type II Alkaline Cleaning, P.S. 12030.

3.4 Hydrochloric (muriatic) acid pickling solution, P.S. 12050.8.

3.5 MASKING MATERIALS

3.5.1 Tapes - Suitable Widths

(a) #470 Pressure Sensitive Tape - Minnesota Mining and Mfg. Company

(b) Microtape Microtube - Michigan Chrome and Chemical Company

3.5.2 Stop-Off Lacquers

(a) Unichrome Stop-Off - M&T Chemicals, Inc.

(b) Microshield - Micro Products

3.5.3 Stop-Off Waxes

(a) Microwax - Michigan Chrome and Chemical Company or equivalent

3.5.4 Plugs and Stoppers

3.5.4.1 Rubber or plastic - suitable sizes - commercial

3.6 CHROMIUM PLATING SOLUTION (SELF-REGULATING, HIGH-SPEED)

3.6.1 Solution Make-Up - The self-regulating, high-speed chromium plating bath shall be made up in accordance with Table I.

CHEMICAL	QUANTITY	TEMPERATURE
CR-110 Salts*	2.4 lb.	132 ± 5°F
Tap Water	1 gal.	
Lead-tin or lead-antimony anodes		
*Available from M&T Chemicals, Inc.		

TABLE I - CHROMIUM PLATING BATH MAKE-UP

3.6.1.1 Fill tank about two-thirds full with water (deionized water preferred), and heat to about 140°F.

3.6.1.2 Add and stir in the required amount of CR-110 Salts as shown in Table I.

3.6.1.3 Add water to bring to operating level and stir thoroughly for at least one hour.

**NOTE:** Do not attempt to completely dissolve all salts. A certain amount will and should remain undissolved.

3.6.1.4 Adjust temperature controller and bring within operating range.

**NOTE:** The chromium plating bath should not be heated over 150°F.

3.6.1.5 Place anodes in the tank, and using dummy steel cathodes, electrolyze at 6 volts for about 2 hours.

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3.6.2 Solution Control

3.6.2.1 The chrome plating solution shall be controlled within the limits shown in Table II as required by 7.2.2.

CHEMICAL	CONCENTRATION	OPERATING TEMP
Chromic Acid CrO <sub>3</sub>	30-33 oz./gal.	132 ± 5°F
Sulfates (as H <sub>2</sub> SO <sub>4</sub> )	0.12-0.15 oz./gal.	
Chloride	0.003 oz./gal. (max.)	
Trivalent Chromium	0.5 oz./gal. (max.)	
Iron	0.5 oz./gal. (max.)	

TABLE II - CHROMIUM PLATING BATH CONTROL (UNICROME CR-110 BATH)

3.6.2.2 The chromic acid concentration shall be analyzed using a conventional volumetric oxidation-reduction procedure for hexavalent chromium. To increase the chromic acid concentration by 1.0 oz./gal. add 1.1 oz./gal. of CR-130 or CR-140 (available from M&T Chemicals, Inc.).

3.6.2.3 The chromic acid concentration may be measured on a daily basis by the use of a hydrometer calibrated in degrees Baume'. Figure 1 shows the relationship between solution density in degrees Baume' and chromic acid concentration at 130°F.

NOTE: Through use the bath will become contaminated with heavy metals which will increase the solution density. Chromic acid concentration determinations by hydrometer should occasionally be compared to analytical results to establish the increase in density due to heavy metals.

3.6.2.4 Barium carbonate may be added directly to the plating bath at operating temperature to lower the sulfate concentration. For each 0.01 oz./gal. of sulfate to be lowered, 0.02 oz./gal. of barium carbonate should be used.

3.6.2.5 Plating bath volume losses due to evaporation should be replaced by deionized water.

3.7 REVERSE-ETCH SOLUTION

3.7.1 Solution Make-Up - The reverse-etch solution make-up shall be the same as the high-speed solution in 3.6.1.

3.7.2 Solution Control - The chromic acid (CrO<sub>3</sub>) and the iron concentrations shall be controlled within limits specified in 3.6.2.

3.8 ANODIC ETCH SOLUTION

3.8.1 Solution Make-Up - The anodic etch solution shall be made up in accordance with Table III.

CHEMICALS	CONCENTRATION	TEMPERATURE
HF - Tech (70% HF) O-N-795	4% by volume	Ambient
H <sub>2</sub> SO <sub>4</sub> , (66° Be') Type I, Class I O-S-809	25% by volume	
Water	Remainder	

TABLE III - ANODIC ETCH SOLUTION

3.8.1.1 Fill the tank to the half full with tap water.

3.8.1.2 With mild tank agitation, slowly add sufficient sulfuric acid and hydrofluoric acid to meet the concentration requirements of Table IV in the final bath volume.

3.8.2 Solution Control The anodic etch solution shall be controlled within Table IV operating limits.

CHEMICAL	CONCENTRATION
Sulfuric Acid	20 to 30% by volume
Hydrofluoric Acid	3 to 5% by volume

TABLE IV - ANODIC ETCH SOLUTION CONTROL

3.9 STRIPPING SOLUTION

3.9.1 Solution Make-Up - The chromium plate stripping solution shall be made up in accordance with Table V.

CHEMICAL	CONCENTRATION	OPERATING TEMP
Alkaline Electro-cleaner	8-10 oz./gal.	70 - 140°F
Sodium Hydroxide	4-6 oz./gal.	

TABLE V - CHROMIUM PLATE STRIPPING SOLUTION

3.9.1.1 Fill tank about two thirds full of tap water. Add required amounts of chemicals in conformance with Table V based on final bath volume.

3.9.1.2 Stir until chemicals are completely dissolved.

3.9.1.3 Add water to bring solution to operating level and heat to desired temperature. Solution temperature of 140°F is desired for more rapid stripping.

3.9.2 Solution Control - The stripping solution shall be controlled within limits specified in Table V.

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4. EQUIPMENT

4.1 Solvent and/or vapor degreasing equipment required by P.S. 12010 and/or P.S. 12020.

4.2 Alkaline cleaning equipment required by P.S. 12030.

4.3 Abrasive cleaning and/or liquid honing equipment required by P.S. 12040 and/or P.S. 12045.

4.4 Hydrochloric (muriatic) acid pickling equipment required by P.S. 12050.8.

4.5 Ovens for stress and embrittlement relief of steel parts. Ovens operating up to 300°F shall meet requirements for Class 3 systems for P.S. 23401. Ovens operating at temperatures over 500°F shall meet requirements for Class 2 systems for P.S. 23401.

4.6 Copper or brass hooks, racks, and wire for suspending parts in solutions.

4.7 Reverse etch and/or anodic etch tank and associated equipment including lead-lined or Koroseal-lined steel tank, heating coils, temperature controller, lead-tin or lead-antimony cathodes, copper anode and cathode bars, filtered compressed air agitation and a D.C. power supply.

4.8 Chromium plating tank and associated equipment including lead-lined or Koroseal-lined steel tank, lead or tantalum heating coils, temperature controller, lead-tin or lead-antimony anodes, copper anode and cathode bars, filtered compressed air agitation and a D.C. power supply.

4.9 Steel tank for cold water rinse after plating.

4.10 Steel tank for hot water final rinse.

4.11 Steel stripping tank equipped with heating coils, temperature controller, copper anode and cathode bars, steel cathodes, and D.C. power supply.

4.12 Filtered compressed air drying equipment.

5. REQUIREMENTS

5.1 PROCESSING REQUIREMENTS

5.1.1 All brazing, welding, forming, heat treating, and shot peening shall be done on parts before chromium plating. When shot peening of steel parts is required, stress relief shall be done prior to the shot peening.

5.1.2 Steel parts Class A or Class B which are plated to final dimensions shall have a surface finish prior to plating that is equal to, or better than, the required finish after plating. When the surface finish of the chromium plate on such parts is not specified on the drawing, it shall be equal to, or better than, the surface finish specified for the base metal.

5.1.3 Prior to plating, steel parts having a tensile strength greater than 180 ksi which are subjected to machining, forming, or grinding following heat treatment, shall be stress relieved per P.S. 15063.

5.1.4 After plating, steel parts shall be embrittlement relieved per P.S. 15063. Embrittlement relief shall be started within 4 hours after plating. If embrittlement relief is not started within 4 hours, parts shall first be embrittlement relieved and then be magnetic particle inspected per P.S. 21201.

5.1.5 After plating and embrittlement relief, steel parts, not including ground support parts, which are specified in the following list shall receive magnetic particle inspection per P.S. 21201. This inspection may be performed with other magnetic particle inspections or be performed for final part acceptance.

- (a) PH13-8 Mo H900-H1000 (> 200 ksi)
- (b) 4330V (> 200 ksi)
- (c) 4340 (> 200 ksi)
- (d) HP9-4-30 (> 220 ksi)
- (e) 300M (> 280 ksi)

5.1.6 Auxiliary lead anodes shall be used for plating in holes, recessed areas, or other difficult hard-to-plate areas, when called out by Engineering drawing or other applicable specification. These anodes shall be of such size and shape commensurate with area being plated. Additional solution circulation into small and deep holes or recesses may be necessary.

5.1.7 Parts should be continuously plated to prevent delamination of the chromium deposit. If parts are pulled from the tank for dimensional checks and plating must be continued, follow the Current Interruption to Measure Dimensions Procedures listed in 6.10.

5.1.8 Parts having chromium deposits that do not meet finish requirements, shall be stripped of chromium and then replated.

5.1.9 Parts which have been removed from the plating tank and are dry and have insufficient plating or are dimensionally under size shall be stripped of chromium and then replated.

5.1.10 Parts requiring chromium and cadmium plating shall be plated first with chromium.

5.1.11 All unplated areas of steel parts shall be protected as soon as possible after plating with rust preventive compound or primer in accordance with the applicable finish specification.

5.2 TEST SPECIMEN REQUIREMENTS

5.2.1 Adhesion test panels shall be 4130 or 4340 steel, approximately 1 inch x 4 inches x 0.040 inch.

5.2.2 Test specimens for evaluation of hydrogen embrittlement relief shall be made of material which is identical in type and heat treatment to the production material, or the specimens shall be made of 4340 steel conforming to MIL-S-5000 or AMS 6414, heat treated to 260-280 ksi ultimate tensile strength. These specimens shall conform to either MCAIR Std. 6M114-1 or ASTM E292 configuration, with 0.010 ± 0.0005 inch notch root radius. The specimens shall be plated to a deposit thickness of 0.0015-0.0030 inch.

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**5.3 PLATING PROPERTY REQUIREMENTS****5.3.1 General Appearance**

5.3.1.1 The as-plated chromium deposit shall be smooth, continuous, adherent and free of blisters. Cracking in the as-plated chromium that can be seen with the unaided eye shall be cause for rejection. A uniform satin lusterless finish is acceptable. The additional requirements specified below shall be met as applicable.

5.3.1.1.1 Parts plated to dimension - The as-plated chromium shall be free of pits, nodules and frosty burned areas.

5.3.1.1.2 Parts to be ground to dimension - Pits having a depth that does not penetrate the final thickness or radius of the part and can be removed by grinding are acceptable. Frosty burned areas which will be removed by grinding are acceptable.

**5.3.2 Plating Adhesion**

5.3.2.1 Adhesion tests shall be made by bending test panels through an angle of 180° on a diameter equal to the thickness of the panel, straightening, and then examining at four diameters magnification. The coating shall be adherent and show no separation from the base metal. Formation of cracks in either the base metal or in the plating, that does not result in flaking or peeling of the plating shall not be cause for rejection.

**5.3.3 Plating Thickness**

5.3.3.1 Thickness of chromium plating shall be specified on the Engineering drawing or other applicable document.

**5.3.4 Embrittlement Test**

5.3.4.1 Four specimens conforming to the requirements of 5.2.2 shall be embrittlement relief baked in accordance with P.S. 15063, loaded in tension to 75 percent of the predetermined notch tensile ultimate strength and held at this load for 200 hours. The samples shall be considered nonconforming if any specimen fails by fracture or if any specimen is cracked. Specimens shall be inspected for cracks by penetrant inspection per P.S. 11202.

5.3.4.2 Nonconformance of any test specimen shall result in red-tagging of the tank, and no further plating work shall be conducted until resolution of the operating problems. The embrittlement relief test shall be repeated immediately.

**5.4 CHROME PLATE RUN OUT**

5.4.1 When chrome plate is applied to fatigue critical or fracture critical parts so designated by the Engineering drawing, and to high strength steel, the chrome plate termination shall consist of a run out within a distance specified upon the Engineering drawing.

5.4.2 The term, "run out", describes the transition of the plating thickness from its finished, ground surface to its termination. (Run out shall be synonymous with other descriptive terms, such as bleed out, feather out and fade out.) Run out is the decrease in plating thickness that takes place in a gradual, uniform manner to result in a tapered edge. The shape of the taper may be straight, or mildly convex, or mildly concave. Steps are not acceptable. Refer to Figure 2 for examples of acceptable run out.

5.4.3 The preferred method for accomplishing chrome plate run out is through proper masking and robber techniques during the plating process. However, run out may be accomplished by careful machine grinding, provided the plating thickness is .002 inch, or greater. Care must be taken to avoid overheating and/or grinding into the steel substrate. The shot peened surface shall not be disturbed.

5.4.4 Additional corrosion protection is required on the thinned out chrome and any bare steel remaining in the run out area. This area shall be brush plated using low embrittling cadmium plate per P.S. 13113 or other coating specified on the Engineering drawing. This protection is not required for parts immersed in hydraulic oil.

**6. PROCEDURES**

6.1 Solvent clean or vapor degrease parts in accordance with P.S. 12010, or P.S. 12020 to remove oil and grease.

6.2 Stress relieve steel parts in accordance with requirements of 5.1.3.

6.3 Remove scale and corrosion products by abrasive cleaning in accordance with P.S. 12040, or by liquid honing in accordance with P.S. 12045.

6.3.1 Shot peen steel parts, as specified by Engineering drawing.

6.4 Mask areas which are not to be plated with rubber stoppers, rubber masks, tape, or lacquer. Before dipping parts in wax or spraying them with lacquer, cover any surfaces that are to be plated with aluminum foil or tape to prevent contamination by wax, lacquer or other contaminants.

6.5 Attach parts to racks or fixtures making certain that good electrical contact has been made.

6.6 Alkaline clean parts in accordance with P.S. 12030, type as applicable for substrate.

**6.7 Pre-Plating Activities**

6.7.1 Ferrous Alloy and Stainless Steel Parts - Anodic etch parts in the "Reverse etch" solution conforming to 3.7 at 1-3 amperes per square inch using a voltage range of 4-6 volts. Parts made of 4130, 4340, or 300M steel shall be etched for 3-5 minutes. All other steel parts shall be etched for 30-120 seconds. Rinse and transfer them to the plating tank immediately. When parts are reverse etched in the plating tank, rinsing and transfer of the parts is not necessary.

ALTERNATE: Activate the parts by anodic etching for 60 seconds  $\pm$  15 seconds in the anodic etch solution (3.8) using a current density range of 4-6 amperes for each square inch of exposed metal; rinse and plate immediately.

6.7.2 Nickel-Plated Parts - Immerse the parts in the 60% hydrochloric acid solution (P.S. 12050.8) for 15 - 30 seconds; rinse and plate.

ALTERNATE: Activate the parts in the Table III anodic etch solution for 60 second  $\pm$  15 seconds using a current density range of 4 - 6 amperes for each square inch of exposed metal; rinse and plate immediately.

ISSUED  
31 JANUARY 1950  
REVISION B  
28 SEPTEMBER 1987

PLATING, CHROMIUM ELECTRO

PROCESS SPECIFICATION

P.S. 13102  
PAGE 4 OF 7

MCDONNELL DOUGLAS

FSCM NO 76301

of standard articles, and particularly where automatic plant is concerned, it is possible to make a fair estimate of the quantity of chromic acid to be added at regular intervals to maintain the concentration. However, the additions should be somewhat less than those required theoretically and the balance made up only after chemical analysis has confirmed the quantity required.

