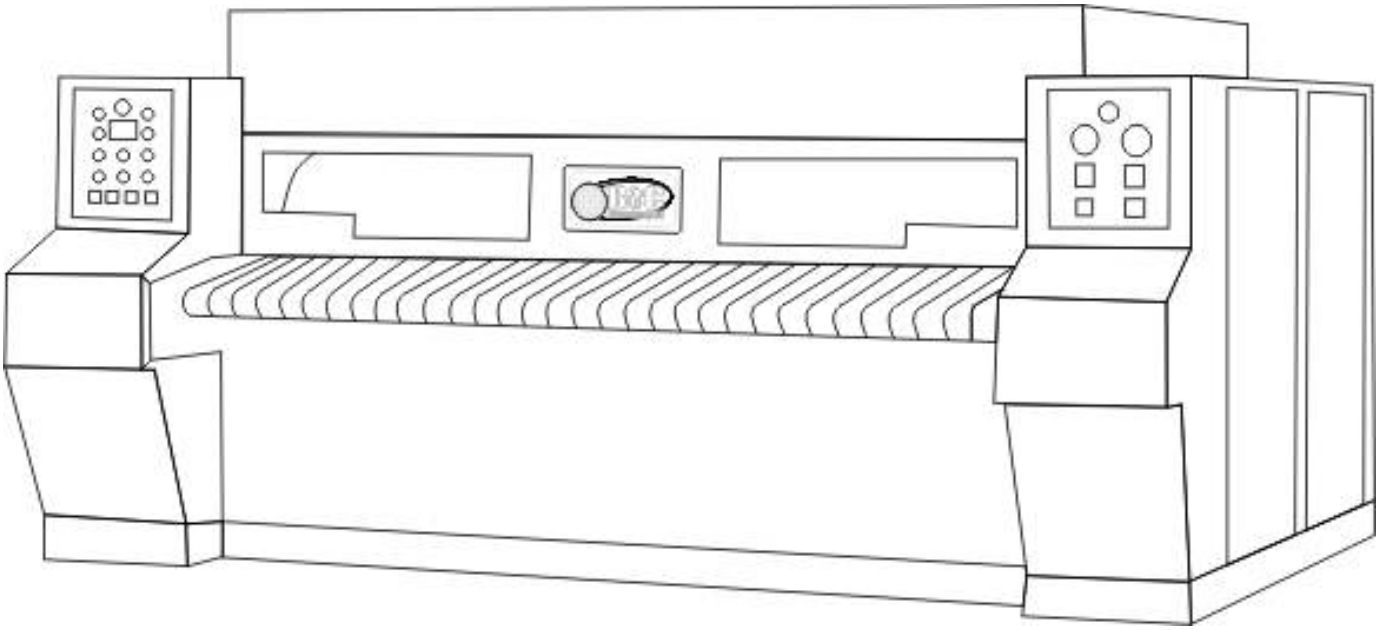
Ironer

IM Installation and Operation Manual

April 6, 2018
Revision 1.4



Executive Summary

The Installation and Operation manual for the IM Series of self-contained thermal fluid ironers. This manual covers the IM-800 and IM-1200 Series self contained thermal fluid ironers.

Chapter 1

Important Safety Information

1.1 FOR YOUR SAFETY - CAUTION!

WARNING: For your safety the information in this manual must be followed to minimize the risk of fire or explosion or to prevent property damage, personal injury or death.

- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.
- WHAT TO DO IF YOU SMELL GAS:
  - Do not try to light any appliance
  - Do not touch any electrical switch; do not use any phone in your building.
  - Clear the room, building or area of all occupants.
  - Immediately call your gas supplier from a neighbors phone. Follow the gas suppliers instructions.
  - If you cannot reach your gas supplier, call the fire department.
- Installation and service must be performed by a qualified installer, service agency or the gas supplier.

Contact your local gas supplier to obtain particular instructions in the event that a user smells gas. Place this sheet and any other instructions obtained from your gas supplier in a prominent location.

1.2 A Note of Caution

There is a protective coating applied to the chests of the ironer that MUST BE REMOVED prior to initial startup of the machine. Remove this protective coating prior to padding or applying heat. Failure to remove the coating can damage or destroy the chest and padding and will require difficult cleaning and replacement. Not heeding these instructions will certainly ruin you day.

Contents

Chapter 2

Important Instructions

2.1 Before Attempting Repairs

WARNING

Rollers and other moving parts can cause serious injury or death. Before attempting repairs, follow proper shutdown procedures, remove power, and allow the machine to fully cool before commencement of service. Before electrical service begins, allow at least 5 minutes after power has been removed to allow the AC inverter drive to discharge.

Safety is of primary concern with any maintenance or repair operation. If you are in any way unsure of how to proceed with a repair or adjustment, consult this manual, a qualified maintenance technician, your local distributor, or the B&C Technologies Technical Service Department at 850-249-2222.

Only trained and experienced personnel should attempt maintenance or repair work on this equipment. Follow all safety procedures including lock-out/tag-out procedures carefully. Ensure that any loose fitting clothing or jewelry is tucked in or not worn to avoid being pulled into the machine. Remember, the machine has no brain - you must use your own.

Before attempting repairs, follow proper shutdown procedures, remove power, and allow the machine to fully cool before commencement of service. Before electrical service begins, allow at least 5 minutes after power has been removed to allow the AC inverter drive to discharge.

Never attempt to clean or service any area of the machine without removing power at the main disconnect and allowing time for the machine to cool completely.

There are certain jobs that must be performed with the ironer running at the slowest possible speed. In this instance, another person must be stationed at the disconnect to immediately remove power if needed. Always avoid moving rolls and be especially aware of pinch points where two or more rolls come together.

Read, follow, and obey these safety rules! The B&C Technologies Technical Service Department is available to answer any questions you may have about the operation and servicing of your machine. Please call with any questions or concerns about the operation of your machine.

2.2 Operator Safety Notes

⚠WARNING

NEVER ATTEMPT TO REMOVE OR ADJUST JAMMED LINEN WHILE THE MACHINE IS IN OPERATION. Attempting to reposition or free jammed linen while the machine is under power can result in machine damage (best case) or serious injury or death (worst case). REMOVE POWER TO THE MACHINE and allow it to cool before attempting removal of jammed goods. Ironer surfaces can reach temperatures well in excess of 400 degrees Fahrenheit (205 degrees Celsius), not something you want to touch.

NEVER REACH around the safety guards or into any area near heated surfaces or moving parts without first powering down the machine and allowing it to cool. Failure to follow this instruction can lead to serious injury or death.

Check operation of the finger safety guard at the start of every work shift. Activating this guard should stop the machine. If this important safety device is not working, power off the machine and notify your manager. DO NOT OPERATE THE MACHINE until the safety guard is working properly.

Make sure that all guide tapes and belts are in place and tensioned properly. Missing or improperly adjusted tapes and belts will cause performance, quality, and production problems. Maintaining a proper waxing schedule also keeps the machine performing at peak efficiency and quality.

Only flatwork should be processed in the ironer - processing goods the machine is not designed to handle can lead to damage to the machine or personal injury.

Do not stand, sit, or kneel on any part of the ironer's front or rear - these parts are not designed to carry your weight.

Follow all lock-out/tag-out procedures when servicing the ironer. Remember, when servicing the machine, power must be disconnected at the main disconnect switch.

Only you can protect yourself by reading and understanding these precautions. Help protect others by making sure all personnel follow these instructions. Do not wear loose clothing or jewelry while operating this machine. Stay away from moving parts and heated rolls.

If in doubt, ask your manager or contact Technical Service to find out how to safely operate the ironer. Remember, only those qualified should service the ironer.

Figure 2.1: Serial Decal

2.3 Parts Ordering Information

If you require literature or spare parts, please contact your local distributor. If a local distributor is unavailable, you may contact B&C Technologies directly at (850) 249-2222 for the name of your nearest parts dealer.

For technical assistance in the United States, contact B&C Technologies:
(850) 249-2222 Phone
(850) 249-2226 FAX
`parts@bandctech.com`
`www.bandctech.com`

2.3.1 Nameplate Location

When contacting B&C Technologies about your equipment, please make note of the model and serial number, located on the nameplate as shown in figure 2.1.

2.4 Key Symbols

Anyone operating or servicing this machine must follow the safety rules in this manual. Particular attention must be paid to the DANGER, WARNING, and CAUTION blocks which appear throughout the manual and shown in figures 2.2 on page 6 and 2.3 on page 7.

2.5 Safety Instructions

2.5.1 Installation Notice

For personal safety and for proper operation, the machine must be grounded in accordance with state and local codes and in the USA in accordance with the National Electric Code, article 250-96. Elsewhere, the equipment should be grounded in accordance with ANSI/NFPA 70, or the Canadian Electrical Code, CSA C22.1. The ground connection must be to a proven earth ground, not to conduit or water pipes.

Natural Gas or Liquid Propane Gas (LP Gas) heated equipment installation must comply with state and local codes, and in the USA, in accordance with the National Fuel Gas Code. Elsewhere, the equipment should comply with ANSI Z22.1, or CSA B149.

Provisions must be made for adequate make-up air and ventilation, and access for equipment service and installation.