### *Trivalent Chromium*

Chromic acid is reduced at the cathode to the trivalent state, but as this product is oxidised to chromic acid at the anode, an equilibrium becomes established. The concentration under equilibrium conditions depends mainly on current density and the ratio of the cathode and anode areas. If the effective anode area is greater than the cathode area, the trivalent chromium concentration remains low. If, on the other hand, due to the shape of the part for deposition, as, for example, in internal deposition, the anode area is small, or if the anodes are not properly maintained then the trivalent chromium concentration may become quite high.

As a general rule, the concentration of trivalent chromium should not exceed  $1\frac{1}{2}$  oz./gal. Concentrations greater than this may cause pitted deposits.

The colour of the solution is a good indication of the trivalent chromium content. If the solution is transparent and orange in colour, the trivalent chromium concentration is low. If, however, the solution is opaque in thin layers and has a greenish hue, it can be assumed that the trivalent concentration is high. The necessity for chemical analysis can be judged by these means, but in any case an exact analysis should be carried out every three months.

### *The Dechromator*

As already stated, the concentration of trivalent chromium in the solution depends on the respective areas of the cathode and anode. By careful arrangement of the sequence of work treated, alternating work requiring a small anode area with work requiring a large anode area, it is usually possible to maintain the concentration at a suitably low level. If this cannot be arranged, trivalent chromium can be oxidised back to chromic acid in the solution by the "porous pot" method (Dechromator). This comprises a small cathode in a porous

container of unglazed earthenware which is hung on the cathode bar while the solution is worked at high current density and with a large anode area. The trivalent chromium in the bulk of the solution is oxidised to chromic acid whilst that formed at the cathode is retained in the pot. When the resistance of the solution in the pot becomes too high for satisfactory working it is discarded, and the operation is repeated, if necessary.

Although widely used, it is not entirely satisfactory except, perhaps, for small installations, since the liquid inside the pot tends to bubble over partly as a result of the tremendous gas evolution and partly through actual boiling resulting from the high current densities employed, so spilling back trivalent chromium into the bulk of the solution.

Another method (Seegmüller and Lamb<sup>334</sup>), which avoids the use of a porous pot, is to work the solution at a high temperature (175°F.) with a high cathode current density (550-600 amp./sq. ft.) and a low anode current density (18-20 amp./sq. ft.). A steel rod can be used as cathode in conjunction with an antimonial lead anode having an area at least thirty times as large as that of the cathode.



Fig. 202.  
Dechromator employed to reduce  
trivalent chromium concentration.

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The following numerical example indicates the speed of oxidation obtained in this way. Using a current of 6 amp./gallon of solution, a cathode current density of 550 amp./sq. ft. and an anode current density of 18 amp./sq. ft., the trivalent chromium concentration was reduced from  $3\frac{1}{2}$  oz./gal. to  $\frac{3}{4}$  oz./gal. in :

22	hours	with	solution	temperature	175° F.
41	”	”	”	”	120° F.
126	”	”	”	”	70° F.

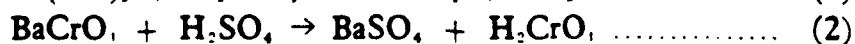
### Sulphuric Acid

The sulphuric acid concentration may decrease due to spray loss and drag-out of solution or it may increase due to sulphuric acid carried over from the etching solution or to its presence as an impurity in the chromic acid additions which are made periodically. If the parts treated have a complex shape, the greatest effect will be due to the acid carried over from the etch, and the sulphuric acid concentration of the solution will gradually increase.

The sulphuric acid content desired depends essentially on the content of chromic acid. The ratio  $\text{CrO}_3 : \text{H}_2\text{SO}_4$ , usually approximately 100:1, should not vary by more than 10-20 units from the value originally fixed. It follows, therefore, that the sulphuric acid concentration should be checked each time chromic acid is added to the solution.

If the sulphuric acid concentration is too low, the necessary extra quantity of sulphuric acid can be added as such. If the concentration is too high, the excess can be eliminated as barium sulphate by addition of barium carbonate or hydroxide. Approximately  $2x$  oz. of barium carbonate or hydroxide are required to remove  $x$  oz. of sulphuric acid.

The reactions involved in the removal of sulphuric acid are probably as follows :



Reaction (1) will take place immediately on addition, but reaction (2) will progress much more slowly as barium chromate is almost insoluble and will remain on the bottom of the vat. In order to increase the speed of reaction, it is preferable to fill the calculated



# HARD FACTS ABOUT HARD CHROME

by Clarence H. Peger, Hard Chrome Plating Consultants Ltd. Cleveland, OH

## XVII—Replating

85% good information but still some is questionable in my opinion.

The word "replating" should mean only one thing — putting another layer of chrome on an existing deposit. It's a no-no to say you are going to "strip and replate a piece." The correct terminology is "strip and plate," a procedure which can save a lot of confusion around the shop. There is also a lot of confusion about how to replate different thicknesses of hard chrome properly. It's not surprising that there are several schools of thought as to the best procedure. Unfortunately one of them is avoid doing it like sin. To *strip and plate* instead of *replating* hits you where it hurts — in the balance sheet at the end of the year.

When replating is done correctly there should be no difference in the layers and grinding through the bond zone should not be noticeable. Some shops call replating "laminating," which is also a bad term. I don't *lamine* and *neither should you*. The word "laminating" suggests two distinct layers, and is terrible public relations. As far as the public is concerned, they know laminating to mean distinct layers with a binder or space in between. Even if the piece is replated two or more times, the final result should be a solid deposit of chrome.

In the METAL FINISHING GUIDEBOOK section on replating chrome, a method is described that gives good results under some conditions but, unfortunately, poor results in others. There are too many variables that affect the outcome to have a simple rule for everything. Some of the variables are chrome thickness, whether the surface is

newly plated or ground, or a surface used in service. Other variables are anode condition, part of the surface left unplated, surface on finish size, spot plating, surface ground or plating worn through in spots, and base material.

All dictate the procedure to be used. The situation is not as bad as this sounds, but it will require a few decisions. First we tackle the basic procedure, which will cover about 75% of the replating jobs, then we take up the rest.

In all cases we want the plating to continue just as it left off. This means a warm-up period in the tank, to get the workpiece up to tank temperature. While you can plate on a chemically clean surface, an etched surface is better. Any surface that has more than 0.0015" (0.038 mm) thick chrome should be reverse etched for three minutes, after warm up, at the regular running voltage of the tank. This will remove about 0.0005" (0.013 mm) of the chrome surface and lightly etch it.

If reverse plating (etching) is allowed to continue much beyond this time the chrome will either be removed entirely or in spots, or be badly etched, which will show in the new layer of chromium. Which of these nasty things happens will depend on the chrome thickness and condition. The three-minute mark for anodic treatment in the chrome plating solution has stood the test of time of over 40 years of replating. Yes, there are exceptions, so watch for them down the page.

Because you are removing a 0.0005" (0.013 mm) thick chrome

layer, it isn't necessary to go through any involved cleaning process. You don't need an electro-cleaner, which is expensive to maintain and will slow you down. Wipe the surface with lacquer thinner and whiting powder, rubbing to remove grease and oil or other foreign matter on the surface. If the part has been used, a greaseless polishing or glass beading treatment may be in order. Get the surface clean and, even more important, keep it clean! Don't lay the workpiece on a dirty bench or scrape it on the anode when reracking it. If you get into any other involved cleaning procedure you wind up with unnecessary equipment, excessive water use, and chemical disposal problems. The wasted time and effort can be better spent on something more productive.

Warm-up time is five to 30 minutes, the actual period depending on the mass of the part. In any case, never warm up the part longer than 30 minutes. Parts heat up very quickly when immersed in a solution. So now you have warmed the piece up and reversed it three minutes. As soon as it hits the three-minute mark cut the voltage down to three volts, then turn the rack around to plating position. Slowly bring the voltage up to plating voltage, but take no longer than one minute to do this. I mean one minute absolutely, positively, so watch the clock!

The reason for the cut voltage is as follows. Especially with conforming anodes and high plating rates, the anode will plate in the reverse

Easy mistake  
Don't strip and replate  
layers of chrome

Don't

Don't  
cut voltage  
too early  
plate up

The reverse overplating by reverse etching for 15 minutes the replated to result!

cycle. This chrome will be plated very rapidly on the high current density areas when the rack is placed in the plating position. If the voltage is lowered at the start, the chromium will deposit on the piece at a more normal rate. Taking one minute to bring the voltage up is more than long enough to deplate the anode. More than one minute wastes time and may induce gas bubble pitting.

Some people recommend taking 10 minutes to bring the voltage up. If your labor is worth 50¢ a minute, a little head math will tell you what this wasted time costs, and believe me, it is wasted. To make up for the removal of 0.0005" (0.013 mm) thick chrome plus slowing down of the anode, which occurs when the anode is dormant in the tank, it will be necessary to add ½ hour to the running time.

If you are looking for these replate racks to be vigorously gassing at the end of three minutes reverse, forget it. Some will and some will not. This is not a reliable indicator that the piece has had the proper reverse treatment. How much gassing you will see is determined by several factors, such as the age and condition of the anode. A new anode will hardly gas at all while older ones gas at a variable rate as they reform.

The condition of the chrome plate also has an effect. If you replate a piece that has been just pulled out of the tank, it will begin gassing vigorously (whatever that means) in less than 30 seconds. If it's turned around with less than 30 seconds reverse, it is very likely to peel immediately or in the grinding operation. The three minutes reverse takes into account the variables for the heavier chrome deposits. You can get in trouble with large pieces that have poor contact, connections, not enough anode, and slow plating rates. Reverse will also be slow, so use four or five minutes for these. What I am saying is that you are not supposed to be plating like that anymore!

When running pieces in conforming tank anodes, it's easy to lift them and check them for size. Subtract 0.0004 (0.01 mm) per inch of piece diameter for shrinkage from

140°F (60°C) to room temperature to get the correct size while hot. Do not rinse it off, and if after a quick check it still needs more chrome, drop it back in the anode. You must reverse it again for three minutes to insure that it will not peel.

There is always some oil floating on the tank which could adhere and cause peeling if it isn't removed by reverse treatment. At that stage of the game it doesn't pay to take chances. A large shaft or roller out of the tank a few minutes doesn't need a warm up. It will take you about five minutes to get it started again, which is enough to bring it back to running temperature.

When replating thin deposits under 0.0015" (0.038 mm) thick you have a whole new ball game. Reverse times have to be shorter to prevent partially or sometimes entirely removing the existing plate. If the material is low-carbon, low-alloy steel, reversing the plate off may be the thing to do. If you reverse the plate off high-carbon, high-alloy steel, or other materials it may be *rejectsville*. Steels that can tolerate only less than one minute reverse will probably misplate where the chrome is entirely stripped off. Of course, other materials that can't stand any reverse will be a total loss if the chrome breaks through.

To avoid these problems, reverse treatment after the warm up can be from ½ to two minutes and, in special situations, no reverse at all should be done. Jobs we are talking about now would be *other than plus grind pieces*. Because of the shorter reverse times it will be necessary to clean the surface more thoroughly and maintain it in a no waterbreak condition.

For the beginners, if a surface is totally free of oil, grease or tallow, water will spread over it in a thin, uniform film. The water will bead up or refuse to cover the surface where any of the just-mentioned soils are present. To clean a surface to a waterbreak-free condition it can be scrubbed with caustic solution from the electrolytic strip tank and pumice powder. You can also use scouring powder purchased from your local grocery store. Most brands have grease-dissolving and wetting agents in them already.

I have mentioned the everpresent oil slick on the surfaces of chrome solutions. Now comes what to do about it. When putting in this type of replate work, it should go in between working racks or at the end of the tank where air agitation bubbles are coming up. You will find no oil slick at these places. A dry surface will pick up oil easier than a wet one. Putting the piece in while wet with water also helps.

How much reverse you should use will depend on the thickness of the existing chrome deposit. A rule of thumb is that you will remove 0.00015" (0.004 mm) thick chrome per minute after the warm-up period. Experience has also shown that if you are going to reverse the work at all, the minimum time is 30 seconds. To be on the safe side you would only want to remove no more than 20% because some areas may reverse faster than others.

You don't have to carry this out to the last decimal point. Close enough would be: two minutes for chrome between 0.001 and 0.0015" (0.025 and 0.038 mm), one minute for 0.0005 to 0.001" (0.013 to 0.025 mm) and 30 seconds for under 0.0005" (0.013 mm) after warm up. I had you fooled there for a minute. I bet you thought this was going to be complicated. you will be replating either thin or thick deposits and just about nothing in between.

There are several situations where no reverse treatment before replating is called for. One of these is a hold-to-size job that comes out a few tenths light. When you unrack any job, treat it as if it will have to go back in the tank. This means don't scrape the anode, remove the holding bottom or tear off the stopoff before checking the piece for size. Keep it clean, wear gloves so you don't fingerprint it and don't lay it on a dirty bench. Remembering this will save you a lot of time and trouble.

To add a little more chrome to the piece, warm it up with only the cathode hook insulated. If the anode works off the other racks, it won't slow down, so it will be easier to figure the additional running time. Keep warm-up time as short as possible, which would be about five or 10 minutes for small pieces.



If you have kept the piece clean, put it back in the tank in an area where there is no oil slick, it will not peel and the plating will be satisfactory. I have used this procedure on pieces that have gotten very rough treatment, with no failures in use. In this case you are replating on a chemically clean surface. A point I may not have made clear is that I always reduce the voltage on every replate job before the piece starts plating again.

Another no reverse situation is a 0.0003 to 0.0005" (0.008 to 0.013 mm) thick flash job that misplates (i.e. has unplated areas) in some area. By moving the anode closer, or adding more anode area and running it at higher voltage a minute or two, the unplated area can be made to plate. Here again, keep the piece clean and get it back in the tank as soon as possible. If you haven't tried to clean, polish or reverse etch, it will be very difficult to see where the missed spots were. If it is a mirror finish job, they will buff out with the rest. If you decide to change the anode and only spot plate the miss, it will be very important to enter the tank where there is no oil slick. Failure to do this will result in rainbow colors all over the chrome on areas away from the anode.

When flash plating, you can run into the situation where you have misses caused by scale left on the workpiece. Glass beading and re-entering the tank at 3V, then bringing the voltage back up, will get them covered. You may have to replate a piece that has copper or brass showing. Warm it up with the anode hook tagged and the cathode hook working on the cathode bar. *This applies to reversible racks only!*

As long as copper or brass has voltage applied, it will not eat up. Keep the warm-up time short and reverse only 30 seconds. I have spot replated many pieces that were on finish size. When the spot plated area was ground to match the other chrome, you couldn't see where it was. While this is truly replating, the success or failure depends more on the stopoff method. It is necessary to border the area to be

spotted with plastic tape or lacquer if tape isn't practicable. Aluminum tape should be positioned 1/4" back from the plastic tape edge. If foil tape is allowed to border the area, reverse treatment will pull some chrome from under the foil tape and it will never plate back. Therefore, when the spotted area is ground, a groove will remain around the area. The plastic tape edge prevents this from happening.

Pieces that have ground-through or worn-through chrome in spots can present a problem. The ground-through area is going to look different from the chrome coated area and there will be a border area that is a combination of both. The border area can look pretty sad, and its width will depend on the thickness of the chrome layer. If you are asked to plate a piece like this to size, you can't strip it first, since this would make it out of round. It would be wise to replate it to the high side or slightly over, to allow polishing out

the border area.

Knowing how to replate saves a lot of time, and time is about 95% of what you have to sell. If you strip and plate you waste the strip time, polish or polish-buff, or glass bead time, stop off and rack time. All of this can add up to many hours — expensive hours. You can hard chrome plate using any of the following types of bonding on either new or chromed surfaces: chemical, mechanical, etch bond, or some combination of the three.

For replating, a chemical bond is adequate for thin deposits not subject to high shock loads. Reversing the chrome layer produces an etched surface and the result is a combination of all three types of bond. If there is a failure, it will be the result of the first layer of chrome not being applied correctly. This in turn is usually caused by using an incorrect reverse treatment. This eases us into next month's article, titled "Reverse Cycles." MF

#### Correction

Very rarely do "gremlins" take over in laying out figures and captions for the articles. In fact, we cannot remember the last time it happened, but we regret that an error was made in the article by Robert D. Wyvill entitled "The Importance of Scab Corrosion Testing" in the January 1982 issue. The captions for photomicrographs 4B and 4C were transposed on page 23. Additionally, the table under Fig. 6, below, belongs with Fig. 5.

Element	Energy Dispersive X-Ray Analysis					
	(5A) Modified Process (Spray)			(5C) Conventional Process (Spray)		
	Weight Percent			Weight Percent		
Fe	R 78.0	σ 0.3	σ/R ± 1%	R 63.3	σ 0.7	σ/R ± 1%
Zn	13.5	0.3	± 2%	21.0	0.8	± 3%
Fe/Zn		6.0			3.0	

The two tables below should have appeared as part of Fig. 6 on page 24.

Final Rinse	Conventional Process: Spray		Conventional Process: Immersion	
	Corrosion to Scribe	Cross Hatch	Corrosion to Scribe	Cross Hatch
20	1.5 mm	7	<1.0 mm	9
18	<1.0	7	<1.0	9
15	<1.0	8	1.0	9

Final Rinse	Conventional Process: Spray		Conventional Process: Immersion	
	Scab Corrosion Total Width	Cross Hatch	Scab Corrosion Total Width	Cross Hatch
20	7.0 mm	7	2.0 mm	9
18	8.0	7	2.0	9
15	5.0	8	3.0	9

We apologize for any inconvenience caused our readers by this error.



# HARD FACTS ABOUT HARD CHROME

by Clarence H. Peger, Hard Chrome Plating Consultants Ltd. Cleveland, OH

## Bright Range—The Total Picture

If you were to plate three lots of pieces, one lot at 130°F, one at 140°F, the other at 150°F, and each piece in a lot was plated a little faster than the others, the brightness of the chrome deposits would vary, as shown in Fig. 1. The three curves in the drawing may not be precise but they are accurate enough.

There could be variations caused by the type of chrome solution, concentration differences, chromic acid-to-catalyst ratio, and anode-to-cathode ratio. In any case, there is such a vast difference in the width of these curves that nit-picking will not be allowed!

For those of you who are current density happy, each curve starts out with the lowest density possible to plate, which produces a very milky plate. As the current is raised, for each succeeding piece, plating gets brighter to a maximum then falls off to badly burnt plate. Both the 130°F and 150°F curves are extremes and shouldn't be used.

Unfortunately, most of the world's hard chrome shops have been trapped into using 130°F hard chrome plating solutions. The cost of this mistake has been untold billions of dollars wasted on excess labor, materials, chrome, energy and plant size.

The 150°F curve looks great but there are serious disadvantages to using this high a temperature. Most tank linings are short-lived including lead, and anodes suffer the same fate. Because of the high voltage and currents necessary to plate 0.010" to 0.012" per hour, contacts and the ability of the part plated to carry the current become critical in a hurry. Large parts would need huge rectifiers to supply the necessary current.

I know of one captive shop that is plating air hammer cylinders 0.012" per hour in the ID at 150°F, but that is all he plates. Most of you have job shops and it's necessary that you be able to plate holes and slots

0.040" in diameter along with large pieces in the same tank at the same time using one rectifier. The hole in this "o" is about 0.040" in diameter.

This is also not very feasible in a 130°F tank, besides all the other horrendous disadvantages. In 1945 I started writing a hard chrome plating book, and actually wrote five pages until I said to myself, "Hell, everybody knows how to hard chrome plate."

It wasn't until 1973 that I found out how wrong I was. On my vacation that year I passed a plating shop in North Carolina. I turned around and went back to see how they were doing. What a shocker that turned out to be! They were trying to hard chrome plate some shafts in what looked like a bright chrome tank.

Over in a corner I noticed some tools, molds, and dies and I asked the foreman when and where he was going to plate them. He answered, "We are not going to plate

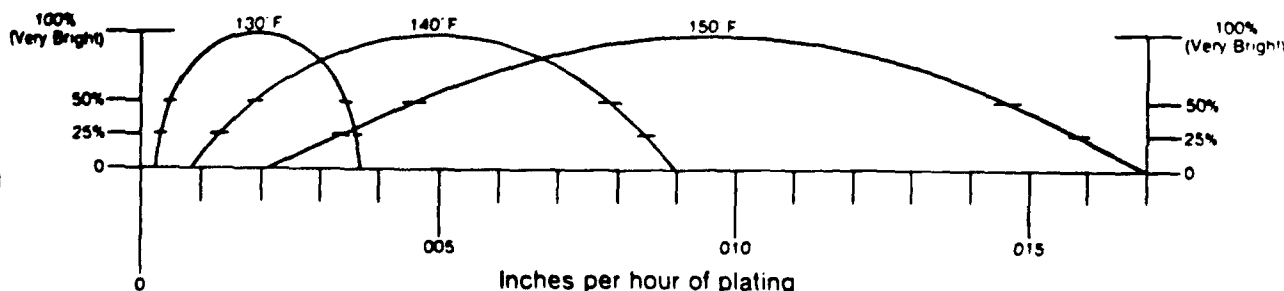


Fig. 1. Milky plate left side of curves up to the 25% point. Burnt plate right side of curves down from the 25% point.

them; they will stay there until the customer gets mad and takes them away."

A stop at three more shops turned up pretty much the same story. Upon returning home I started writing the book that should have been written 28 years earlier.

Of course these shops and probably yours are suffering from the plating by amps, 130°F syndrome. Believe me, it's not the way to plate! A look at the 130°F curve will show you why. If you don't plate at a 2 Amps per sq in (ASI) rate you're quickly in trouble. At 1 A, the piece comes out milky; at 4 A they burn up.

As if that isn't enough, the whole method is rotten to the core. At 130°F and 2 ASI, you're always fighting high trivalent levels by dummifying the tank (you can't sell the dummy rods!) or worse yet, throwing out the solution! Shafts come out with too much chrome on the ends and not enough in the mid-

die. Large flats only plate on the edges; zilch in the middle.

Have you stopped and figured out how much it really costs you and the customer to plate and grind this sloppy work? There is a long list of other bad things you have to contend with if you are plating that miserable way. Of course, how would you know if you have never seen a shop that plates at 140°F, 0.002" to 0.006" per hour rates and uses the reversible rack system.

Notice in the 140°F curve that you can plate anywhere between 0.002" and 0.006" per hour and have an acceptable hard chrome plate. I have been plating this way all my working life (since 1941 to be exact), and it's no pipe dream. There are virtually no disadvantages to plating this way. You don't abuse the solution or equipment, you get 3 to 4 times more work out of a tank, and at least twice as much productivity out of a plater. If you can't equate these things with more money in

the bank and happier customers there is no hope for you!

What gets me and your customers mad is that most of you are not shaping up (look at the drift to captive shops). Ninety percent of you really don't know how to hard chrome plate and the other 10% have a lot to learn. Stopping chrome on pieces is not hard chrome plating, nor makes you a hard chrome plater.

Chrome shops plating the hard way never seem to have time to learn anything new. No wonder—most of their time is spent spinning their wheels. The amount of plating jobs it takes you a week to do should be done in one or two days!

Quality-wise, on a scale of 1 to 10, 130°F shops are barely a 1 while 140°F shops using the reversible rack system are a 10.

Don't sit there gnashing your teeth—make me prove it. I can, you know. MF

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# HARD FACTS ABOUT HARD CHROME

by Clarence H. Peger, Hard Chrome Plating Consultants Ltd. Cleveland OH

## XVIII—Reverse Cycles

**W**hile it's possible to plate everything without a reverse cycle, the result would be a weak bond on many materials. Such a bond may survive a sliding friction application but not be adequate for thick deposits or parts subject to shock and bending stresses. Not knowing exactly how everything you plate is going to be used requires all pieces to have the best possible bond.

All pieces that can be reversed in chromic acid should be reversed in the chrome tank. A separate chrome reverse tank is a waste of time, chrome, floor space, and equipment. That's a lot of wasted money for nothing. True, a separate reverse tank will keep the plating tank slightly cleaner, but I have never found it necessary or worth the effort.

A hard chrome plater needs to know virtually nothing about chemistry and something about electricity, but much more about machine shop practices and a lot about metallurgy. A trip to your local library to read a metallurgy book or two can only be a rewarding experience. If you don't understand the metallurgy involved in the reverse cycle, everything else may be done perfectly to no avail. That means *Rejectville* and perhaps lost customers.

The tendency is to under reverse for two reasons. Because of the different combinations of alloying elements in various steels and different degrees of heat treating, the maximum amount of reverse for each alloy varies widely. Large spacing and slow plating rates re-

strict the amount of reverse you can use because you don't have the throwing power to plate even light carbon coatings.

Table 1 reverse times may be near what you use now, but in fact you may be using 1/3 as much etch as is customary in the reversible rack system of plating. For the same time, if you are plating three times faster, reverse will be three times greater. To a point this gives a more desirable bond between the base material and the chrome.

When reversing cast iron or carbon steels, you should be able to see a darkening of the surface. This will be carbon etched and drawn to the surface. However, too much carbon will weaken the bond and make the surface difficult to plate. Low-carbon steels will turn a reddish hue in reverse, while high alloy steels turn gray. If you don't know the alloy you are reversing and can check progress of the reverse cycle by looking at the surface, the above colors will tell you how much reverse to give it.

Check the surface color at the 15 second, 30 second, 1 minute, 1½, 2 and 2½ minute points if you can go that long. You don't have to look at all of these points if it's obvious that the surface isn't changing quickly. High alloy steels will turn gray between the 15 second and 1 minute points. They will show an etch quickly and it must not be overdone or the piece will not plate.

High-carbon steels will turn blackish between the 15 second and 2 minute marks depending on the percentage of carbon they con-

tain. Low-alloy and carbon steels will stay bright and only start turning slightly red at the 3 minute mark. Red turning steels can tolerate hours of reverse and still plate. If a rack is left in reverse accidentally, check the color. If it is black or gray, it will have to be repolished or ground if it's not completely scrap. If it's red, turn the rack around and plate it.

In Table 1 the first column shows AISI numbers that you will find on most complete blue prints. If the customer only sends in a small drawing or part of a larger print, the material and heat treat box may be missing. A phone call may supply the missing information.

How important this is can be clearly seen in the *seconds reverse* column. These reverse times are about 50 to 70% of the maximum reverse they will take in the average condition of heat treatment they are usually in. Metals in the annealed or soft state can usually tolerate two or three times more reverse than listed. This is another good argument for visually checking reverse progress when possible. Need I say there must be good lighting over the chrome tank?

The first of the four numbers in the standard and alloy steel columns indicate the type of steel it is. Second number is the percentage of the principal element, while the last two are the carbon content expressed in hundredth of one percent. An example is 5160, which is a chrome steel with about 1% chrome and 0.60% carbon. Table 2 shows the first number for the dif-



concentrations will only be rougher on the aluminum rack and stopoffs besides increasing drag-in to the chrome tank.

A word of caution—when pouring this much sulfuric acid into water, *it will get very hot!* Use protective clothing and eyewear and add the acid *very, very, very slowly*. If you don't use ice in, or cooling water on, the outside of the tank, it will take at least eight hours to add the acid.

Hydrofluoric acid should never be put in a glass container as it will dissolve glass in a short time. *People also!* The mixed solution will be 30% acid, so use with caution. High nickel alloys such as 680 to 690 Hi-temp, Hi-strength steels, Inconel, Hastelloy and more than 100 other high nickel alloys are reversed for 15 to 30 seconds, then put in plating position for another 30 seconds.

Give these parts a thorough water rinse, then immerse them in the chrome tank with the voltage at 3.5 V. Turn the voltage back up to plating voltage promptly.

Cobalt-containing alloys may only take five seconds reverse and Monel metal should not be reversed at all, only 30 seconds in plating position in the high nickel etch bath. This bath should be run at 4.5 V and its bus bars can be connected to the chrome tanks.

Starting with High Speed Tool Steels, letter numbers M1 through Water Hard W5 are letter numbers you will find stamped somewhere on all types of tools, punches and dies. Look for them before stopping off the part.

You should remember the A numbers are *air hard*, O numbers *oil hard* and W numbers are *water hardened*. The method of quenching steels gives you a clue as to the quantity and number of alloying elements present. Air hardened have the most, water hardened the least. Also notice that air hard have short reverses, oil hard in between, water hard the longest.

The list of materials are most of the ones you will be asked to plate. A few of them could use more explanation. Aluminum bronze is exactly that, with enough aluminum to

cause a peeling problem.

Usually your first introduction to it will be crackle chrome all over when it comes out of the tank. If it is stripped in muriatic acid, neutralized in caustic, rinsed in water, put back in the tank without polishing or otherwise touching the surface, it will plate right.

If you know it's aluminum bronze, wet the surface with caustic for five minutes, which will eat the aluminum off the surface. It will then plate right the first time.

Carbide and stellite can't be reversed in the chrome tank, as even a few seconds reverse will bring up a loose carbon layer and remove too much material. Misses and peels will result. Reverse in the caustic strip tank will give it the proper etch.

I have plated carbide cutting surfaces that held up in use, but don't recommend it. Stellite can also be reversed in the high-nickel etch bath. Ferro Tic is an alloy of carbide with one of several steels. Some of them act like a pure carbide and the electric strip treatment works. Strangely enough, if it doesn't, 45 seconds reverse in the chrome tank will.

The customer usually doesn't know what type of Ferro Tic he has, so you may have to try both procedures before you get the right one. Cheer up, you have a 50/50 chance of being right the first time!

Carburized and hardened is a heat treatment on low-carbon steels. This allows most of the part (the core) to remain soft and tough while only the surface, that has absorbed carbon, will harden. This is accomplished in one of two ways.

One method is to pack the parts in steel boxes with charcoal as the carbon source. Now you know why it's called *pack hardening*. The other method is to add carbon to the furnace atmosphere, hence the name Vapor Carb. As you can see, there is a big difference in the reverse for each one. The carbon in a vapor carb piece is easily reversed

back out so about 30 seconds is all it can stand. If you don't give a pack hardened piece at least three minutes reverse it will probably peel.

I don't know of any sure way you can tell which is which before you reverse it. The customer will only tell you that it's been carburized and hardened. It's best if you reverse these 30 seconds and look at it. A pack hardened piece will not have changed much while the vapor carb piece will have a decidedly black look. If it has been pack hardened, continue the reverse for exactly another 2½ minutes.

Cyanide hardening (sometimes called "carbo-nitriding") isn't being done very often any more, but it is another process for surface hardening. Nitrided pieces can be a problem. An alloy called "Nitroloy" is sometimes used for this process, but you may also see parts made of it that haven't been nitrided. The problem is the scale produced during the nitriding process. Too often all of the scale is not ground off and the chrome will either peel on it or the reverse will turn it black so it will not plate.

When the scale is ground but not quite removed it will look almost exactly like the base material. You need good eyesight to be able to see the slight difference in shading. The scale remaining can be quite thick and that can be another problem. If it's removed there may be many unsightly depressions. Small plastic mold core pins can almost be destroyed because so much of it is scale.

The surface that doesn't have scale on it is easily plated, so if the pieces are muriatic stripped or pickled the scale will be removed. The vapor blast or glass bead advice and only five seconds reverse hopefully will give the piece a mechanical bond on both the steel and scale without turning the scale too black to plate. This is particularly advisable on thin core pins or other thin sections. Pins thicker in diameter, ¼" on up, can be reversed 30 seconds in the chrome tank or pickled in a muriatic acid strip to loosen the scale.

This can be followed with either

glass beading or polishing depending on the finish required. Large pieces will have to be pickled. You may need to plate only a small bearing area, so before pickling, protect the rest of the part from scale removal damage. Most of these surface hardening heat treatments only penetrate the surface about 0.015" or less. If the surface has been ground undersize enough, you may be plating the softer base material.