Installation and Operational Safety Instructions

1. Read all instructions prior to operating this equipment.
2. Ensure that the equipment is properly grounded before applying power and operation commences.
3. Do not process goods that have been previously cleaned in, soaked in, or exposed to gasoline, dry cleaning chemicals, or any other flammable or explosive materials, as they could catch fire or explode without warning, even after being washed.
4. Do not allow children to play in or around or operate this equipment.
5. Check the operation of all safety interlocks at the start of every shift. If the interlocks do not stop the equipment immediately, the machine must be removed from service. Notify your immediate supervisor, and do not operate the machine.
6. Never attempt to service the machine while it is running. Never reach over, under, around, or behind any safety device, or into any area near moving parts or hot surfaces without shutting off power and allowing the machine to adequately cool.

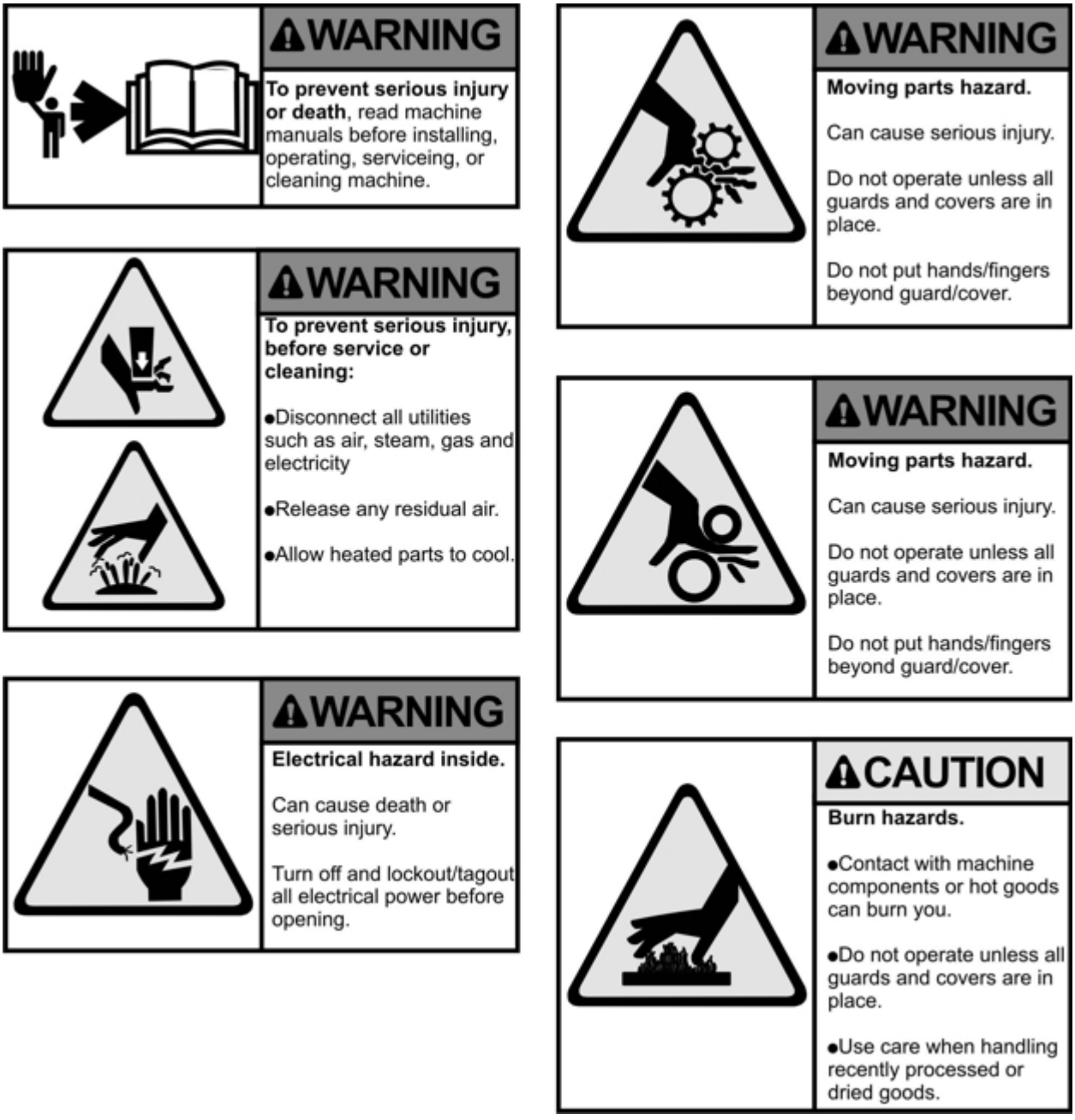


Figure 2.2: Key Symbols

Figure 2.3: Key Symbols

7. Read, understand, and follow all safety instructions. Do not come close to moving parts and hot surfaces. Do not wear loose clothing, jewelry, neckties, or any other garment that could become caught in the machine while operating or near the machine.

8. Only a qualified technician should attempt to service or repair the machine.

9. Do not install the machine in an area where it could be exposed to water or weather.

10. Do not alter or tamper with the control system.

11. To reduce the risk of fire, do not process plastics or articles containing foam rubber or similarly textured rubber-like materials.

12. Keep the area near the exhaust ducting clean and free of lint, dust, dirt or debris.

13. Keep the interior and exterior of the machine clean of lint, dirt, dust and debris. The interior of the machine, along with the exhaust ductwork should be periodically inspected and cleaned to avoid potential fires (lint is highly flammable).

14. Improper installation, operation and maintenance of this machine can cause exposure to substances in the fuel or from combustion that can cause serious illness or death. The machine must be exhausted to the outside.

15. Always disconnect the electrical service from the machine and allow it to cool before performing service.

16. This machine must be installed according to the installation instructions. All exhaust, electrical connections, and gas or steam connections must comply with state and local codes and must be made by a licensed installer where required.

Chapter 3

Machine Installation

3.1 Installation

3.1.1 Receiving Inspection

Upon receipt of the equipment, visually inspect for shipping damage and note any damage with the carrier before signing the shipping receipt, or advise the carrier of the damage as soon as it is noted.

If damage is discovered, a written claim must be filed with the carrier as soon as possible.

Note: Warranty is VOID unless the equipment is installed according to instructions. The installation must comply with the minimum requirements listed in this manual. All national, state and local codes must be followed including but not limited to gas, electrical, plumbing and HVAC. Due to various requirements, statutory codes should be well understood before installation commences.

The ironer is delivered in ready-to-connect modules. The supply and return lines for all utilities such as heat, compressed air, power, exhaust, etc. must be installed on site. Each module is covered with a protective plastic wrapping. The cover panels are normally mounted to the ironer module.

3.1.2 Product Description

1. **Design And Construction**
   The heavy-duty ironers are manufactured in modules. The modules can be combined into ironers of one to four units with diameters of 800 mm (32 in.) or 1200 mm (47 in.) in widths of 3000 mm (118 in.) or 3300 mm (130 in.). Other widths are available - consult the factory.

2. **Modular System**
   The modular design allows an increase of modules (up to four) to fit the individual requirements of the particular installation.

3. **Heating System**
   The ironers can be ordered for the following heating systems:

   - High Pressure Steam
   - Hot Oil / Thermal Fluid

4. **Drive System General**
   The heavy-duty ironer is driven by a variable speed gear drive or a variable electric drive for the multi-roll units. The power is directed to a slip-on gear box on each roller and in feed conveyor through a high-performance V-belt system. The required in feed speed can be adjusted at the right control panel and can be monitored with the rate meter display. Programmable speed selectors are available as an option. The selectors can only be modified by trained personnel.

5. **Heating Chests**
   Heating chests are constructed of heavy gauge boilerplates with stiffeners to take the required forces. The contact surfaces of the chests are ground and polished. The chests are adjustable and are mounted on rollers integrated in the main frame.

6. **Bridging Chests**
   The heated bridging chests (gap pieces) are specially designed to prevent a loss of heating efficiency between the modules and ensure a high finish quality due to the uninterrupted heating surface by steam or oil passing through the bridging chest. Steam-heated chests consist of a copper heating coil embedded in the chest. Thermal Oil heated chests are of a special welded design to optimize heat transfer. The surfaces of the bridging chests are ground and polished.

7. **Rolls**
   The rolls consist of a perforated, large-diameter cylinder covered with felt or nomex padding. Each roll has its own vacuum fan that ensures the efficient removal of condensation. Each vacuum fan can be individually adjusted through a butterfly flap located in the exhaust duct portion of the module. Through this individual adjustment, a constant temperature can be maintained at the padding. Each roll is mounted on the left side to a swing bracket with a self-aligning bearing. The right side is mounted to a slip-on gearbox integrated in a swing bracket. All available padding can be supplied to meet customer specifications.

8. **Roll Procession**
   The speed difference between rolls is created by the variable pulley belts on the drive side of the slip-on gear boxes (similar to the gear box on the infeed belts). The procession between rolls should only be modified by trained personnel.

9. **Roll Lifting Mechanism**
   Each roll can be individually raised and lowered through a pneumatic cylinder arrangement. The controls are located on the left hand control panel. After shutting off the power or in case of a power failure the rolls are lifted automatically. A safety device built into the cylinders prevents the rolls from dropping in the event of a failure in the compressed air system. This safety device prevents damage to the padding. The pressure between roll and chest is created by the pneumatic cylinders. A pneumatic control valve, located on the right side of the first

module, controls the pressure which is monitored via a pressure gauge on the left control panel. As an option, individual pressure control of each roll is available.

10. **Linen Infeed**
    The infeed of linen occurs on the front side of the ironer via wear and temperature resistant flat belts. The belts are driven by a textured infeed roller. A finger guard, located at the end of the belts, stops the ironer and lifts the first roller immediately if activated.