To treat metal sprayed surfaces, use vapor blast or glass bead, no reverse. You can't strip most metal sprayed surfaces. Most are extremely porous so muriatic acid will make mush out of them and a caustic strip will load the pores with caustic, which will most likely cause it to peel. The only safe out is to have it reground if you botch it the first time.

To avoid this, wet it down while dropping it in an oil-free area of the tank. You should be aware that a metal sprayed bearing may have been turned down 0.100", plus a

series of deeper grooves have been machined into it. If you lose the metal spray, the bearing might need 0.150" or more to bring it back to size.

Table 1 is based on plain round outside diameters. For other shapes and conditions subtract the percentages shown on Table 3.

**Table 3. Factors for Reverse Cycles on Shapes from Table 1 Data**

Subtract 15% for inside diameters.  
 10% " flat surfaces.  
 20% " splines, slots.  
 80% " fluted surfaces such as taps, drills.  
 10% or more if the surface is in poor condition.

So far we have made a good dent in what you should know about metallurgy as it pertains to hard chrome plating. You should make copies of the tables, put them in transparent envelopes, and hang them near your chrome tanks. Next month, racking principles. MF

**Problems for Weiner's article — see page 95**

**Problem 1**  
Write the symbols

Aluminum	Lead
Cadmium	Magnesium
Calcium	Manganese
Carbon	Nickel
Chlorine	Nitrogen
Chromium	Oxygen
Cobalt	Phosphorus
Copper	Silver
Fluorine	Sulfur
Gold	Sodium
Hydrogen	Tin
Iron	Zinc

**Problem 2**  
Write the elements for the following symbols

Al	F	N
Cd	Au	O
Ca	H	P
C	Fe	Ag
Cl	Pb	S
Cr	Mg	Na
Co	Mn	Sn
Cu	Ni	Zn

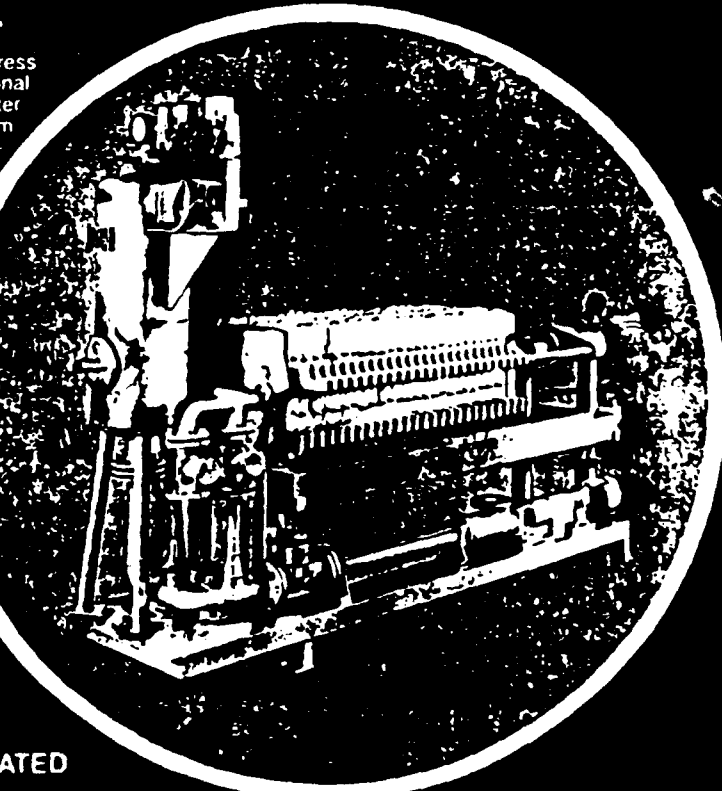
--For Answers refer back to page 95

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# FINISHING POINTER

by J.B. Mohler

## Agitation of a Plating Bath

**T**he fundamentals of a plating bath include the composition, concentration, current density and agitation. Consider each chemical in the composition, the concentration of each, the range of the current density, the effects of temperature and agitation. How long will it take to say it all about one type of bath? Too long!

Set the limits or discover the limits of a specific bath and you will have an opportunity to discover all that you need to know about that particular bath. You might set nice, comfortable, controllable limits of a cyanide bath that responds to total concentration, free cyanide, metal content and temperature.

Then along comes the energy crisis and pollution control. Now you need a new set of limits for a low cyanide bath. So it pays to know about each variable and the influence that it can have. Possibly the least of these variables is agitation, but it is worthwhile to consider what it does so that it will be taken into account when a change must be made.

R.O. Hull Sr. once expressed the thought about a chromium plating bath, that it might only be limited by the size of the bus bars. He was saying that there would be essentially no limit on the current density in a chromic acid bath if the bath composition and temperature were controlled necessary and the current density are allowed to increase in proportion to the cross sectional area of the bus bars.

He was also suggesting that usable

deposits at the high current density might be possible because of the low cathode efficiency that provided effective agitation due to profuse hydrogen gas evolution at the cathode. This bit of fantasy did not consider the problem of containing the solution in the gassing tank but it did put the potential influence of a moving solution into perspective.

Real experiences with rapidly moving solutions over a cathode surface indicate that sound metal can be deposited quickly when the solution is moved at high velocities. However, there is a limit to the rate at which the metal in the solution can be brought to the cathode surface. There must also be a limit to the current density, but Graham and Pinkerton showed, for example, that it was above 3000 A/ft<sup>2</sup> for lead deposited on a rotating cathode surface.<sup>1</sup>

High current densities applied to moving strip and wire, in continuous plating lines, also show that plating rates can be increased substantially when there is selective movement between the cathode and the solution. Imagination and facts tell us that solution movement has a great influence on the depositing metal. So it is interesting to contemplate the influence that agitation can have.

Should every bath be agitated? No! But agitation in every bath should be considered. What does it do? It allows high current densities, keeps the bath well mixed, reduces polarization at the electrodes and increases the plating range.

Agitation can be a nuisance as well

Table 1. Possible Benefits of Agitation

1. Composition: Agitation extends the plating range so that the bath may operate within wider limits.
2. Concentration: Agitation brings more metal to the cathode surface so the chemical concentration may be lowered if desired.
3. Current Density: Agitation may allow an increase in current density as an alternate to a lower bath concentration.
4. Temperature: Agitation will promote an increased response to automatic temperature control.
5. Anodes: Agitation reduces anode polarization and aids anode corrosion.
6. Cathodes: Agitation may allow operation at a higher current density.

as a boon to the plater. It can disturb the sludges on the anodes and on the bottom of the tank. It can carry sludge to the work where it will cause rough plating and it can increase the plating of noble metal impurities in the bath.

A hot bath such as an alkaline tin bath will keep itself adequately mixed by thermal convection. A low efficiency bath such as a copper cyanide strike will keep itself mixed by electrolytic gassing. A moderately warm, relatively high efficiency, bath such as represented by bright nickel, will respond to mild agitation.

Without agitation the bath will suffer a loss in plating range due to diminishing concentration in the vicinity of the work. This is often avoided with cathode rod agitation that replenishes the depleted solution (cathode layer) by movement of the cathode.

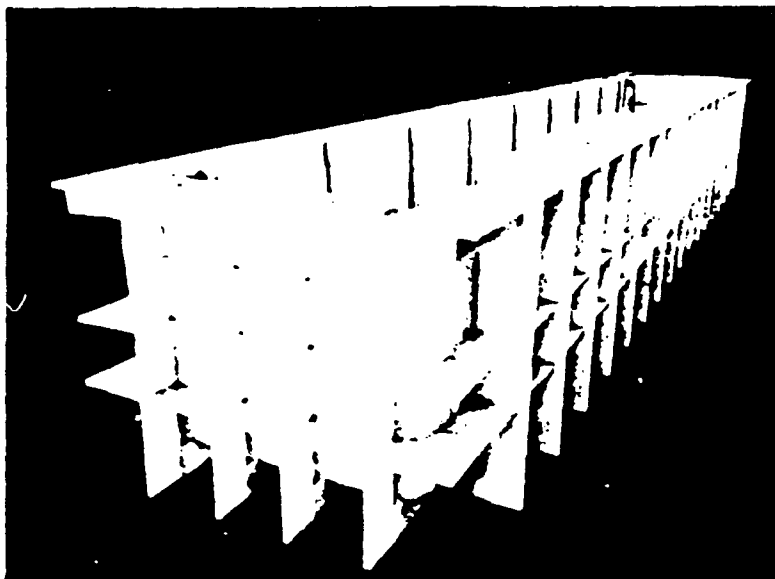
Increasing metal concentration in

(Continued on page 84)



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one form to another. How does this apply to our shop?

If we buy 100 lbs of nickel, 100 lbs of nickel must go someplace. Some of it goes on the parts as an electroplated coating. This will give us a good day. If the plater forgets the water hose in the nickel tank on Friday afternoon, the solution will go down the sewer. Nickel is neither gained nor lost to the world but it is lost to the plating shop. Also the allowable limits of the effluent will be exceeded.

So we lost money for the nickel, the cost of fines for the effluent and Monday the tank will not plate. Fumes could waste nickel in a similar manner. Don't you think Sonny will learn some useful things as he studies chemistry?

Next we will discuss the Law of Conservation of Energy. This states that under ordinary conditions energy can be neither created nor destroyed, but only changed from one form to another. The various forms of energy are heat, mechanical, electrical, light, sound, and chemical. Great, but what does this mean to the finisher? One example will explain the significance.

If a plater in "Rejectville" on a bad day—Friday—leaves a heater on in a hard chromium tank, energy is not wasted. The electrical energy keeps heating the solution, the tank and the surrounding air. No energy is wasted to the world, only to "Rejectville."

Now walk through your metal finishing shop. Use the chemistry you have learned. The Laws of Conservation of Matter and Energy mean chemicals can be used or wasted. We can account for all the chemicals and energy. We can use more of the chemicals and the energy and waste less.

In subsequent articles we will explain chemistry and discuss how we can apply chemistry to improve the quality of your finishing, and go down the "Cause-Effect Highway" to beautiful "Profitland" and Good Days. MF

### References

1. L. Pearce Williams, Michael Faraday Library of Congress Card Number 65-19542, p. 22
2. Milton Weiner, Good Days — L. Days: Energy, Metal Finishing, 79, 3 March 1981, p. 39

## 10. ANODE REACTIONS

### *Oxidation of Trivalent Chromium*

In a chromic/sulphuric acid solution, trivalent chromium is formed at the cathode during electrolysis and is oxidised to chromic acid at the anode, where oxygen is evolved. Such oxidation is a function of the nature of the anode and its surface area. The nature of the anode and its surface area in relation to cathode conditions must be such that the trivalent chromium (chromium chromate) content remains stationary at  $\frac{1}{2}$ - $1\frac{1}{2}$  oz./gal., otherwise the solution may become useless due to increasing resistance following loss of free chromic acid.

Use of an insoluble anode is essential since soluble anodes, *e.g.*, chromium metal, dissolve rapidly and do not allow oxidation of trivalent chromium. Antimonial lead (6-8% antimony) is most commonly employed and the greater the anode area, the greater the oxidising effect. That the material of construction is more important than the anode area is demonstrated by the work of Haring and Barrows<sup>10</sup>. Solutions containing 43 oz./gal. chromic acid and a fairly high initial concentration of chromium chromate were operated with lead and iron anodes and with anode:cathode areas of 1:3 and 3:1, at 113°F. with a cathode current density of 90 amp./sq. ft. The results are summarised in Table I from which the tremendous increase in chromic acid final concentration following the substitution of lead for iron anodes, will be obvious.

Table I. Effect of Nature and Surface Area of the Anode on the Oxidation of Trivalent Chromium.

Anode : Cathode Area	Anode Material	"Free" Chromic Acid	
		Before Electrolysis	After Electrolysis
1 : 3	Lead	84	95
	Iron	84	50
3 : 1	Lead	84	98
	Iron	84	65

Table IV. Plating Speed (in Thousandths of an Inch per Hour)

Current Density A/in <sup>2</sup>	Sulfate Bath			Mixed Catalyst Bath		
	110°F	130°F	150°F	110°F	130°F	150°F
1.0	0.43	0.31	0.30	0.48	0.43	0.38
2.0	1.06	0.80	0.75	1.24	1.20	1.1
3.0	1.75	1.40	1.24	2.1	2.0	1.9
4.0	—	2.06	1.82	—	2.9	2.8
5.0	—	2.78	2.44	—	3.8	3.7
6.0	—	3.54	3.08	—	—	4.5

phase may go out. While in other plating baths this may not produce defective work, in chromium plating solution, a dull plate would be obtained immediately along with a reduction in thickness. As discussed previously, the mixed catalyst baths are less sensitive to AC ripple problems than the conventional sulfate bath.

### ANODES

In chromium plating, an insoluble anode is used since chromium is replenished by the addition of chromic acid. Iron anodes have been used but are not generally suitable because they add iron to the bath and allow the build-up of trivalent chromium. Platinum has had limited success but also allows the build-up of trivalent chromium in solution. The universally used material is lead or lead alloy, especially 7% tin, which oxidizes the trivalent back to hexavalent chromium during electrolysis.

The reaction at the anode is dominated by the formation and release of oxygen, but a side reaction is the oxidation of trivalent chromium when it is present. During use, lead dioxide forms on the surface of the lead and the anodes occasionally may be cleaned by electrolyzing outside the plating tank, by soaking in special cleaning solutions, or by scrubbing. Often the anodes can be activated by electrolysis before each use. The important thing to watch is that the resistance on the anodes does not rise as they age due to scale buildup.

The ability of the lead anode to keep the trivalent chromium at about 0.5 oz/gal or less is dependent on keeping the lead anode active and the ratio of anode to cathode area above 1:1 and preferably above 1.5:1. As the ratio is lowered to less than 1:1, the tendency for trivalent chromium to accumulate in the bath increases sharply. If the amount rises above about 1 oz/gal problems become significant. Above 2 oz/gal, the problems get progressively worse until the bath becomes unsatisfactory for use. These problems include burning or rough chromium deposits at high current densities, possibly a brown film at low densities, and definitely a tremendous decrease in bath conductivity so that only low currents are obtained at full tank voltages.

*2401 is best*

If the type of plating requires that the lead anode area be less than the cathode area, then auxiliary electrolysis may be required. This may be done in the same tank if time (e.g., overnight) or space are available, or it may be done in a separate tank. The anode area may be 20 to 30 times the cathode area (e.g., a small cathode with regular tank anodes) to increase the rate of oxidation. Raising the temperature to 130 to 150°F and solution agitation are also beneficial.

Care and control of anodes rank with control of solution chemistry and operating conditions for successful chromium plating.

### FIXTURING AND RACK DESIGN

For both decorative and engineering chromium plating, careful attention is required for fixturing and rack design. The techniques for decorative plating, with its very thin deposit, are very different than those for engineering plating, with its much thicker deposit. In engineering chromium (hard chrome), a major objective is to obtain very

## 21. ANODES

### *Anode Materials*

Pure lead anodes may be used but it has been found that they are attacked by the solution and form excessive amounts of lead chromate. The most common anode material is a lead alloy containing 6-8% antimony which is mechanically stronger and more resistant chemically. Alloys containing about 7% of tin are also in commercial use and are preferred in solutions containing fluorides. Lead anodes with small percentages of silver or tellurium have been the subject of experiment but have not been adopted in practice.

Which ever material is employed, purity is of the greatest importance. In the case of un-alloyed lead, the electrolytic material, 99.99% pure, is generally employed. Antimony must also be pure and free from arsenic<sup>33</sup> which may cause rough deposits even when only traces are present.

There is a tendency for lead anodes to warp and bend during use and since this must be avoided at all costs in hard chrome deposition, which relies on accurate anode-cathode positioning, it is customary to employ anodes which are either corrugated or else are provided with thick beaded edges to provide added stiffness. There does not appear to be any justification for the claim which is sometimes made to the effect that corrugated anodes improve throwing power. Where a more rigid type of anode is required, steel covered with antimonial lead may be used and for higher conductivity, copper similarly covered.

Although oxidation of trivalent chromium does not take place on a platinum surface, this metal can be used for deposition in small holes.

Chromium anodes are not satisfactory as they dissolve anodically to the trivalent state and there is no possibility of oxidation to the hexavalent state. Some shops hang an anode on a cathode rod when plating small areas. This is a practice which is not to be recommended because, if the anode becomes coated with metallic chromium

and is then replaced on the anode rod, it leads to the production and accumulation of trivalent chromium in the solution. A scrap cathode can be used instead. Steel, nickel and aluminium do not give good results for similar reasons. However, pure iron, electrolytic iron or armco iron may be used. Such anodes corrode less than steel but they are not satisfactory for continuous use as they give rise to a high concentration of trivalent chromium and iron in the solution. Anodes for use on internal surfaces or to conform to complicated shapes may be constructed from soft iron wire and electro-deposited with lead before use.

### *Anode Area*

The anode:cathode area has been variously recommended as 2:1, 1:1, and 1:2. Which is the best to use depends on the conditions under which one is operating. All these recommendations can normally be complied with in the case of deposition on exterior surfaces which permits some flexibility in the anode arrangement. In the case of internal deposition, it is often impossible to do so as the shape and size of the anode are conditioned by the surface to be plated. If the anode area is too small, the regeneration of chromic acid will be insufficient and the trivalent chromium content may rise to dangerous proportions.

A practical method for overcoming such difficulties is to arrange for alternate internal and external deposition. In addition, the anode area can be increased during deposition on external surfaces. Alternatively, the solution can be regenerated by working with a large anode area whilst isolating the cathode by means of a porous cell which prevents trivalent chromium from migrating to the main solution (see page 469).

Where there is sufficient room, build-up of trivalent chromium and anode polarisation can often be avoided by cutting corrugations in the surface of the internal anode or by burning strips of lead on to its surface to increase the anode surface area. Thus, in plating cylinder liners, it is usual practice to cut a fairly coarse thread on the face of the anode. Care must be taken to ensure that the depth of thread or thickness of such additions is not too great. Otherwise, in view of the short anode : cathode distance, rarely exceeding  $\frac{1}{2}$  in., such variations may be reproduced in the thickness of the deposit.

## *Anode Maintenance*

During deposition, antimonial lead anodes become covered with a layer of black lead peroxide ( $\text{PbO}_2$ ) which protects the surface from attack and assists oxidation of trivalent chromium. When new anodes are first put into use, it is best to pass current immediately until the protective layer of lead peroxide has been formed. Whilst antimonial lead anodes are insoluble in chromic acid, they may become covered with a layer of yellow lead chromate ( $\text{PbCrO}_4$ ) if left in the solution when current is not being passed. This layer is an insulator and may upset the current distribution. It should be removed either by brushing or by dissolving in a solution of sodium chloride acidified by the addition of a small quantity of hydrochloric acid (Salauze<sup>23</sup>) or by electrolytic cleaning in a 10% caustic soda solution at 160-175° F. with a current density of 100-300 amp./sq. ft. (Bilfinger<sup>24</sup>).

The lead chromate coating may also be converted readily to peroxide by working the anode hard, that is, at a high current density for half an hour or so using scrap cathodes.

It follows that it is good practice to take the anodes out of the solution when the vat is not being used. They should be swilled, brushed with a fibre or bristle brush, swilled again and allowed to dry. They can then be put into use again immediately plating is to be resumed since this treatment does not impair the peroxide coating. The change from brown or black to yellow is also a good indication of which anodes are working (making good contact) and which are not.

acid which may be dragged in from nickel baths, and the list of other "complexing agents" is legion. A method of determining the relative strength of complex fluoride catalysts by means of the rate of solution of aluminum has been patented [87].

An unexpected behavior of solutions catalyzed largely with fluoride or silicofluoride is that the current efficiency increases with increasing chromic acid concentration in the usual commercial range, whereas in sulfate-catalyzed baths the reverse is true. This behavior is portrayed in Figure 8.

#### NOTES ON OPERATION

##### ANODES

Lead anodes, insoluble in chromic acid solution, are almost always used in chromium plating from chromic acid baths. The film of lead dioxide which forms on these anodes during use causes the chromium(III) to be reoxidized continuously to chromic acid, thereby keeping its concentration at a low value.

Anodes of chemical lead can be used; but, as compared with lead alloy anodes, they are much more readily attacked by the solution and cause the formation of excessive amounts of lead chromate sludge. Antimonial lead is preferable to chemical lead because of its greater corrosion resistance and strength [88]. Lead-tin alloys have high corrosion resistance and are widely used [89].

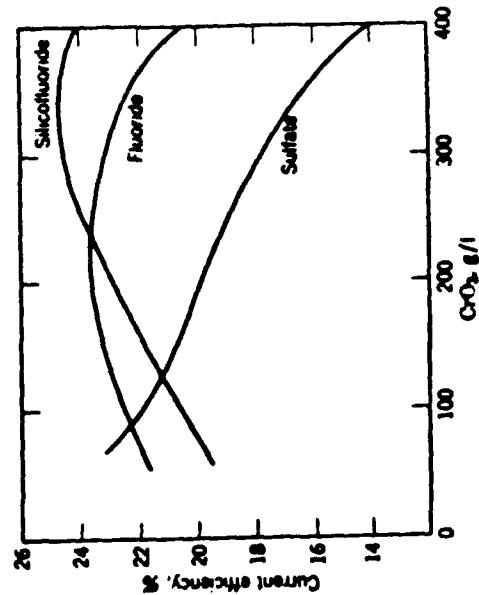


Fig. 8 Current efficiency versus CrO<sub>3</sub> concentration. (Bilfinger [84])

Some workers also recommend lead-silver alloys [90-93], but they are expensive. However, various combinations of silver with tin, antimony, or both are useful, and are available commercially.

Lead and lead-alloy anodes of varying cross section have been proposed from time to time. It is important to use thick enough anodes to conduct the high currents required. Anodes that are too thin will overheat in use and tend to corrode and warp excessively. Cibulskis and co-workers [94] avoided this difficulty by the use of solid round lead anodes. These aid in securing good current distribution because considerable current can come from the back as well as the front.

Many anode materials other than lead alloys have been tried, but nothing better has been found [5]. Pure iron, such as Armco or electrolytic iron, is corroded less as anode than steel, nickel, stainless steel, or similar alloys. Iron anodes have occasionally been used, particularly in industrial chromium plating, in special instances where greater strength and rigidity than are obtainable with lead are desired. Their continued use, however, leads to the accumulation of iron and chromium(III) in the bath. Where iron anodes are used, it is recommended that they be coated with lead whenever feasible. Small platinum wire anodes can also be used for special purposes, such as plating the inside of very small openings, like those of wire-drawing dies.

Auxiliary conforming anodes are sometimes used through the complete cycles of decorative plating to get improved coverage on difficult shapes, or more uniform plate distribution on significant surfaces where a minimum plate thickness is required, as for the production of microcracked chromium. Pure nickel anodes are perhaps the best for this service, and cast nickel is sometimes used to produce a number of anodes of a special shape. Platinized titanium anodes are also used for this service, but have the disadvantage of a limited life and insufficient indication of when they are becoming inoperative, except for increasing rejects. Nickel dissolves slowly in use and can be replaced when visibly worn away.

Lead anodes used in chromium plating cannot have too heavy or irregular a coating of lead dioxide on them, or the current distribution may be affected. It is customary to clean anodes regularly, especially those used in heavy hard chromium plating which conform closely to the article being plated. The cleaning is done by means of acid dips and scratch brushing but is difficult and time-consuming, and frequently not all the semiconsulating coating is removed. Hyner [95] developed the method of electrolytic reduction of the coating to metallic lead by cathodic treatment in an alkaline pyrophosphate solution. Alkaline immersion dips are also used [96, 97], but they are not as powerful in their action.

Lead anodes coated with lead dioxide tend to become "passive" after



# HARD FACTS ABOUT HARD CHROME

by Clarence H. Peger

## VI—Lead for Hard Chrome Plating

At one time all of the conforming anodes used for hard chromium plating were made of 6% antimony lead. Because of the advantages and general superiority of cast lead we now only make small anodes, that can't be made from cast mats, out of rolled sheet lead. With 1/2 inch anode to cathode spacings, the lead has to be stiff. Tin-lead is too soft and shouldn't be used. Antimony is a relatively hard and brittle metal and a small percentage has a strong hardening effect on lead. In the form that you can buy it, you only need hit it with a hammer to make smaller pieces.

Now 6% antimony rolled lead will plate at a certain rate for about 60 hours. Then, rather suddenly, it will drop down to about a 10% slower rate. There seems to be something about the rolled skin that allows it to plate faster. Scraping the anode down to clean lead will not bring back this faster rate. I have not seen this happen when using cast lead anodes.

Rolled or extruded lead will develop large hard flakes in a plating solution. These can cause rejects if they fall on a shoulder and stop off part of the surface being plated. It is easy to keep small anodes brushed clean. They should be brushed after the last use while still wet. Cast lead doesn't form flakes because the oxide remains in small grains. This is one reason this type of lead plates so well. The fine texture of the oxide layer also allows it to reform quickly to plating condition after it has been dormant in the tank for a while.

Cast lead mats are made out of scrap lead (see Figure 1). If all your scrap is 6% antimony, it should be mixed with some junkyard lead scrap. 6% antimony lead age hardens quickly and tends to become too brittle. Addition of about 60% junkyard scrap makes it more suitable for anodes. A barrel of junkyard lead usually contains many alloying elements



(Photograph by the author, courtesy Simmons Plating & Metal Finishing, New Orleans, LA.)  
Figure 1. Bright chrome tank anodes made of scrap lead mats.

with the lead.

What the final alloy of any particular mat is doesn't seem to make any difference as regards to its plating characteristics. There will be some variation as to how fast it age hardens. Conceded, in a lab you can prove some alloys plate faster than others. We won't nitpick this point because we don't plate in a lab but in a job shop. What I am telling you here gets the job done at the lowest possible cost under job shop conditions.

### LEAD FOR HARD CHROME PLATING

If the mats are to be bent or formed, this should be done as soon as they cool after casting. In a few hours it may be impossible to bend them without breaking them. Always bend them around a pipe or form them on the piece to be plated, using a wooden paddle. The lead mats can be made a

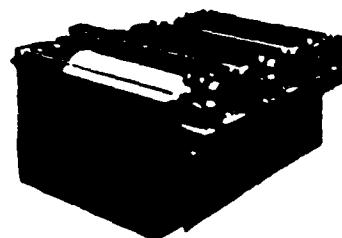
head of time and at a later time be put in an oven at 375°F for a couple of hours. This will anneal the alloy and make the anodes bendable again for an hour or so. Small anodes with small radiuses (or radii) should be made from thin mats. Just cover the bottom of the mold when pouring. Large anodes should be made with full mold thick mats.

The design of the lead mat mold is important. If the holes are too big it will show up as a waffle pattern in the plated piece. If the holes are too small, you lose throwing power. If the lead ribs are too small, the mats will not be able to carry the current for large anodes. If the mold is made too big it may be impossible to unmold the mat. Making the best possible mold is not simply like running a milling machine over a piece of metal.

My visits to plating shops have

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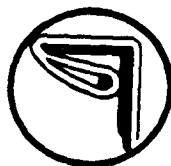
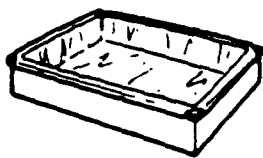
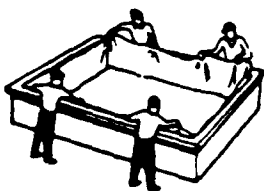
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shown me far too many of you are trying to make anodes using soldering irons, plumber's acetylene air torches, and are using flux. These are extremely bad tools for "burning" anodes together. Even if the anode holds together long enough to plate the job, it will fall apart sooner than later.

To make good, long lasting anodes, use a light weight torch with 0 and 00 tips, fueled by either acetylene, butane, or natural gas with oxygen. Professional lead burners use hydrogen gas, but for you this isn't necessary. Natural gas is the easiest and cheapest fuel to use. Do not use flux of any type. Just be sure the edges to be joined are scraped clean. If the fit between pieces isn't good, use a strip of the lead you are using for the anodes to fill in the crack.

In most cases this shouldn't be necessary. Use a small blue flame. Too much oxygen will give the flame a harsh white look; too little, a yellow look. It is better to start with a flame that is too small than to melt too much lead. Do not move the torch around and heat a wide area. The flame's inner cone should just touch the seam and move along it as the lead melts together. *You positively, absolutely, must wear eye protection!* Even skilled lead burners can have the lead spatter under certain conditions. **BE SAFE, NOT SORRY!**

Properly made scrap lead mat anodes will plate faster than rolled or extruded lead of any kind. They will hold their shape even when used to make huge anodes. There are a few anodes you can't make from lead mats — for these you can use 5 or 6 lb lead. The strip that goes from the working anode to the rack anode clamping bar is made of 12 lb. rolled 6% antimony lead. This is easily bent so the anode can be positioned correctly. You will also need 1/16, 1/8, 3/32, 1/4, and 1/2 inch 6% antimony lead wire to make ID anodes. Scrap lead is selling for about 40¢ a lb, while new lead is \$1.50 a lb. A better anode costs less.

Here goes another dragon: Never, never dummy run new anodes! A new lead anode will do its best plating when it is new, before it gets an oxide coating! How do I know? I have made and used thousands of new conforming and tank anodes of all sizes. The first few pieces plated just as good if not better than pieces plated after the oxide film formed. If your experience has been different, you should have blamed your cleaning or etch cycle. Next month I will discuss chrome plating solutions. MF

25072 1.17.65 F. J. ...  
 H. R. ...

TABLE 12. CHROMIUM (BATHS)<sup>a</sup>

Composition	1		2		3 <sup>b</sup>		4	
	g/L	oz/gal	g/L	oz/gal	g/L	oz/gal	g/L	oz/gal
Chromic acid, CrO <sub>3</sub>	248	33.0	398	53.0	338	45.0	180-225	24-30
Sulfuric acid, H <sub>2</sub> SO <sub>4</sub>	2.5	0.33	4.0	0.53	2.2	0.29	0.9-1.1	0.12-0.15
Ratio <sup>c</sup> CrO <sub>3</sub> / H <sub>2</sub> SO <sub>4</sub>	100:1		100:1		155:1		200:1	
Catalyst	—	—	—	—	—	—	0.5-1	0.07-0.13
Conditions <sup>d</sup>								
Temperature, C (F)	43-49	(110-120)	43-49	(110-120)	55	(130)	38-49	(100-120)
Current density, A/dm <sup>2</sup> (asi)	10-22	(0.7-1.5)	10-22	(0.7-1.5)	15-36	(1.0-2.5)	15-36	(1.0-2.5)
Cathode efficiency (approximate)	13-18		13-18		13-18		16-24	
Volts	6-12		6-12		6-12		4-12	

Agitation is not generally used. Filtration is uncommon. Anodes are usually lead or a lead alloy used in the ratio of 1:1 to 2:1. Catalysts are usually fluoride compounds of one type or another. Self regulating baths use a fluoride with limited solubility present in excess so baths must be stirred occasionally to ensure solution of the required catalyst. Silicofluoride catalysts give the highest efficiency. Trivalent chromium is usually required for proper operation of the bath and is usually maintained at about 1% of the chromic acid concentration.

Suitable materials of construction: 1, 5, 9, 10, 14, 15. (Also see Ref. 2.)

Use: Bright decorative deposits 0.01-0.03 mil in thickness. Hard deposits for wear resistance 0.1 mil and heavier.

Applications: Decorative coating over copper and/or nickel protective coatings on all basis metals. Industrial or hard coatings over ferrous basis metals for tools, dies and gauges. Also for surface protection of electrotypes, engraving plates and other items. Porous coating for improved lubrication, wear and corrosion resistance of piston rings and cylinder liners.