11. **Utility Connections** (when looking from the front)

Electricity	Type 800	Left side
	Type 1200	Right side
Compressed Air	Type 800	Right side
	Type 1200	Left side
Exhaust	Type 800	Right side
	Type 1200	Left side

12. **Control Panels**
    The left control panel includes emergency stop button, roll temperature, air pressure for each roll, steam inlet temperature, steam pressure The right control panel includes rate meter, speed selector lift and lower switch for each roller, switch for on and start, push button drive on, pilot light for main power, pilot light for overload, pilot light for control, push button for control, jog button (reverse), drive start push button, emergency stop and selector switch.

13. **Electrical Components**
    The electrical panel is located at the right side for model 1200 and Left side for model 800 of the first module in an enclosure with a door that can only be open by a special key. All electrical components on the panel are DIN rail mounted for easy repair and maintenance. The serial plate is located on the left side in the enclosure.

14. **Safety Features**
    The infeed side is protected by a windowed heat-resistant finger guard that, if activated, will instantly stop the drive motor and raise the first roll. Two emergency push buttons are located at either end of the ironer and should only be used in emergencies. If activated, these emergency buttons will shut off the ironer and raise all the rolls. All mechanical and electrical components are covered by sheet metal panels or located behind enclosures. Panels and service doors can only be opened with special keys.

15. **Optional Canopies**
    Canopies can be provided so that heat losses are reduced to a minimum. The canopies are of aluminum construction.

3.2 Electrical & Gas Specifications

Refer to Table 3.1 for complete details on gas and electrical requirements. Gas must be provided between 1/2 and 2 PSI, with gas piping provided to meet the volume of gas required. Best re-

sults will be obtained with a properly sized incoming gas line. Undersized gas lines will cause performance and burner issues.

Table 3.1: IM Electrical & Gas Requirements

Model	BTU	Volts	FLA	Breaker
IM-12301-2T	800,000	200-230, 3ph, 50/60Hz	60	70
IM-12301-4T	800,000	380-460, 3ph, 50/60Hz	30	40
IM-12331-2T	800,000	200-230, 3ph, 50/60Hz	61	70
IM-12331-4T	800,000	380-460, 3ph, 50/60Hz	31	40
IM-12302-2T	1,600,000	200-230, 3ph, 50/60Hz	81	90
IM-12302-4T	1,600,000	380-460, 3ph, 50/60Hz	41	50
IM-12332-2T	1,600,000	200-230, 3ph, 50/60Hz	85	100
IM-12332-4T	1,600,000	380-460, 3ph, 50/60Hz	42	50
IM-8301-2T	600,000	200-230, 3ph, 50/60Hz	54	60
IM-8301-4T	600,000	440-460, 3ph, 50/60Hz	27	40
IM-8331-2T	600,000	200-230, 3ph, 50/60Hz	55	70
IM-8331-4T	600,000	440-460, 3ph, 50/60Hz	27	40
IM-8302-2T	1,200,000	200-230, 3ph, 50/60Hz	69	80
IM-8302-4T	1,200,000	440-460, 3ph, 50/60Hz	35	50
IM-8332-2T	1,200,000	200-230, 3ph, 50/60Hz	71	80
IM-8332-4T	1,200,000	440-460, 3ph, 50/60Hz	36	50

3.3 Work Rates

3.3.1 Realistic Work Rates for 1 Roll 48”x118” (1200mm) Ironer

Goods		Working Temperature															
		170C / 338F				180C / 356F				188C / 371F				200C / 390F			
g/m2	lb/yd2	m/min	ft/min	kg/h	lb/hr	m/min	ft/min	kg/h	lb/hr	m/min	ft/min	kg/h	lb/hr	m/min	ft/min	kg/h	lb/hr
														200			
Sheets @ 80% Bed Coverage																	
130	0.2400	14	46	260	573	16	52	290	639	18	59	320	706	22	72	380	838
160	0.2954	11	36	260	573	13	43	290	639	15	49	320	706	19	62	380	838
190	0.3508	10	33	260	573	11	36	290	639	12	39	320	706	14	46	380	838
Small Pieces @ 60% Bed Coverage																	
220	0.4062	9	30	215	474	10.5	34	250	551	12	39	285	628	14	46	330	728
280	0.5170	7.5	25	225	496	9	30	270	595	10	33	300	662	11.5	38	345	761
330	0.6093	7	23	260	573	8	26	295	650	8.5	28	310	684	10	33	370	816

3.3.2 Realistic Work Rates for 1 Roll 32″x118″ (800mm) Ironer

Goods		Working Temperature															
		170C / 338F				180C / 356F				188C / 371F				200C / 390F			
g/m2	lb/yd2	m/min	ft/min	kg/h	lb/hr	m/min	ft/min	kg/h	lb/hr	m/min	ft/min	kg/h	lb/hr	m/min	ft/min	kg/h	lb/hr
Sheets @ 80% Bed Coverage																	
130	0.2400	9	30	175	386	10	33	195	430	11	36	215	474	13	43	255	562
160	0.2954	7.5	25	175	386	8.5	28	195	430	9.5	31	215	474	11.5	38	255	562
190	0.3508	6.5	21	175	386	7.5	25	195	430	8.5	28	215	474	10.5	34	255	562
Small Pieces @ 60% Bed Coverage																	
220	0.4062	5.5	18	130	287	6.5	21	155	342	7	23	170	375	8.25	27	195	430
280	0.5170	4.5	15	135	298	5.5	18	165	364	6	20	180	397	7	23	210	463
330	0.6093	4	13	150	331	4.5	15	165	364	5	16	185	408	6	20	220	485

3.3.3 Realistic Work Rates for 2 Roll 48″x118″ (1200mm) Ironer

Goods		Working Temperature															
		170C / 338F				180C / 356F				188C / 371F				200C / 390F			
g/m2	lb/yd2	m/min	ft/min	kg/h	lb/hr	m/min	ft/min	kg/h	lb/hr	m/min	ft/min	kg/h	lb/hr	m/min	ft/min	kg/h	lb/hr
														200			
Sheets @ 80% Bed Coverage																	
130	0.2400	32	105	580	1279	36	118	645	1422	40	131	710	1566	48	157	840	1852
160	0.2954	26	85	580	1279	30	98	645	1422	34	112	710	1566	42	138	840	1852
190	0.3508	24	79	580	1279	26	85	645	1422	28	92	710	1566	32	105	840	1852
Small Pieces @ 60% Bed Coverage																	
220	0.4062	20	66	475	1047	23	75	545	1202	25	82	595	1312	29	95	690	1521
280	0.5170	16	52	480	1058	19	62	570	1257	21	69	630	1389	24	79	720	1588
330	0.6093	15	49	550	1213	17	56	625	1378	19	62	700	1544	22	72	810	1786

3.3.4 Realistic Work Rates for 2 Roll 32″x118″ (800mm) Ironer

Goods		Working Temperature															
		170C / 338F				180C / 356F				188C / 371F				200C / 390F			
g/m2	lb/yd2	m/min	ft/min	kg/h	lb/hr	m/min	ft/min	kg/h	lb/hr	m/min	ft/min	kg/h	lb/hr	m/min	ft/min	kg/h	lb/hr
Sheets @ 80% Bed Coverage																	
130	0.2400	22	72	410	904	24	79	455	1003	26	85	500	1103	32	105	590	1301
160	0.2954	19	62	410	904	21	69	455	1003	23	75	500	1103	27	89	590	1301
190	0.3508	17	56	410	904	19	62	455	1003	21	69	500	1103	25	82	590	1301
Small Pieces @ 60% Bed Coverage																	
220	0.4062	13	43	310	684	15.5	51	370	816	17	56	405	893	20	66	475	1047
280	0.5170	11	36	330	728	13	43	390	860	14.5	48	435	959	17.5	57	525	1158
330	0.6093	9	30	330	728	11	36	405	893	12.5	41	460	1014	14	46	515	1136

Production rates based on initial moisture of 50%, final moisture of 2%. Use the correction chart for further refinement of production rates.

3.3.5 Moisture Retention Correction Factors

Moisture retention	Correction Factor
25%	1.39
30%	1.29
35%	1.19
40%	1.12
45%	1.06
50%	1
55%	0.95
60%	0.91
65%	0.87
70%	0.83

3.3.6 Calculating Moisture Retention

Percent Moisture Retention is a measure the water remaining in the goods being processed. To determine the water retention of flatgoods being processed do the following:

1. Pull a sample of 10 pieces from the middle of the pile (goods on top tend to be dryer and will give false results).
2. Immediately weigh your sample of 10 goods and record that weight as ”W1”. 3. Pass them through the ironer once and wait 5 minutes.
3. Weigh the sample again and record the weight as ”W2”.
4. Iron the sample goods a second time.
5. Weigh the sample a third time and record this as ”W3”.

From these weights one can find: 1) The dry weight of the laundry, 2) The moisture retention of the ironed goods, 3) The initial moisture retention of the goods before ironing.

To calculate moisture retention, use the following formulas:

Moisture Retention (%) before ironing = (W1-W3)/ W3

Moisture Retention (%) after ironing = (W2-W3)/ W3

As a general guide: The Moisture Retention before ironing should be 30% to 50%. The Moisture Retention 5 minutes after ironing should be 2% to 4%.