References: 1, 2, 22, 23, 24, 28, 56; 25, 26, 27, 28

Problems with chromium plating generally revolve around proper brightness and covering power for decorative baths. These problems can usually be ascribed to one of three classes of causes:

**Improper operating conditions:** This includes deviations in current density, temperature, bath composition, particularly bath ratio, trivalent chromium levels or contamination with iron, copper or nickel. At the present time there is no generally simple way of removing metallic contamination. Specially constructed ion exchange units using carefully selected resins may be used in some cases, but it is far better to avoid contamination.

**Improper current control:** This includes inadequate or excessive current densities, excess ripple in the current supply, interruption of the current during plating, and stray currents.

**Improper preparation of substrate:** This includes inadequate activation of nickel or nickel iron, inadequate cleaning, etc. Nickel plated parts from solutions with excessive brightener levels can cause "rainbow" in the low current areas; stripped parts improperly activated before rechroming will not cover properly, etc.

Because of the high current densities involved, and the generally poor throwing power of the chromium solutions, racking of parts is particularly important. Racks must be of adequate cross-section, and use of auxiliary anodes, or thieves and/or shields may be necessary for complete coverage. Proper maintenance of racks is also important for the same reasons. Additionally, chromium is a serious contaminant for most plating solutions, and improperly maintained racks can carry solution from tank to tank, causing severe problems.

<sup>a</sup>Proprietary baths are also available (see Ref. 2, Chapter 6).

<sup>b</sup>Bath ratios of 80:1 to 120:1 are not uncommon (see Ref. 2 for discussion of F<sup>-</sup> and SiF<sub>6</sub><sup>2-</sup> catalysts).

<sup>c</sup>Temperatures from 70 to over 150 F with variations in cathode current densities from 1.5-8.0 asi and cathode efficiencies between 10 and 20% are possible. For bright deposits the exact values must be carefully controlled and related (see References for detailed information).

<sup>d</sup>Non-proprietary crack-free process.

Inidium  
 In<sub>2</sub>SO  
 Sodium  
 Na<sub>2</sub>SO  
 Indium  
 InCl<sub>3</sub>  
 Potassiu  
 Potassio  
 Dextro  
 C<sub>2</sub>H<sub>12</sub>  
 Indium  
 In (B  
 Ammor  
 NH<sub>4</sub>I  
 Fluobo  
 HBF  
 Boric a  
 By ana  
 Indiu  
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is eliminated. Stainless steel is usually preferred as an insoluble anode, but hard carbon, "Ni-chrome," and "Duriron" have also been used.

**Iron.** Anodes for iron plating are high-purity forms such as low-carbon "Armco" ingot iron, wrought iron, or Swedish iron, usually in the form of chill-cast or rolled slabs. The iron dissolves chemically in these highly acid baths. Bags of "Vinyon," "Dynel," or blue African asbestos are a necessity to prevent roughness.

**Lead.** "Chemical Grade" lead is used for soluble anodes in lead plating. The ASTM (B29-49) specification for this material is:

Pb, min.—99.90%	
Ag—0.002-0.020%	Zn, max.—0.001%
Cu—0.040-0.080%	Fe, max.—0.002%
As + Sb + Sn, max.—0.002%	Bi, max—0.005%

Sheet lead may be used as anode; cast forms are also available with rectangular, multi-edged, or corrugated cross sections and with positive-contact hooks cast integrally with the anode or soldered into a hole in the top. Sheet lead is best supported by bolting between two bus bars.

Insoluble lead anodes are universally used in chromium plating and also find other applications in acid copper and sulfate nickel plating and as electrodes in electropickling, electropolishing, and anodizing.

In chromium plating pure lead anodes are attacked by the bath when the current is off; therefore the more resistant alloys with about 6 per cent antimony or tin are used. A small loss due to chromate formation cannot be avoided, and the anodes do not last indefinitely. The rate of chromate formation is lessened, and the desirable reoxidation of trivalent to hexavalent chromium in the bath is favored if the anode has a film of brown lead peroxide on its surface. This may be formed by anodic treatment in a sulfuric acid electrolyte overnight or for several days. It will be converted to chromate when the chromium bath is idle but will reform, with some loss, when the bath is again used. The reoxidation of trivalent to hexavalent chromium is also favored by a large anode area, and many special anode cross sections, some of them patented, are available. These may be ridged, ribbed, corrugated, or multi-edged. One study<sup>28</sup> has indicated that round cross sections are preferable to flat or oval shapes in that the entire

anode surface is active. It was also shown that there was little difference in performance between rod and tubular anodes of the same outside diameter; the latter represented a saving in weight of 25 to 40% for the 1½ to 2 in. sizes. Anodes made by casting lead around a steel or copper core are also available. These have added strength, rigidity, and conductivity and are necessary when very long anodes are used and in other special applications. Lead-plated copper rods serving as anodes in the chromium plating of gun barrels has been described<sup>22</sup>. Flame-surfacing the lead anode prior to use allegedly improves its resistance to attack by the chromium bath<sup>8</sup>. A case alloy lead anode, containing 1 per cent each of tin and silver, is reported to perform best in a continuous strip plating line for chromium (see Chapter 27).

Although lead peroxide has a conductivity approaching that of metals, too heavy or irregular a coating may interfere with proper current distribution, especially when closely conforming anodes are used as in hard chromium plating. It is therefore customary to clean the anodes regularly, which is usually done by means of acid dips and scratch-brushing. A less tedious method has been patented<sup>20</sup> involving cathodic treatment in an alkaline pyrophosphate solution said to reduce the peroxide to lead.

Lead anodes are frequently called upon to carry heavy currents, and they must be thick enough to do so without overheating, which warps them and causes them to corrode excessively.

**Nickel.** Typical analyses of the various forms of nickel anodes available are shown in Table 2. The anode polarization of nickel increases and the evenness of corrosion in a given solution decreases with increasing purity of the anode and with the amount of mechanical work, i.e., rolling or forging performed on it. However, oxide additions, as in the depolarized anodes, increase the activity markedly. Rolled depolarized high-purity anodes corrode evenly and well in all modern nickel solutions.

Cast-carbon and rolled-carbon anodes do not corrode satisfactorily in solutions above pH 4.6<sup>6</sup>. The carbon and silica contents of these anodes form a film on the anode surface which retains loose nickel particles long enough to permit them to dissolve; otherwise an intolerable amount of sludge containing much valuable undissolved nickel would be formed. This was the principal objection to the low-carbon, low-



# HARD FACTS

## ABOUT HARD CHROME

by Clarence H. Peger

### III—Anode Spacing and Design

**I**t's a simple fact that the closer the anode is to the surface to be plated, the more control you will have over where the plating goes. It's also true that you can plate faster and at lower voltages when you use closer spacing. The first shop I worked in used  $\frac{3}{8}$ " between the anode and cathode as their standard spacing. Tank voltage was 4.2 V and solution temperature, 140°F.

This, without a doubt, is the very best way to hard chrome plate. The only drawback to this close a spacing is that you need workers with good eyesight who will see to it that the piece is centered with respect to the anode. With this spacing you can "hold to size" plate a larger variety of work. Using  $\frac{3}{8}$ " spacing we plated pistons that were tapered 0.0005" because of grinder error. After 0.003" plate they were in tolerance, +0.000 - 0.001, without any taper at all.

Using  $\frac{1}{2}$ " spacing and 4.4 V, you can plate just as fast, but lose some control over where the plating goes. Unless you do a lot of "hold to size" production work, the  $\frac{1}{2}$ " spacing, 4.4 V system works out fine. You will be trading off some plating thickness control for easier setups and larger pieces that can be run with conforming anodes.

Another example of plating thickness control is a production job that needed 0.0008" thick chromium. When using tank anodes the plating on a piece varied from 0.0002" to 0.0015" with running time of 75 min. Plated in a reversible rack with  $\frac{1}{2}$ " spacing, 0.0008" plate with variation of 0.00003 total was produced. That's right, there are four zeros in front of that three. Hey! It gets worse, running time 23 minutes!

In this series of articles we are discussing the best possible way to plate smaller pieces such as tools, dies, molds, machine parts, etc. and OD's and ID's to about 16" diameter. It is

difficult to draw a line to limit the size because many of the parts plated this way are much larger than 16" diameter. As anodes are made larger it becomes more difficult to maintain  $\frac{1}{2}$ " spacing. The larger pieces are mostly OD's, ID's, and large flats. These are plated with 1-3" spacing at 5.5 or 6 V. More about this type of plating in future articles.

My experience is that the volume of reversible rack type of work should be about 85% of the jobs taken in by a job shop. A few jobs will be done with tank anodes, but this is a sloppy way to hard chrome plate.

Now we come to the exceptions to the  $\frac{1}{2}$ " spacing rule. ID's as small as  $\frac{1}{8}$ " can be plated using  $\frac{1}{8}$ " dia lead wire at 4.4 V. This is only a  $\frac{3}{8}$ " spacing, but the anode to cathode ratio is 1:4, which limits the plating rate to 0.006" an hour on the diameter. This is about the smallest practical hole size that can be plated at 4.4 V, together with the other work. Methods of reducing the tank voltage to accommodate one or two racks, and anodes used to plate holes and slots as small as 0.040" dia are the subject of another article.

The smallest OD anode should be 2 $\frac{1}{2}$ " dia. An anode this size will plate a  $\frac{1}{4}$ " dia. rod 0.006" per hour on the OD. Here again you have more than  $\frac{1}{2}$ " spacing, but the anode to cathode ratio is 10:1. What saves the poor little  $\frac{1}{4}$ " dia rod from burning up is the increased spacing. If you plate very fine wires, it's better to use lead wire anodes to reduce the amount of anode surface. You could go to a 6" anode, but the wire wouldn't plate as evenly. The 2 $\frac{1}{2}$ " anode will plate OD's from  $\frac{1}{4}$ " to 1" dia at the same 0.006"/hr rate. At these sizes the change in spacing balances out the anode to cathode ratio change.

When plating into corners, dovetails, shoulders, radii, or undercut areas, you can reduce the spacing to

$\frac{1}{4}$ ". Many of you plate shouldered shafts with tank anodes and large spacings. The surface at the shoulder gets little or almost no chrome, the other end gets too much. The running time has to be excessive to make up for the uneven plating.

The same shaft in a conforming anode can be made to plate straight by turning in the anode at the shoulder to  $\frac{1}{4}$ " spacing with the rest having a  $\frac{1}{2}$ " spacing. If the shaft is not being held to size it will only require a minimum of grind stock. The high plating rates and minimum grind stock make for very short tank times.

I want to slay another dragon here. Chrome is chrome and if it is deposited in the bright range the hardness is the same whether it goes on at the rate of 0.001 or 0.003" thick per hour. They didn't believe me at an aircraft factory that I worked in. We plated six samples at each rate and sent them to the lab. After a few days I had to ask, "What happened to the samples?" The reply came back, "The lab couldn't tell which was which."

When designing a conforming anode, take into consideration the cathode surface and determine what areas will plate faster or slower. By adjusting the amount of lead area spacing, problem areas can be made to plate as fast as the rest. To increase the anode area "saw tooth" the edge with a band saw. Without close spacing conforming anodes it's almost impossible to hold pieces to size with a commercial plate, i.e., plating in the range 0.003 + 0.000 - 0.001".

Two bus bar system reversible rack shops plate a high percentage of their work to size. This is another reason for the high volume of work they are capable of doing, using less equipment. On average, you can run four racks of commercial plate in the time it takes to plate one rack plus grind.

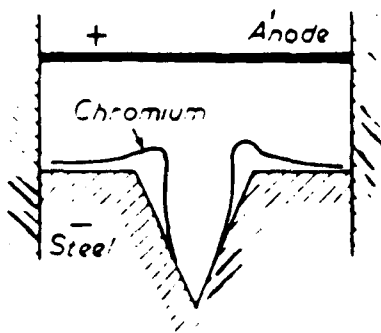
Next month our subject is titled "Stop Off the Better Way."

## 22. ARRANGEMENT AND SUSPENSION OF WORK AND ANODES

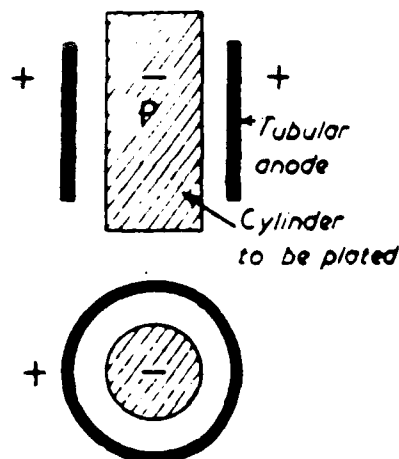
There are no hard and fast rules governing the arrangement of the various devices to ensure even current distribution. In fact, the art of chromium deposition lies in the careful arrangement of anodes and screens and the positioning of the parts in respect of the complexity of the surface to be plated. For every problem, there are often several solutions. Some basic principles are summarised below.

### *Anode Arrangement*

The arrangement of anodes for chromium deposition follows the same general rules as for other plating processes. However, in view of the high currents used and the necessity for obtaining an even deposit despite the poor throwing power, particular care must be taken in arranging the anodes in relation to the surface to be plated. Where conditions allow, the most usual anode to cathode distance is 5 to 6 inches. As far as possible anodes should be slightly shorter than the articles being plated to avoid excessive build up on the lower edges.



*Fig. 23. Demonstrating Irregular Deposition of Chromium. There is excess deposit on the edges and lack of deposit in deep recesses.*



*Fig. 24. Uniform deposition on the curved surface of a cylinder obtained by using a tubular anode shorter than the cathode.*

The shape and position of the anodes must be considered to prevent excessive thickness on high points, and lack of deposit in recessed areas (See Fig. 23).

Take, for example, a simple case, that of plating the curved surface of a solid right cylinder. There are various possible solutions.

A tubular anode of the same length as the cylinder is equi-distant from all points to be plated. However, plating is not uniform, being thickest at the ends, particularly at the top and bottom edges due to the tendency for current to concentrate in these areas. These end effects can be minimised by shortening the anode (Fig. 24) and eliminated by using a longer anode in conjunction with false end pieces to artificially lengthen the cathode (Fig. 25).

A third solution is to use a double conical anode, the anode-cathode distances increasing progressively toward the ends of the cylinder and thus reducing the end effects (Fig. 26).

As a second example, consider the case of deposition on the interior and exterior of a rectangular box. The outside can be plated by using four anodes, similar in shape but smaller in size than the four faces of the box. For the inside a special 'X' section can be used with the edges towards the corners of the box, thus assisting a uniform current distribution (Fig. 27).

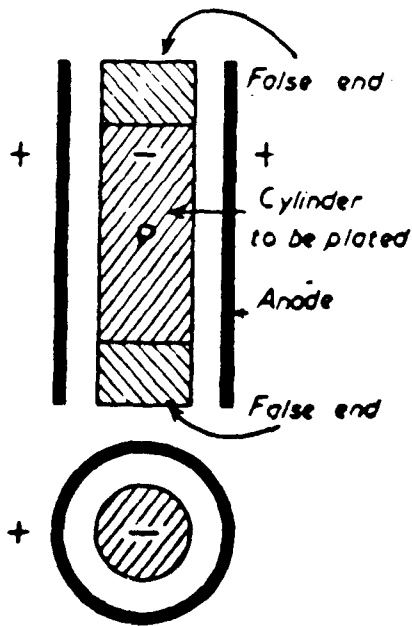


Fig. 25 Uniform deposition on the curved surface of a cylinder obtained by using false end pieces in conjunction with a tubular anode.

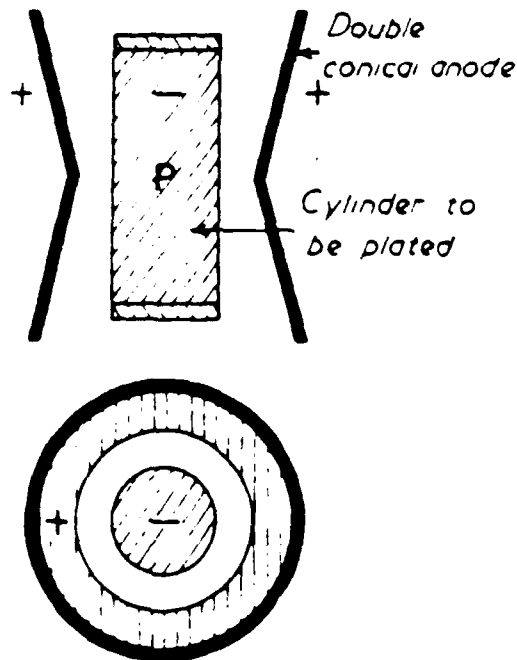


Fig. 26 Uniform deposition on the curved surface of a cylinder obtained by using a double-conical anode.