Fabric Weight is a major factor needed to determine the actual practical work rate for flat goods. Fabric weight is typically expressed as g/m^2 (grams per square meter), lbs/yd^2 (lbs per square yard), or oz/yd^2 (ounces per square yard). The fabric weight for the goods must be known to find the proper ironing speed in the Work Rate Chart. The weight of the flatwork can be determined easily by:

1. Measure the Length and Width of each of the 10 sample pieces used above. Multiply the measurements for each sheet to find the total area of each piece (Area = Length x width).
2. Add the calculated area for all 10 pieces.
3. If the sheets are measured in inches, divide the sum by 1296 to convert to square yards (yd^2).
4. Divide the total dry weight (W3 from above) by the area in square yards from step 3 to calculate the weight.

Fabric weight = Total Weight (lbs) / Total Area(yd^2)

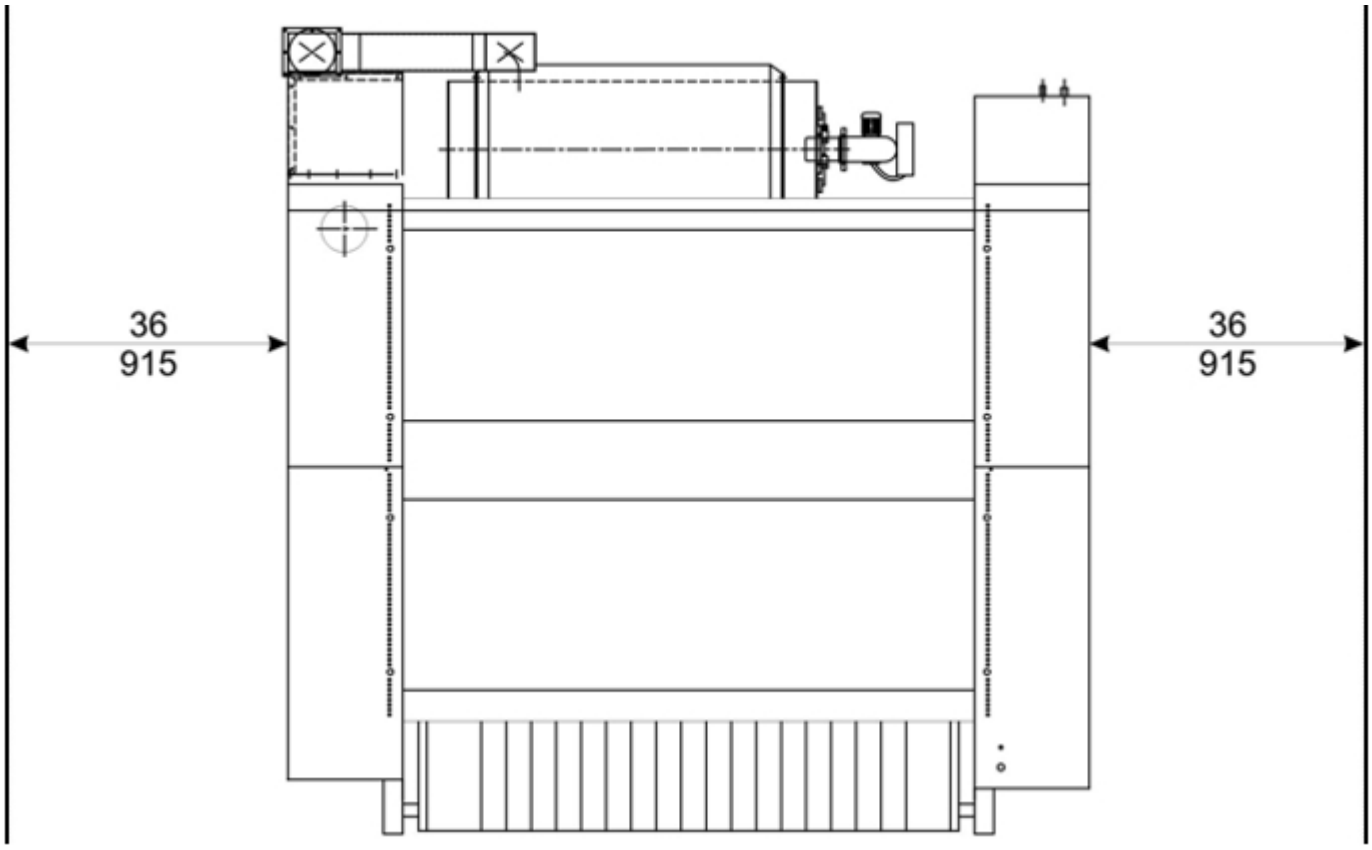


Figure 3.1: Machine Clearances

3.4 Site Requirements

3.4.1 Service Clearance

Figure 3.1 shows the recommended minimum service clearances. The dimensions shown are needed to adequately service and operate the machine with maximum efficiency. Reducing this clearance is not recommended. You must allow space around the machine for maintenance.

3.4.2 Floor Requirements

The installation site must have flooring capable of supporting the weight of the machine without flexing. Consult the general specifications in the previous section for specific details on the machines weight and other technical specifications. No special foundation, grouting, or anchoring is required by the manufacturer, but some shimming may be required so that the machine is completely level. Always follow local codes when performing a machinery installation. It is the responsibility of the installer to be familiar with the requirements of local codes.

3.4.3 Gas Requirements

The ironer requires a significant gas service capable of providing the volume and pressure needed to achieve the BTU rating of the particular machine. Typical gas pressure ranges from 1/2 to 2 PSI with ratings up to 2.5 million BTU. Refer to the previous section for gas connection sizing, gas pressure requirements and BTU ratings.

3.4.4 Thermal Fluid Requirements

The ironer is shipped with a minimal amount of thermal fluid. Before commissioning, the machine must be properly filled with thermal fluid. Follow the procedure outlined in the Maintenance section of this manual for specific procedures for filling and purging the system.

3.4.5 Exhaust Duct Requirements

A short run of pressurized gas flue vent ducting and a short run of exhaust vent ducting is required and must be procured locally. Adequate ventilation is required and must meet all local codes. Refer to the previous section for airflows and other pertinent information.

Important: Do not interrupt the flow of make-up air or the exhaust!

Use the shortest possible path with the fewest number of bends to connect to the outlet ductwork. Measured back pressure should not exceed 0.3 inches of water column pressure for reliable ignition and best results.

Note: Check for proper exhaust fan rotation direction before placing the equipment into service. If the rotation is incorrect, remove power from the machine and exchange any two incoming power leads.

3.4.6 Compressed Air Requirements

A clean and dry source of compressed air must be provided. This supply must meet the minimum requirements listed in the previous section for pressure and volume. Wet and/or dirty air will cause rapid deterioration of internal components and void your warranty on these parts. Install a compressed air dryer to prevent water build up in the airlines. Make sure to use best practice when installing air lines so that water does not damage internal air components - the machine should not be the low point in the air path.

3.4.7 Electrical Requirements

Pay attention to the nameplate of the machine - it contains the specific electrical requirements of the machine. Additional requirements can be found in the previous section.

Note! Do not use phase adders (roto-phase) on inverter driven equipment!

The machine should be connected to an individual branch circuit not shared with lighting or other equipment.

A lockable, load break rated, visible break disconnect switch with safe working clearances is required for all installations. A disconnect plug is also acceptable, so long as it is able to safely break the load, is in an accessible location, and can be locked.

The connection should be shielded in a liquid tight or approved flexible conduit with proper conductor of correct size installed in accordance with National Electric Code (USA) or other applicable codes. The connection must be made by a qualified electrician using the wiring diagram provided with the machine.

For personal safety and for proper operation, the machine must be grounded in accordance with state and local codes and in the USA in accordance with the National Electric Code, article 250-96.

The ground connection must be to a proven earth ground, not to conduit or water pipes.

Do not connect the ground to the neutral (N) leg at the terminal strip.

If a DELTA supply system is used, the high leg should be connected to T or L3, as control power is derived from L1 & L2.

3.5 Machine Placement

3.5.1 Uncrating

Prior to removing the packaging from the machine, ensure that the installation site is acceptable and any necessary floor or foundation improvements or modifications have been made.

Remove all packaging materials from the machine including bagging, crating, straps and any other materials while leaving the machine attached to the pallet.

Remove these and move to a safe place until called for:

- Optional canopies
- Optional railing
- All end frame panels
- Boiler ductwork

Carefully check all enclosures and remove any other materials shipped with the machine. These items will be used later in the installation process, so move to a convenient place.

3.5.2 Clean Gap Pieces

Before placing the ironing modules, the gap piece(s) must be cleaned. There is a protective coating applied during the manufacturing process that protects the finely polished surface during shipping.

Carefully remove the plastic covering, making sure that all plastic covering has been completely removed.

Thoroughly wipe down the entire gap piece using a clean, dry lint-free cloth. Do not use solvents or abrasives during this process. Make sure the entire surface is cleaned of protectant.

3.5.3 Placement and Alignment

WARNING! Modules are heavy. Ensure that proper equipment and personnel are available to prevent injury or damage. Modules should only be moved by qualified machinery riggers using correct equipment.

Each module section has a chest and roll arrangement and up to 4 modules can be combined. Keep in mind the following terminology:

- The front module contains the controls and electrical connection.
- The center module(s), if necessary, include no extra equipment.
- The rear module contains the boiler, gas connection and compressed air connection.

Place the sections beginning with the rear module, then the center modules if so equipped and finally the front module. Once the rear module is placed, the position of the ironer becomes fixed.