Fig. 27. Uniform deposition on the inside and outside of a rectangular box using the internal and external anodes  $A$ ,  $A_1$ ,  $A_2$ ,  $A_3$  and  $A_4$ .

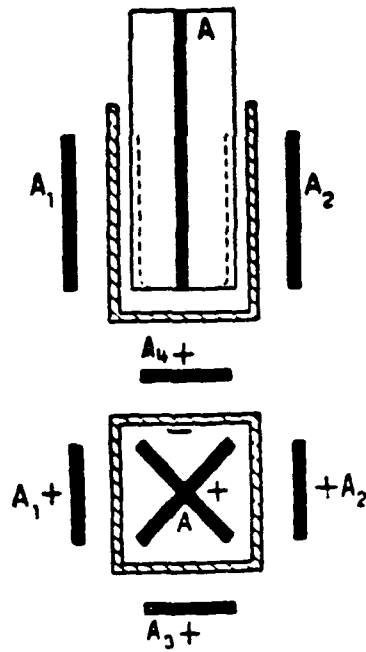


Fig. 28 shows the anode and cathode arrangement for the plating of a cylinder liner. The cylinder itself is supported by the perforated

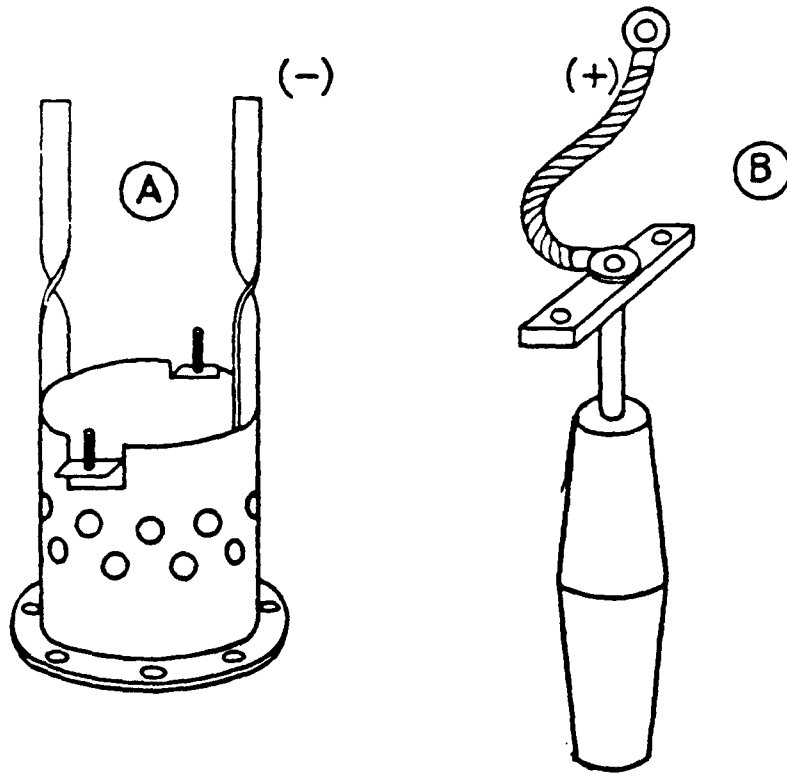


Fig. 28. Anode and cathode arrangements for plating the inside of a cylinder liner.  
 A: perforated ring to support the cylinder. B: double conical anode.

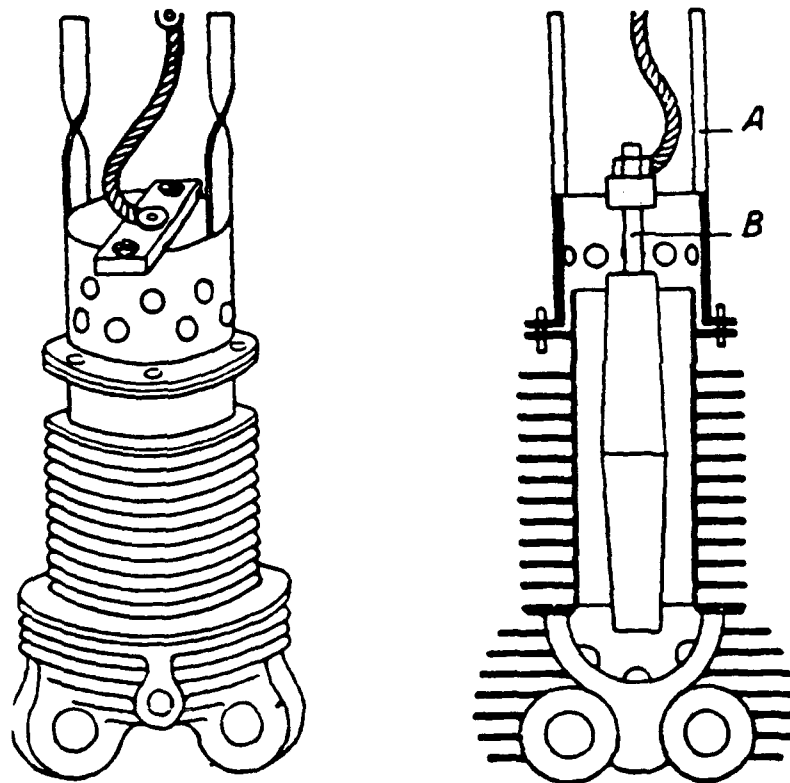


Fig. 29. *Perspective and sectional views of complete arrangement for plating the inside of a cylinder liner.*

ring assembly A and the anode B is double conical in shape. Fig. 29 shows the complete fixture in perspective and in section (De Vaultier<sup>27</sup>).

Before deposition onto complicated shapes, the anode arrangements must be studied carefully in accordance with the principles given above. This is especially true when plating to size or when the part is to be used straight from the solution without machining. With the appropriate arrangement of anodes, it is possible to cover quite complicated shapes and the good results obtained justify the time spent in preliminary study. Some examples of specially designed anode arrangements are shown in Figs. 30 and 31.

Deposition on the interior of tubes requires an internal anode. Various arrangements are in use, one of the simplest being as follows. One end of the tube is sealed with a cork, the tube filled with chromium plating solution, and a thin steel wire anode inserted and connected to the anode rod. This method is only suitable for very thin deposits and it is more usual, especially in the case of heavier deposits, to plate tubes in the plating vat. with the aid of internal





# FINISHING POINTER

by J.B. Mohler

## Where Does the Current Go?

**N**o matter how busy you are or how urgent the job; plan before you act. Spend enough time in the beginning to do it right. It's true that there is a great satisfaction in turning out work early and getting the job done, but the planning that must be done before the job starts is essential to success.

This is particularly true when the current density and metal distribution are in question. This occurs because each shape that is to be racked and plated presents a problem with current distribution that should be considered before the work starts.

If the part is to be processed through an alkaline tin bath or a low efficiency copper cyanide bath there is less need for concern, because these baths are endowed with excellent throwing power. However, if the job calls for plating with acid tin, or other high efficiency acid baths, we should ask ourselves, "Where does the current go?"

The current flows through the medium and path of least resistance. When the anodes are larger than the work the current will flow into the body of the solution and to the ends of the work where it will deposit excessive metal. To compensate for this tendency, use anodes that are a little shorter than the length of the work, as shown in Figure 1.

The special problem for a particular part may be of little importance but it should always be considered as an economic opportunity, to save time and metal. This is the time to evaluate the shape and plan for the racking of the parts and the placement of the anodes.

Parts with deep recesses require special attention. That is not to infer that plain shapes are necessarily easy. The extent of the problem depends on the characteristics of the plating bath, the required thickness, and the acceptable variation in the thickness.

Consider plating a sphere with a total variation of thickness of  $\pm 10\%$ . It might be done with remote anodes or with closer anodes placed in all directions.

Consider precision plating on a flat sheet. It can be done by plating a sheet that is larger than necessary, with symmetrical sheet anodes, and then trimming the edges; or it can be plated uniformly within confining nonconducting walls.

Sharp corners present special problems. External corners can be robbed but internal corners will not accept a deposit completely into the corner. When the internal corner is sharp, it may only be solved by requesting a design change that allows a slight radius. A radius will also reduce the buildup on external corners, but these can be shadowed or robbed if necessary. So you might advise the designer to balance the cost of machining a radius against the increased cost of plating.

A current distribution problem can be evaluated by plating in a bath with a particular arrangement of the part and anodes followed by measuring the thickness of the deposit on significant and critical areas.

A problem can also be solved, with an instrument known as a *plating simulator*, by measuring the current distribution over a part that is immersed in a conductive solution.

This method is especially useful to measure the current in three dimensions.

A problem can be solved by a two-dimensional method of analysis with a conductive paper cutout of a cross section of the part. With this method, a current is imposed on the conductive paper and the equipotential points are located with a probe that is connected through a galvanometer to a voltage divider.<sup>2</sup>

It pays to gain experience by trial and error and by planned experimentation. The resulting bank of experience is handy when the job does not include sample parts or time for measurement and experimentation, so I urge that you examine the part in detail and think of current distribution in terms of throwing power and bath geometry. Consider the general shape of the part and the details of projections, recesses, angles and radii. Consider the tank walls, anode placement, racking, shadowing, and the use of bipolar anodes.

I like to take the time to sketch a

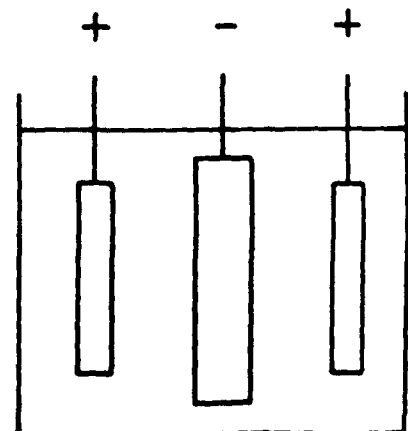


Figure 1. Use short anodes to avoid excessive deposition on the ends and corners of the work.

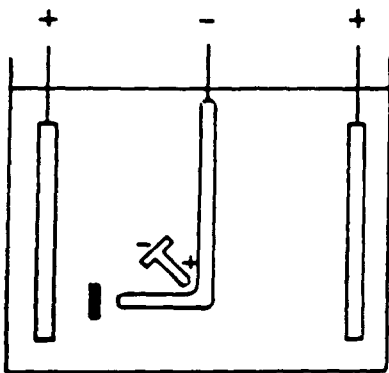


Figure 2. Shadow external projections and use supplemental anodes (or bipolar electrodes) for internal corners.

cross section of a part and estimate the bath geometry. Consider the cross section of an L-shaped part, as in Figure 2, that must be plated to an acceptable uniformity.

My first guess is that the anodes should be a little lower in the solution than the part, that the anodes should be equally distant from the vertical portion, that the bottoms of the anodes should be a little lower than the horizontal portion of the

part, that a shadow should be placed to avoid excessive thickness on the left edge of the horizontal portion, and that a bipolar electrode should be used to deposit metal into the inside corner.

Consider the cross section of the S-shaped part in Figure 3. Is the recess in the upper portion of the part generous enough to receive the current? A low efficiency alkaline tin bath would surely throw into this recess, but how about an acid bath at 100% cathode efficiency?

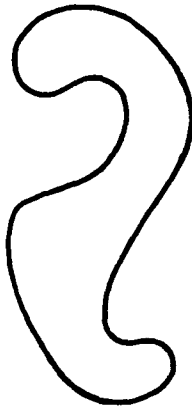


Figure 3. Cross section of an irregular part.

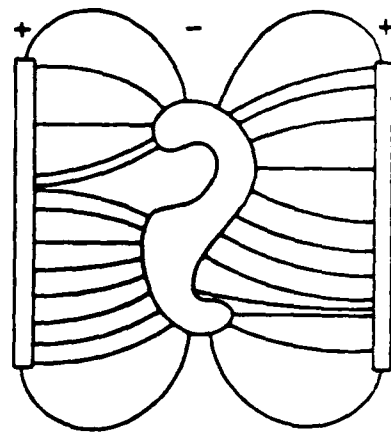


Figure 4. Qualitative current line analysis of an irregular part.

When I draw my guess for the current lines, as in Figure 4, I see that it will be difficult for the current to penetrate the cavity at a sufficient current density to assure a protective thickness.

A drawing of current lines to a cross section of a part is based on the principle that the current enters and leaves the electrodes perpendicularly to the surface, or, more accurately, the current lines are perpendicular to the tangent of the curved surface at the point of contact.

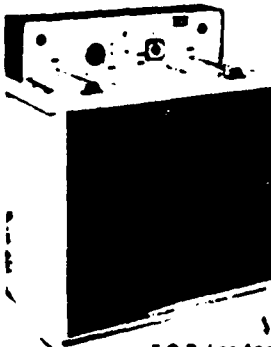
It is also true that the current along a curving line flows from one point on an electrode to a near point on the electrode of opposite sign. Problems with the areas of projections and recesses become apparent when the current lines are drawn with these two principles in mind. The high and low current areas are obvious by examination, but they catch our attention better when the lines are drawn by estimation. It is obvious in Figure 4 that the current will vary greatly and that one low current area will be critical.

Experience teaches us to evaluate potential plating problems by examining the part to be plated. A current line sketch sharpens that experience and actual measurements of the current distribution and plating thicknesses point the way to modification of the tank geometry to favor acceptable plating. MF

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2. Rousselot, R.H., *Metal Finishing*, 57, 58 Oct. (1959).

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# Plating on Difficult-to-Plate Metals

Report of an American Electroplaters' Society Symposium

by D.S. Lashmore, Assistant Editor



D.S. Lashmore

## INTRODUCTION

The first AES sponsored symposium on plating on difficult to plate metals was held in New Orleans, Oct. 30-31, 1980. Perhaps instead of the word "metals" in the title, the word "materials" would have been more appropriate, as several of the papers presented concerned plating on ceramics, silicon, and gallium arsenide.

Whether or not a material is considered difficult to plate is of course a subjective judgement and is usually dependent on the plater's previous experience; therefore, it is revealing that of the 18 papers presented, seven concerned electrodeposition onto aluminum substrates, indicating that a broad interest in this subject exists and that a simple process amenable to all alloys still remains to be developed.

The remaining papers dealt with plating on such materials as beryllium, molybdenum, nickel, Kovar, stainless steel, thorium, uranium, titanium, tungsten, lead and zirconium alloys. In Table I, the processes discussed at this symposium are summarized. Only a few of the most successful processes were selected for inclusion in the table.

A broad spectrum of papers was presented at this symposium, ranging from theoretical to practical. Such a format provides a means for interaction between researchers and those involved in commercial plating. This interaction is invaluable for both types of people involved, therefore the organizers are to be congratulated for their excellent format.

The conference got off to a rather sad start as many of us learned for the first time of Harold Wiesner's death. The overview for this symposium which he had previously prepared was read by Bill Harding. In this keynote message, Wiesner stressed the importance of quantitative adhesion testing. All too often in the literature, including in some of the papers presented at this symposium, adhesion is characterized as being excellent, good, poor, or non-existent. Such a classification is useful only to those doing the characterization and has limited meaning to the rest of us.

Wiesner's paper presented a review of the most important literature dealing with typically hard to plate materials. Obtaining adequate adhesion was the goal of most of the processes presented at this conference. It was shown that adhesion can be obtained in a number of ways, such as: (1) metallic bonding, in which the oxide or passive film, covering a metallic surface has to be removed and replaced by a metal coating, (2) mechanical bonding, in which the surface of the substrate has to be etched in such a way that there remain a large number of anchor points into which the subsequent coating can lock or "key" into, (3) mechanical bonding, in which the passive film itself is modified in such a way as to produce keying points, such as by anodizing and (4) A recently patented method brought to our attention in Wiesner's paper (U.S. Patent 4,181,590— 1980) which involves surface modification by ion implantation of noble metals

until an oxidation resistant surface is built up.