3.5.4 Moving the Ironer to Location

a) **General**

The modules can be moved by using a fork lift or a crane with an appropriate sling system. The weight of the modules can be found in the technical data of the ironer. The minimum required entrance dimensions are:

Type 800: 71 x 71in (1800 x 1800mm)
Type 1200: 87 x 71in (2200 x 1800mm)

For single roller ironers the minimum required entrance dimensions are:

Type 800: 83 x 71in (2100 x 1800mm)
Type 1200: 99 x 71in (2500 x 1800mm)

b) **Using a Fork Lift**

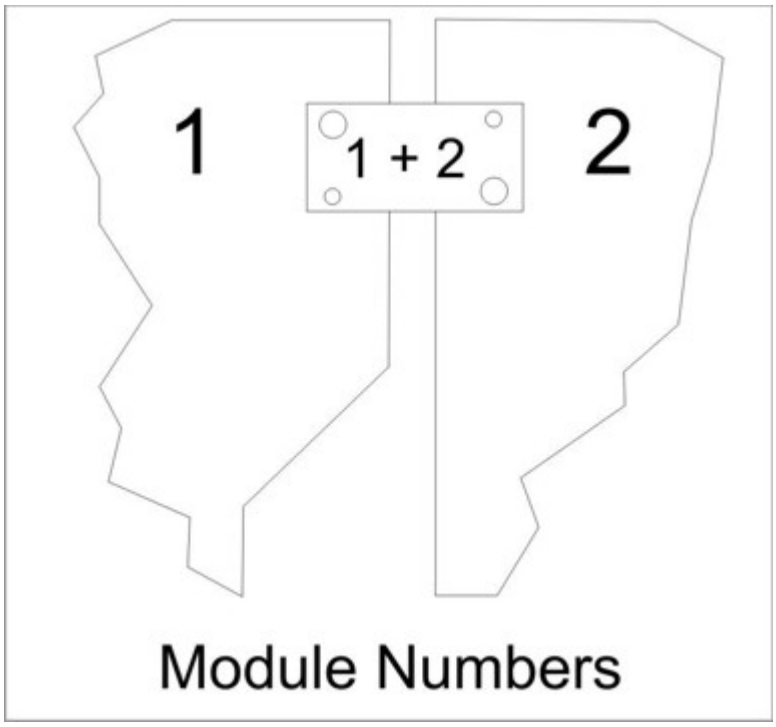


Figure 3.2: Module Bolting

NOTE: The fork lift used must have the required capacity and be fitted with appropriate forks.

The modules can be picked up at the I-Beams at the front side. If using a fork lift, then one side of the ironer is to be lifted and skid rollers are to be used for the opposite side. Lift the ironer and move it slowly to its destination. The passage of the load should be clear of any obstruction on the floor or overhead, such as power lines, ceiling beams and others.

c) **Using a Crane**

The transport brackets must be in position before attempting to move the modules with a crane.

NOTE: The crane used must have the required capacity and be fitted with appropriate slings and a spreader frame.

The modules are to be moved in a horizontal position only. After the modules are in position, remove the transport brackets before mounting the modules together.

3.5.5 Positioning and Leveling

The ironer should be positioned as per installation drawing. The minimum required side distance to walls or other obstructions or equipment is 36 inches (915mm).

NOTE: The module number can be found at the top of the side frame beside the connecting bracket (see figure 3.2).

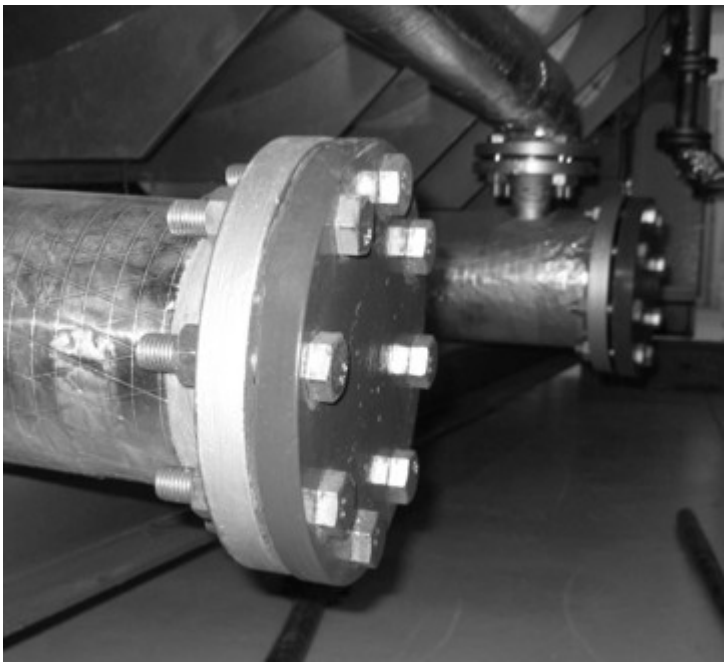


Figure 3.3: Flange Cover Detail

3.5.6 Center/Front Module Placement

With the module still on its skid, move it near its final position, about 12 inches (300mm) from the already placed module and remove the skid bolts.

Place drip pans under the flange shipping covers (painted red).

Note: Thermal Fluid may cause a skin reaction in sensitive individuals. Wear protective clothing. Refer to the Material Safety Data Sheet in the Appendix of this manual.

Remove the flange shipping covers from the thermal fluid supply and return connections. A small amount of fluid will drain out. Wait until the flow completely stops before continuing.

Note: Follow local codes for handling the disposal of the thermal fluid collected in the drip pans. Do not attempt to reuse this fluid!

Carefully clean the flanges and any additional spilled thermal fluid. Carefully dispose of the thermal fluid and cleaning materials according to local codes.

Using a crane or forklift, lift the module straight up and carefully remove the skid. Do not drop or twist the module.

Move the module until it is directly above its final location. The endframes of the modules will be in contact with one another. Carefully lower the section to its final position. Ensure that the gap piece is aligned with the chest of the previously placed module.

- The gap piece should be slightly above the mating chest and extend just beyond the surface

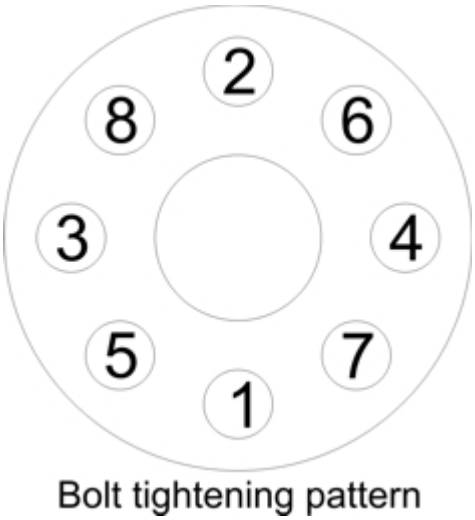


Figure 3.4: Thermal Fluid Flange Bolt Tightening

edge of the chest. The endframes must rest firmly on the floor.

- After the modules are set in location, bolt the lower I-Beams together using the hex bolts (M20 x 50). Do not tighten the bolts yet.
- Bolt the upper connecting brackets between the modules using the hex bolts (M8 x 35). Do not tighten the bolts yet.
- Level the modules by using sheet metal shims. The shims are to be used only under I-Beam at the chest support. The modules are to be leveled horizontally in two directions and must be parallel to each other.
- The holes for the roll pins (8 x 25) are drilled while the ironer is preassembled at the factory. Now tighten all bolts using the following torque values: (M8 = 16 ft-lb / 22 Nm) (M20 = 300 ft-lb / 420 Nm)

3.5.7 Internal Piping Connections

Once all modules are aligned, secured, and bolted together, the thermal fluid piping must be connected.

Starting at the rear module, connect the thermal fluid piping to the next module using the gaskets and bolts provided. Use care to avoid damaging the gaskets during installation.

Tighten the nuts and bolts by hand, then follow the crisscross pattern shown in figure 3.4.

Repeat these steps for each additional module.

After all internal thermal fluid piping has been connected, recheck for level on all modules using a large carpenters level.

Install the drive motor assembly at the rear right-hand side of the ironer. Align the drive pulleys with the driven pulleys using a steel straight-edge. Anchor the drive unit to the floor. Install the V-Belts between the drive pulleys and the driven pulleys.

Secure the machine to the floor or foundation if required by local codes.

***ACCESS LADDER (OPTIONAL)** Install the access ladder to the rear mounting position. Ensure the assembly bolts are tight to prevent any accidents! Only authorized technicians are permitted access to the top of the machine

***SAFETY RAILINGS (OPTIONAL)** Install the safety railing to the machine ensure installation is secure before technicians again access to the machine top.

3.6 Compressed Air Connections

3.6.1 Internal Connections

On each side of the machine in the electrical raceways, compressed air connections must be made. Follow the numbering scheme to connect the air lines correctly.

3.6.2 External Connection

The IM Series ironers require compressed air in order to raise and lower the rolls. Clean, dry compressed air must be provided at a minimum pressure of 65PSI (4.5 bar). A 3/8NPT connection is provided on the right side of the front (infeed) module.

3.7 Electrical Connections

3.7.1 Internal Electrical Connections

There are multiple connections to be made between modules before main power can be applied, including control cabling, temperature probe cabling, and burner cabling.

Note: Only a qualified electrician should complete the electrical connections inside the machine. Improper connections could lead to improper operation and serious injury. Do not connect main power to the machine until all internal connections are complete and verified.