In summary, an excellent review of the recent literature published since 1970 was presented by Weisner, and his paper would be an excellent starting point for those platers starting to work with these materials. A summary of the papers presented broken down by substrate material is presented below.

*Zincate on aluminum*  
ALUMINUM: *Followed by chrome is better!*  
Austin Beebe, Federal-Mogul Corp., discussed the fabrication technology involved in the manufacture of steel backed aluminum bearings. Essentially, his paper was concerned with the electrodeposition on an aluminum steel assembly. Significantly over 400 million such bearings have been produced since 1956.

Beebe departs from the usual procedure for the plating onto aluminum in two ways. First he subjects aluminum clad steel bearings to a rather severe etch, removing between 4 and 5  $\mu\text{m}$  of material. Following a desmutting operation, he zincates the specimens, allowing the immersion reaction to occur for only 10 sec. Then he applies a d.c. current for 20 sec. Apparently the application of this current during zincate immersion allows those portions of the aluminum near the edge of the steel to be coated.

Normally, with only a zincate immersion, the presence of steel on the backside of the bearing results in an impressed potential on the aluminum which inhibits the normal zinc immersion coating near the edge of the

specimen. Following zincating, Beebe normally applies a nickel strike in a near-neutral electrolyte. The actual bearing surface is a ternary lead alloy containing 9-12% tin and 2-3% copper electroplated onto the nickel from a fluoroborate electrolyte.

David Kunces, MacBermid Inc., reviewed the steps used to plate autocatalytic nickel onto several aluminum alloys. He mentioned during his talk that occasionally the zincated aluminum was immersed in a 0.25% sulfuric acid solution to "neutralize" any zincate electrolyte remaining on the surface after rinsing. Most probably this occurs, but also it was shown by this writer that the large zinc crystallites are partially dissolved in the dilute acid, leaving a more uniform zinc surface.

Leo Missel and Greg Kishi, IBM

Corp., described a neutral nickel strike used as a replacement for the cyanide copper strike usually used as part of the zincating process. This procedure is so successful that it is now being made part of the ASTM-B253 recommended practice for plating on aluminum.

The advantages of this procedure are (1) it is free of cyanide (2) the nickel electrolyte operates at room temperature, (3) it is not necessary to immerse the zinc coated specimen "live" — this makes the method especially amenable to barrel plating, (4) the electrolyte is unusually stable and requires little maintenance, (5) the nickel deposit is less porous than copper at a comparable thickness, (6) the process is royalty free. A description of the process and appropriate references are available in Table I.

Lashmore, National Bureau of Standards, described some of the results of AES Project 41 which dealt with anodizing as a pretreatment prior to subsequent plating (or adhesive bonding). The influence of anodizing parameters on 7146 T6 aluminum was presented. In particular, it was shown that adhesion is a linear function of anodizing voltage.

The first direct transmission electron micrographs of cross-sections through nickel plated on anodizing aluminum reveal that (1) the nickel completely filled the pores and (2) there was no metallic bonding between the nickel and the substrate. It was shown that adhesion of the coating is related most critically to the composition of the anodic film.

As this composition can be controlled by appropriate additions to the

Table 1. Processes Used to Plate on Some Difficult to Plate Metals

Substrate	Process Summary	Peel Test Data	Shear	Conical Head Tensile	Reference
Aluminum	1. Zincate & copper cyanide strike	~100 N/cm		300-500 MN/m <sup>2</sup>	1 2 3 4
	2. Zincate & neutral nickel strike	200 N/cm			
	3. Stannate (proprietary)	>200 N/cm			
	4. Phosphoric acid anodizing	50 to 200 N/cm			
Beryllium	Zincate in sodium zincate electrolyte with pH 3.0-7.7 cyanide copper strike as usual on a zincated surface		~250 MN/m <sup>2</sup>	170 MN/m <sup>2</sup>	11
Beryllium Copper or (Berylico 10 <sup>-2</sup> )	HCl pickle: Degrease, caustic soak, pumice scrub, anodic-treat in Oakite 90 for 2 mins. at 268 A/m <sup>2</sup> , 1 min. in 18% (by wt) HCl, nickel sulfamate plate as desired		212 (as plated) 431 (400°C for 5 hrs.)		11
Ceramic	Electroless Ni-B (or Ni-P)		15,000 psi.		5
GaAs	Same as Silicon				10
Kovar	Gold: HCl pickle		163		12
	H <sub>2</sub> SO <sub>4</sub> pickle & Woods nickel strike		169		
	Nickel: HCl pickle		403		
Lead	Lead fluoborate		12 MN/m <sup>2</sup>		11, 13
Magnesium	1. Clean, zincate, copper strike		113 MN/m <sup>2</sup>		6
	2. Clean, immerse in 100 g/L ethylenediamine tetramethyl phosphonic acid, pH 6.-7.3, then zincate, copper strike		143 MN/m <sup>2</sup>		
	3. Clean, immerse in 5% HNO <sub>3</sub> , zincate, copper strike		145		
Molybdenum	1. Gold: Clean, etch in alkaline ferricyanide for 10 sec., rinse, HCl dip (50% vol.), rinse, acid gold strike to deposit 0.06-0.37 μm, rinse & dry, diffuse gold at 1000°C for 30 mins. in H <sub>2</sub> , plate gold & again this time up to 0.5 μm, diffuse at 1000°C, then plate as desired				7
	2. Rhodium: Clean, etch in alkaline ferricyanide, rinse, sulfonic acid dip 10 sec. (5-10% vol.). Rhodium strike to deposit 0.06-0.10 mg/cm <sup>2</sup> , rinse & dry. Diffuse at 1000°C, 30 min. 10 <sup>-2</sup> torr., repeat deposition of rhodium until 0.5 μm is built up				
Nickel	Woods nickel strike, 540 A/m <sup>2</sup> , 5 mins. Anodic in 400 mL H <sub>2</sub> SO <sub>4</sub> , 1080 A/m <sup>2</sup> , 3 mins. Anodic in 100 g/L sulfamic acid, 1080 A/m <sup>2</sup> , 3 mins.			711 MN/m <sup>2</sup> 762 752	11

Continued on page 9

electrolyte or by predepositing a coating on the aluminum itself, it is foreseen that anodizing as a pretreatment may become a more widely used process, not only for plating on those alloys for which it is presently not feasible, but also for adhesive bonding which makes use of a similar sort of process, and most probably involves a similar adhesion mechanism.

Art Wasserman, C.P. Chemicals, Inc., described a brush plating technique for plating nickel directly on etched aluminum. Even though this is a brush plating process, it was shown that this procedure is also amenable to plating on sheet (one side only).

Glen Schaer, Battelle Memorial Institute, described his experience with a zinc alloy immersion process for plating aluminum alloys. In many features the process resembles the Bri-

tish Bondal process in that electrolytes for both contain copper and nickel salts. Schaer also showed that a zinc-cobalt immersion process was capable of providing excellent adhesion.

In his experience the best adhesion resulted from either a cyanide copper strike with free cyanide in excess of 15 g/L or in a pyrophosphate copper strike. He typically measured adhesion by wrapping a piece of plated aluminum wire around itself. Even though this is a qualitative test, it is in the opinion of this writer one of the better qualitative tests available.

#### CERAMICS:

Don Baudrand, Allied-Kelite Div. of Richardson Co., discussed the deposition of nickel-boron alloys on metal-

lized ceramic substrates. It was found that the ceramic could be made catalytic to the electroless nickel boron electrolyte by incorporating from 1 to 3% by volume of nickel into the ceramic itself. By doing this, the palladium processing step and its associated problems could be eliminated.

#### MAGNESIUM:

A.L. Olsen, Norsk Hydro A.S., Norway, described a process for plating on magnesium alloys. This process consisted of (1) activation by acid treatment followed by rinsing, then a final alkaline treatment; (2) zincating by immersion in an electrolyte containing zinc sulfate complexed with pyrophosphate.

This zincate also contains fluoride ion to control the deposition rate. The

Table 1. Processes Used to Plate on Some Difficult to Plate Metals (Continued)

Substrate	Process Summary	Peel Test Data	Shear	Conical Head Tensile	Reference
Silicon	1. Alkaline electroless nickel boron directly on the unactivated surface				9
	2. Activate with palladium containing HF, HCl, or acetic acid, then plate with electroless gold				10
Stainless Steel	Chromium plating: Clean, etch in 65% sulfuric acid and 5% hydrofluoric acid (1 min., 21°C at 31 A/dm <sup>2</sup> ). This process may be suitable for other deposits besides chromium				8
Thorium	Nickel: Vapor degrease, caustic clean, rinse, pickle in 830 ml/L HNO <sub>3</sub> plus 2 ml/L HF at room temp. for 10 mins., rinse, anodic etch in 100 ml/L HCl at 538 A/m <sup>2</sup> for 5 mins. at room temperature, rinse. Repeat the HNO <sub>3</sub> pickle, rinse, pickle in 200 ml/L sulfuric acid for 3 mins. at 45-50°C, rinse, electroless nickel plate		146		11, 14
Titanium	1. Pratt & Whitney Process: Abrasive blast, clean in hot alkaline solution, HCl pickle, bright dip in 12% (vol.) HF (70%), 1% HNO <sub>3</sub> , bal. H <sub>2</sub> O, then anodic etch for 6 mins. at 162 A/m <sup>2</sup> , 40°C in 13% (vol.) HF (70%), 83% acetic acid; 4% H <sub>2</sub> O. Finally, plate with 25 μm of nickel from a sulfamate solution. Then, heat 2 hrs. at 48°C.		148		11
	2. Ionitech				12
	3. CrCl <sub>2</sub> -HCl-H <sub>2</sub> O: anodic in 210 g/L CrCl <sub>2</sub> ·6H <sub>2</sub> O plus 100 ml/L HCl, 10,000 A/m <sup>2</sup> , 5 mins. 100°C		177 MN/m <sup>2</sup>		11
	4. CrCl <sub>2</sub> -HCl: Anodic in 210 g/L CrCl <sub>2</sub> ·6H <sub>2</sub> O diluted to 1 liter with conc. HCl (37 wt.%), 6,000 A/m <sup>2</sup> , 10 mins. 100°C.				11
Tungsten	Clean, etch in 3 parts HF, 1 part HNO <sub>3</sub> , and 4 parts H <sub>2</sub> O for 5 mins. at 50°C, nickel plate (a chromium strike might improve adhesion prior to nickel plating)		22 MN/m <sup>2</sup>		15, 11
Tungsten-Nickel-Iron	Same as above		235 MN/m <sup>2</sup>		15, 11
Uranium (pure)	Etch in 1,400 g/L for 10 mins. at 43°C ferric chloride, then nickel plate		371 MN/m <sup>2</sup>		16, 11
Alloy	Vapor degrease, cathodic alkaline, clean. Immerse in 15 g/L ammonium bifluoride, ½ ml/L H <sub>2</sub> SO <sub>4</sub> , 1 min. at 22°C then nickel plate after heating at 700°C, 1 hr.		15-25 MN/m <sup>2</sup>		11
			~38 MN/m <sup>2</sup>		

process is said to be adaptable to barrel plating. The subsequent strike over the zinc can be of any type so long as it is compatible with plating on the zinc layer.

J.W. Dini, Lawrence Livermore National Labs., and H.R. Johnson, Sandia Labs., described a process similar to Olsen's and showed that the use of an acid pickle improved adhesion from 113 MN/M<sup>2</sup> to 145 MN/M<sup>2</sup>. Heating the zincated magnesium yields no increase in adhesion, indicating that the maximum adhesion possible was most probably obtained simply from correctly operating the immersion process. These processes are summarized in Table I.

#### MOLYBDENUM:

D.J. Levy, C.R. Arnold and D.H. Ma, Lockheed Research Laboratory, described a procedure for plating gold directly over the oxide which normally covers a molybdenum surface. After plating, the oxide was then reduced by thermally treating the specimen in hydrogen. Rhodium was also plated on molybdenum by this technique, though in this case the bonding was achieved by thermal diffusion through the oxide.

#### SUPERALLOYS AND STAINLESS STEEL:

W. Baldauf and E.S. Chen, Watervliet Arsenal, reported a method for activating superalloys and stainless steel for chromium plating. They experimented with chromic acid and sulfuric acid solutions without success. They found that the best adhesion was obtained with mixtures of sulfuric and hydrofluoric acids.

Their best procedure involved a mixture of 65% by volume sulfuric acid with 5% by volume HF used anodically at 21 °C and at 30 A/dm<sup>2</sup> for 1 min. This procedure was found to work on Types 304, 316, 410 and superalloy U-700. Adhesion was evaluated using a groove test run on a shaper in combination with observation of the resultant groove by optical microscopy.

#### SEMICONDUCTORS:

Kei Yoshida, Bell Labs., described the deposition of Ni-P alloys from an electroless bath onto silicon for use as ohmic contacts. It was shown that a significant difference exists between *n* and *p* type material. The *n* type is far more easy to plate. Yoshida offered several explanations of this phenomena.

The nitrate ion was shown to be very detrimental to the adhesion of a

Ni-P alloy to the silicon and therefore a great deal of care went into obtaining a high purity (nitrate free) nickel to make up the initial electrolyte. The fluoride ion was also shown to be detrimental, especially for *p* type material. During the discussion of this paper, D'Asaro proposed that light be shown on the *p*-type material in order to raise the Fermi level and thereby give the surface more of an electron donor (*n* type) character.

L.A. D'Asaro, S. Makahara and Y. Okinaka, Bell Labs., discussed the role of palladium catalysts in the electroless gold plating of gallium arsenide and silicon. It was shown that the bonding of palladium to the substrate was a result of the reduction of Pd<sup>2+</sup> ions by galvanic displacement. The activation electrolyte contained PdCl<sub>2</sub>, HCl, acetic acid, or H.F. Therefore, subsequent adhesion of the gold to the substrate is critically dependent on the nature of this bond. A transmission electron microscopic (TEM) study of the Pd deposited on various semiconductor surfaces was therefore expected to yield insight into the adhesion process.

The semiconductors examined in this investigation were (110) GaAs and (111) Si which were thinned to electron transparency before deposition of the Pd. The results of this study indicate that on GaAs the Pd was fine grained and covered about 80% of the surface area of the substrate. On Si, the grain size was much coarser. The adhesion of subsequent coatings was related to the Pd distribution, being quite poor on Si and good on GaAs. The difference between *n* and *p* type silicon noted by Yoshida were not noted by D'Asaro.

#### TITANIUM, BERYLLIUM, KOVAR, LEAD AND MAGNESIUM:

J.W. Dini and H.R. Johnson discussed techniques developed over a number of years for plating on a wide variety of difficult to plate materials. Many of these techniques involve either etching the surface to provide mechanical bonding, or by providing a displacement coating to which bonding is facilitated. One of the many important contributions of Dini and Johnson was the introduction of a relatively easy to use quantitative adhesion test—the ring shear test. Data from this test is listed in Table I wherever available, along with peel test data and conical head tensile test data.

Beryllium is plated using a zincate whose pH was found to be relatively unimportant (3.0 to 7.7). Beryllium-

copper alloys required an HCl pickle prior to a nickel strike. Electroless Ni-P was not found to work well on this alloy.

On Kovar the pretreatment procedure was not critical, a simple HCl pickle being quite adequate. Lead can be plated onto lead from a fluoroborate electrolyte by simply immersing the specimen into the electrolyte for two minutes prior to applying a current. Magnesium is plated much like aluminum with the optimum procedure involving a 5% HNO<sub>3</sub> pickle followed by the zincate immersion and then a copper strike (pH 10.3).

#### SUMMARY

The conference as a whole was an enjoyable and worthwhile experience. It was very well organized, as most AES conferences are. If it had any drawbacks it was that several of the speakers felt that they had to read their papers. MF

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