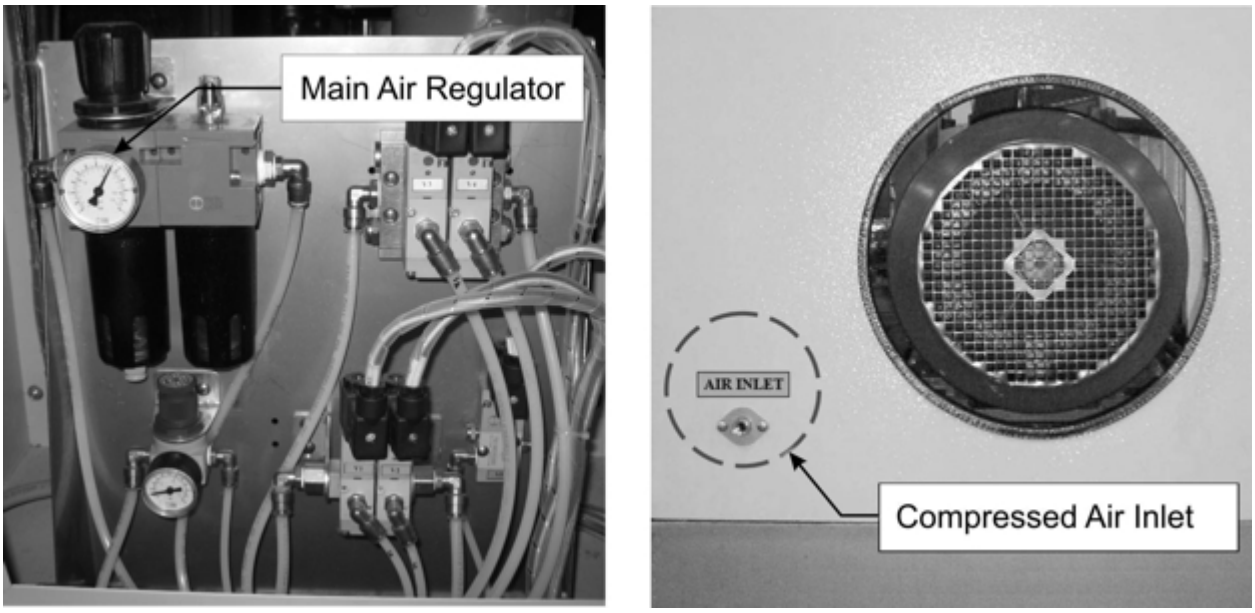


Figure 3.5: Compressed Air Connection

Figure 3.6: Electrical Panel

3.8 Exhaust Installation

3.8.1 Exhaust Connection

Separate venting of the machine into suitable exhaust systems is required for operator safety, ironer operation, and ironer reliability. Incorrect installation can lead to an unsafe environment for operators and damage to the ironer or padding. Labor and materials needed to properly vent the ironer must be locally sourced. Comply with all local codes regarding installation of the duct work.

3.8.2 Internal Duct Work

The roll exhaust ducting is inside the left frame of the machine when facing the infeed side of the machine.

Remove all packaging from the duct work, and connect using the supplied hose clamps. Verify the proper electrical phasing of the exhaust blowers and ensure that the blowers are rotating in the correct direction. Severe performance problems will occur if the phasing is incorrect.

3.8.3 External Duct Work

There are two separate exhaust systems on the IM Series ironer:

- A pressurized gas flue for the burner which heats the oil
- A non-pressurized vent for the roll evaporation blower

Caution: Two separate ducts are to be used for the machine - one for the roll evaporation blower and one for the oil heater. The two systems cannot be combined.

Note: Do not vent either system into a wall, ceiling or other enclosed area of a building.

3.8.4 Make Up Air

The IM Series ironer requires a constant supply of fresh air for combustion and make up air. Generally, the machine will require approximately 1.5 sq ft (0.14 sq m) of open area depending upon the size of the machine. Refer to the general specifications for additional details.

Check local codes to determine make up air requirements for the particular installations. Always follow local codes.

3.9 Gas Connection

3.9.1 Gas Pressure Requirements

The nameplate specifies the gas inlet pressure and BTU requirements of the machine. In order to perform reliably, the machine must be provided with the correct gas pressure and volume.

Gas pressures provided outside of the range indicated on the nameplate will likely cause performance issues or malfunction of the machine. Verify before installation that the gas supply is sufficient to meet the requirements of the nameplate.

All labor and materials needed to connect the gas supply to the machine are to be locally procured. Always follow local codes and regulations to ensure proper installation.

3.9.2 Gas Line Connection

The gas connection is made on the final roll of the ironer at the left side when facing the exit side of the machine. The gas line feeding the ironer must be at least a 2 inch line, regardless of the connection point size (varies with ironer model). The incoming gas line should be routed in such as way as to not interfere with service panel access and must not block any service access to the machine.

Be certain to check all internal gas connections and tighten any unions in the event that any came loose during the shipping and installation process. Use pipe joint compound when making gas connections and ensure that all local codes and requirements are followed. Use the proper bell reducer when connecting the gas supply line to the ironer. It is best practice to include a union at the point of connection to facilitate future service and maintenance operations.

Best performance will be achieved if the ironer's gas feed is not shared with other equipment.

3.9.3 Regulator Venting

If so equipped, the top of the gas regulator must be vented in order to operate safely. Depending on local codes, either a vent cap or vent tube must be connected to the regulator, allowing the regulator diaphragm to breathe and to limit/vent any escape of gas should the regulator fail.

Follow local codes requirements if a vent safety tube is used. The discharge end of the tube must be protected from the elements and insects or other debris that could clog the end of the tube. Route this line carefully using the shortest and straightest run possible.

3.10 Thermal Fluid Connection & Filling

3.10.1 Thermal Fluid Familiarization

Refer to the system diagrams on pages 28 and 29 for details on item nomenclature.

1. **Thermal Fluid** The thermal fluid used is either Paratherm HE, Shell Thermia B, or an equivalent Fluid. Also referred to as "'thermal oil"', "'heat transfer fluid"'. Formulations vary with different suppliers, but in general these fluids are not highly hazardous. Always keep a current MSDS sheet for your fluid on site.

2. **Insulation** In some locations in the machine fiberglass based insulation is used. If any of this insulation becomes soaked with thermal fluid it is important to remove, properly dispose of, and replace with new insulation as soon as possible. Thermal fluid soaked fiberglass can generate spontaneous combustion fires like oily rags in a dryer.

3. **Valve A (Expansion Tank Valve)** This valve blocks the flow of thermal fluid to and from the expansion tank. It should NEVER BE CLOSED during operation for any reason. Closing it can cause severe damage to your flatwork ironer and/or severe personal injury.

4. **Valve B (Pump inlet cut-off valve)** - This valve is used for servicing the thermal fluid pump, filter screen, or drying out the thermal fluid tank. This valve should never be closed in normal operation.

5. **Valve C (Pump outlet cut-off valve)** This valve is used for servicing the thermal fluid pump or filter screen. This valve should never be closed in normal operation.

6. **Filter Screen** This is a trap for particulate matter in the oil circulation system. When the ironer is new it is normal to find a small amount of foreign material like weld slag in the screen. As the ironer ages pieces of carbon may be found. This indicates that the system needs to be cleaned with a special solvent. Contact your thermal fluid supplier for a solvent and cleaning proceedure.

7. **Thermal Fluid Pump** This pump moves the fluid around the system. It is a higher performance precision pump. Note that there is a weep hole under drive shaft at the end of the pump body. In normal operation there should not be a significant amount of fluid coming from this hole. Never plug this hole. Weeping fluid indicates the need for new seals in the pump. See the Etanorm thermal pump manual for more information.

8. **Thermal Fluid Boiler** Although commonly called a boiler, the boiler is actually a high efficiency heat exchanger. It transfers the heat from the burner into the thermal fluid. item **PS2 (Pressure Switch 2)**) This normally open switch is connected to the inlet of the boiler. It goes closed when the inlet pressure reaches a pressure setting to confirm operation of the pump. On some machines there is an isolation valve feeding this pressureswitch branch line if present this valve should never be closed.

9. **PS3 (Pressure Switch 3)** This normally closed switch is connected to the outlet of the boiler. It protects the chests and transfer plates from excessive pressure and helps to confirm oil

flow through the system. On some machines there is an isolation valve feeding this pressureswitch branch line if present this valve should never be closed.

10. **PS4 (Pressure Switch 4)** This is an optional normally closed pressure switch that goes open in the event of excessive system pressure. This switch must be manually reset and if tripped will lock out operation of the heat source.

11. **Valve D (Bleed Valve)** this valve allows purging air or other gasses from the thermal fluid system. It should always be kept closed in operation.

12. **Valve E (Fill Valve)** This valve is located close to the pump inlet. This valve is used to fill or drain fluid from the system. It should always be kept closed during operation.

13. **Valve F** This is the high pressure gauge line valve. If this valve is present on your machine it is critical that it be kept open. We recommend removing the handle form this valve at commissioning to prevent accidental closure.

14. **Valve G** This is the low pressure gauge line valve. If this valve is present on your machine it is critical that it be kept open. We recommend removing the handle form this valve at commissioning to prevent accidental closure.

3.10.2 Filling the System - For Ironers with Recirculation Line Installed

This procedure details the recommended process for filling the thermal fluid system. This proceedure should be followed when commissioning a new machine or refilling the machine with fluid after service, or filling the system with cleaner (which is available from your thermal fluid supplier). Do not attempt to service the thermal fluid system unless you are properly trained and completely understand the operation of the machine. If you have questions consult your distributor or B&C Technologies service department. For reference, see the system diagram in figure 3.7 on page 28. Perform this procedure with the Rolls in the raised position.

1. **NEVER OPERATE THE THERMAL FLUID PUMP DRY!!** Before filling the machine remove the seal weep hole in the thermal fluid pump and fill it with thermal fluid as described in the pump manual. Operating the pump with dry seals for only a few seconds will permanently damage the seals.

2. If you are commissioning a new machine the system filter screen should be opened and cleaned before proceeding with the fill.

3. Make certain (check twice!) that the fluid expansion tank is clean and free of debris or water. Make certain (check twice!) that the fluid you are using for filling is new, clean and contains no water. If you are filling from an open drum pump a gallon from the bottom of the drum into a bucket and look for water, rust, or other contamination.

4. Connect a properly sized hose barb to outlet of valve E. Connect the fill hose from your barrell pump to this point and secure it to the barb with a hose clamp.

5. You should have a 3/8″ copper tube installed to the top of Valve D (bleed valve). This line should be routed to allow oil to flow from it into the tank vent.

6. Make certain that valves A, C and D are fully open. Valve A and B should be fully closed.

7. Open Valve E and begin pumping fluid into the system. Continue until a steady stream of fluid with little or no air comes out of the bleed tube into the expansion tank

8. Close Valve D, open valve A and continue pumping until the expansion tank is filled to of its volume.

9. Close valve E. Open valves A, B, C, D(C should already be open). Make sure the expansion tank cap is open and the new recirculation line is over the vent so that you can see oil flow from it into the tank.

10. The system should now be nearly full of oil, however there will still be some air bubbles in the boiler tubes and other locations. Now its time to ″degass″ they system. Before proceeding make certain that the master heat switch on the left control panel of the ironer is in the off position and the pump switch is in the ″manual″ position. The machine should also be completely assembled, powered, and commissioned before proceeding. During the remainder of this proceedure you should pour fluid accumulated in the 5 gallon bucket in the expansion tank when the bucket gets to full. You should also add thermal fluid to the expansion tank to maintain a level of .

11. Proceed by turning the ironer on, the pump will start automatically.

12. Close valve D slowly until a steady stream of oil flows from the recirculation tube into the expansion tank and let it run until no more air or foam comes out, typically about ten minutes.

13. Set the mode switch on the burner to ″manual″ so the burner can light but not go to high fire. High fire should not be used during initial degassing.

14. Set the main temperature control setpoint to 150F (65C). Turn on the machine and set the heat system control switch to ″on″.

15. Allow the machine to warm up and watch the recirculated oil stream for air bubbles. When there is no more air or foam for 10 minutes proceed to the next step.

16. Set the main temperature control setpoint to 210F (100C).

17. Repeat step 15

18. Set the main temperature control setpoint to 300F (150C).

19. Repeat step 15

20. Close Valve D and shut off the ironer for 10 minutes to allow foam and small bubbles to coalesce into large bubbles.

21. Restart the ironer, open Valve D, then repeat step 15.

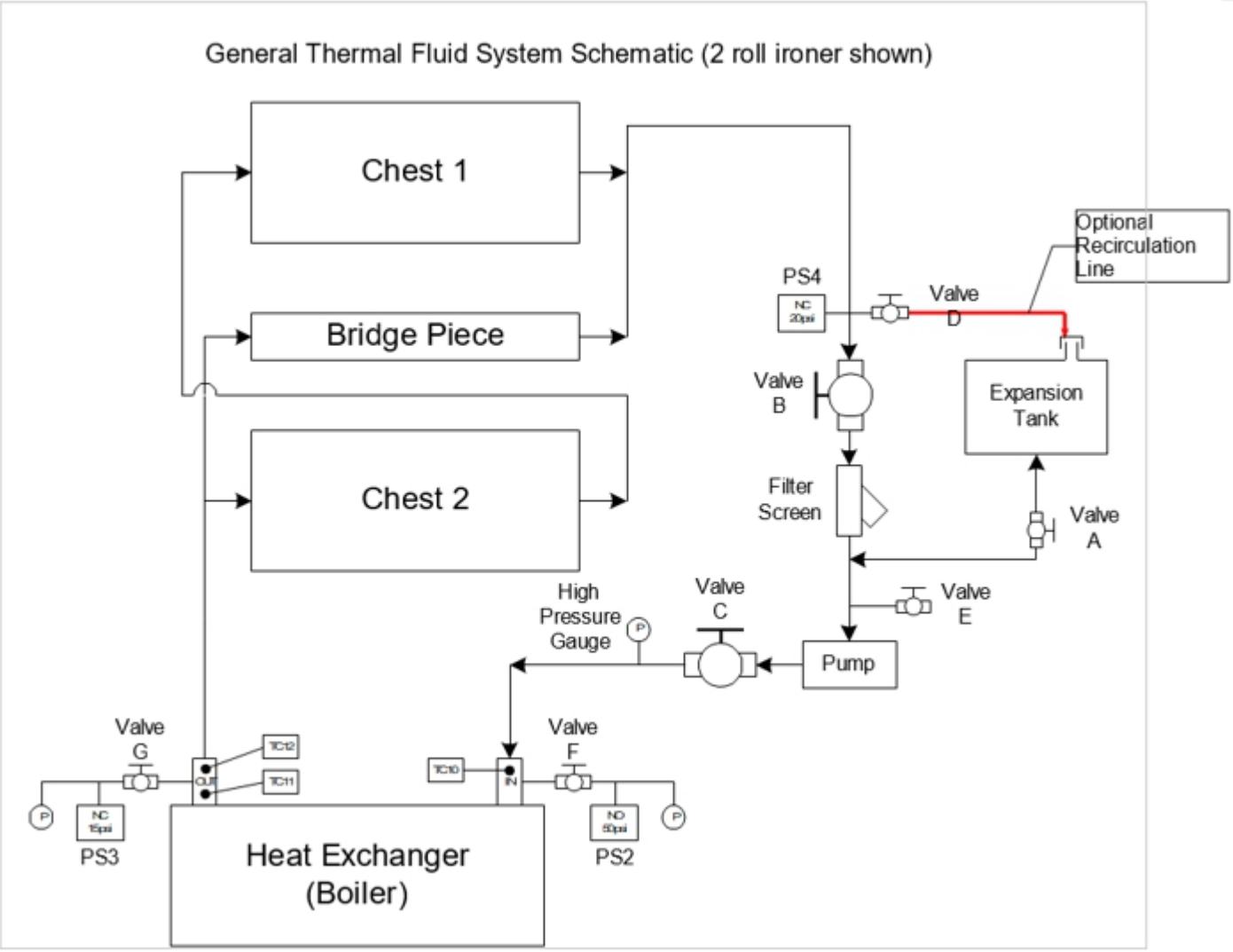


Figure 3.7: Thermal Fluid System Digram

22. Close Valve D and cap off the expansion line. You can leave the line in place.
23. The thermal fluid system should now be degassed.
24. Clean up any spilled oil, close valves D and E and remove any fittings and fill tubing installed earlier. Reinstall the caps or plugs removed from the system.
25. It is recommended that you seal and store the drums under a roof.

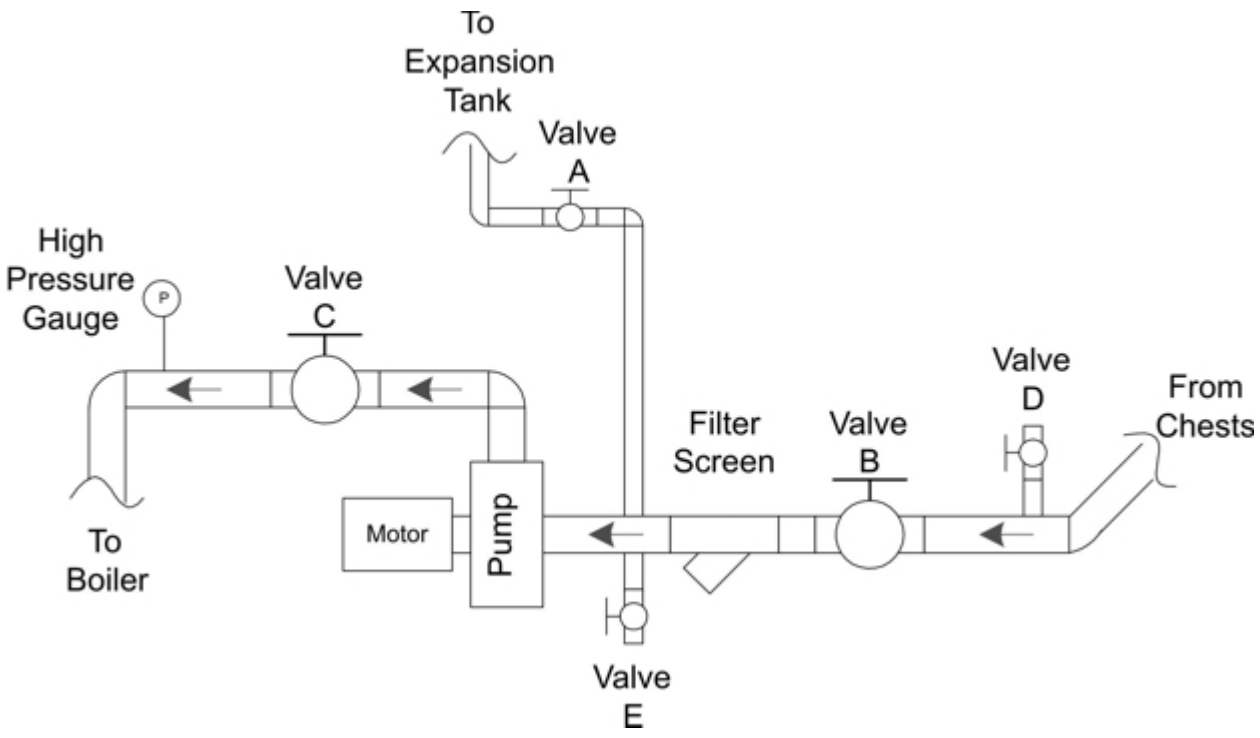


Figure 3.8: Thermal Fluid System Valves

3.11 Riello Burner Setup

IM Thermal Fluid Ironer, Initial burner setup procedure:

NOTE: For LP Gas you must install an LP Gas kit in the burner and follow the kit instructions. Note that with LP gas the required pilot pressure, main regulator pressure, and delivery pressure for max firing rate are very different.

1. Set air bypass screw and gas disk at according to the guidelines in the Riello Manual for the maximum required firing rate. Note that the Gas disk should always be set at 0 when firing LP gas, only the air bypass is adjusted.
2. Remove and inspect the flame holder assembly verify the spacings specified in the manual for the pilot, flame rod, and ignition electrode. Make sure the flame rod is in the new position specified in the Riello service bulletin.
3. Don't adjust the red, blue, and orange cams on the damper servo, leave them at the 90-0-15 factory positions.
4. The gas supply pressure feeding the machine should be 2 psi (140mbar). Never exceed 5psi as this will damage the pilot regulator.
5. If this is a new startup, set the pilot regulator to 6 W.C. (15 mbar) for natural gas and the air damper at pilot to about 15 degrees on the damper dial (this is adjusted with the cam profile screws).
6. Set the main regulator on the Krom-Schroder to about 3.0 W.C. (7.4 mbar) for natural gas.
7. If this is a new startup, set the damper so it is fully open (at 90 degrees on the damper dial) at 90 degrees on the servo cam.
8. Set the jumper on burner terminal 30–V11 to the 30–VP position, or install a switch for easier future adjustment.
9. Make sure the throat on both Krom-Schroder solenoids is fully open (this adjustment is at the top of each solenoid).
10. Set the burner mode switch to "manual"
11. Now try to light the burner – the pilot should light and nothing else. Manipulate the pilot regulator pressure in small increments until a stable clean pilot flame that relights easily results.
12. With a stable pilot set the jumper back on 30–V11 (or flip the pilot switch if one was installed).
13. Now relight the burner, still in "manual mode", and watch for the main burn to start. The pilot will now light for a few seconds, then the main burner will light, then the pilot will turn off after about 3 seconds. If the burner blows out when the main valve turns on then reduce the gas pressure setting on the Krom-Schroder regulator and try again. If a little faint blue main flame or no main flame appears, then decrease the damper setting slowly until a successful transfer from pilot to low-fire results.

14. When a good "crossover" from pilot to main burn occurs regularly, continue.

15. Run the burner up to high fire, set the main regulator pressure for a clean burn with less than 50 ppm CO at 3% to 6% O2 on a combustion analyzer inserted in the flue get the CO as low as possible. A CO level of 10 ppm or less can be achieved very easily.

16. Drop the burner to the next cam profile screw level and now set the damper position (very small adjustments) to achieve less than 50ppm CO at 3% to 6% O2 on a combustion analyzer. Again, a CO level of 10 ppm or less can be achieved very easily.

17. Repeat 15 until you reach the minimum firing point. It may be difficult to get the CO at min firing to less than 100ppm without running it too rich. The adjustment at this firing point is very touchy adjust the damper profile screws in very small increments. It may be necessary to increase the minimum firing point (red cam) on the servo and readjust the pilot pressure to attain reliable ignition and crossover with the burner now fully tuned.

18. Recheck pilot crossover and pilot stability by lighting and shutting the burner down several times.

19. With the burner at low fire, increase the setting of the air flow pressure switch until the burner faults, then reduce the setting by 20%, for example if it cut out at 1.0" WC reduce the setting to 0.8 WC.

20. Check that the burner does not exceed the maximum firing rate specified for the ironer it is installed in. If it does, reduce the red cam position until the pressure corresponding to the max firing rate is measured at the gas pressure test point on top of the burner.

Burner	Rolls	Roll Size	MBTU/hr(max)	Mcal/hr
RS50M	3	48 (1200)	2.5	630
RS38M	2	48 (1200)	1.6	403
RS28M	1	48 (1200)	0.8	202
RS38M	2	32 (800)	1.2	302
RS28M	1	32 (800)	0.6	151

Natural Gas Initial Settings Summary

Burner	RS28/M	RS38/M	RS50/M
Pilot Regulator Pressure	6.0"WC (150mmWC)	6.0"WC (150mmWC)	6.0"WC (150mmWC)
Pilot Damper	15deg	20deg	20deg
Main Regulator Pressure	3.0"WC (75mmWC)	3.0"WC (75mmWC)	3.0"WC (75mmWC)
Max Fire Damper	90deg	90deg	90deg

LP Gas Initial Settings Summary

Burner	RS28/M	RS38/M	RS50/M
Pilot Regulator Pressure	3.0"WC (75mmWC)	3.0"WC (75mmWC)	3.0"WC (75mmWC)
Pilot Damper	15deg	20deg	20deg
Main Regulator Pressure	8.7"WC (220mmWC)	11.4"WC (290mmWC)	14.2"WC (360mmWC)
Max Fire Damper	90deg	90deg	90deg

Ignition electrode should be 1/8″ from diffuser disk surface.
Pilot tube face should be 5/16″ from diffuser disk surface.
Flame rod should be 1/8″ from diffuser disk down stream surface.

See Chapter 5, section 5.7.7 for full details on settings.

Chapter 4

Operation

4.1 Operating Procedure

4.1.1 Perform Daily Inspection

1. Walk around machine and look for oil leaks, make sure the folder is in place, look for any loose parts and hazards.
2. Check the guide tapes. If there are many broken they should be replaced when the machine is cold.
3. Check the oil level. When the ironer is cold the level should be in the bottom 1/4 of the sight glass. When the machine is hot the oil will expand to 3/4 on the sight glass.
4. On the left control panel make sure the burner is off (green switch) and the oil pump switch is in the automatic position.
5. On the right control panel make sure all Roll switches are in the up position and the Blower is in the off position.
6. On the right control panel push the green on button. The machine will power up and the oil pump should start. Listen to the sound of the pump for irregular sounds or vibration. If you hear anything abnormal (slurping sounds, excessive vibration, etc.) please call for an inspection.
7. On the left control panel set the burner switch to on, and make sure the temperature is set for 330^{o}F on the lower display.
8. When the burner lights the Heating On lamp will be lit. If there is a problem, one of the burner / alarm or low pressure / Gas lamp will turn on. If the burner alarm turns on, then you can press the burner reset button on the right panel to restart the burner If you have to reset the burner regularly please call for service.
9. The machine will take about 30 minutes to heat up (depending on how cold it was). During this time review the waxing procedures and prepare to wax the machine.

10. When the Temperature on the upper display reaches about 270°F the machine is warm enough to be waxed.
11. Wax the ironer EVERY DAY according the waxing procedures.
12. After waxing the ironer is ready for work when the Temperature on the upper display is close to (10°F under) the temperature on the lower display.

4.1.2 Operating Tips

Leave the ironer at a set working temperature and adjust the speed so that your goods come out just dry. Any time you are not running the ironer you should raise the rolls (On the right panel set the Roll switches to up). This extends the life of the roll padding. Feed sheets and large items in the center of the ironer. With small pieces its best to spread them out across the ironer, however with a chest ironer you can safely run them in lanes.

4.1.3 Shutdown Procedure

1. One the Left panel set the burner switch to off.
2. On the right panel, set all roll switches to up, set the blower switch to off
3. Push the red off button.
4. The machine will power down except the oil pump will continue to run until the oil cools to a safe temperature. The pump will then turn off automatically.

4.1.4 Waxing Procedure

Every Monday

1. Wait for the ironer to warm up to at least 270°F (135°C).
2. Set the blower switch to off and set the speed to 10 – 15 ft/min (3 – 6 M/min).
3. Set the Folder to bypass or a waxing program.
4. Lower the rolls by setting all roll switches to down
5. Feed the wax cloth into the center of the ironer from the front edge with the aluminum scouring pad facing down and the wax flap up.
6. When the front edge of the wax flap is half way across the in-feed belts press the red off button on the right control panel. The wax cloth should be stopped in the ironer with the front edge of the wax pocket close to the safety gate.

7. Open the wax pocket and spread a 10 – 12 inch (25 – 30 cm) wide, 1/8 inch deep band of wax across the width of the sheet starting from the front edge of the wax pocket.
8. Lay the wax pocket flap down on top of the wax (this prevents too much from getting in the roll padding).
9. Push the green on button to restart the machine and make sure the roll switches are in the down position. The machine will start up, lower the rolls and begin pulling the wax cloth into the first roll.
10. Make sure the wax cloth comes out of the folder evenly - it will be very hot so wear thick fabric or leather gloves to protect your hands.
11. Take the wax cloth out of the folder and let it rest and cool for a minute to make it safer to handle.
12. Move the wax cloth back to the front of the ironer. Position the front edge to the left side of the in-feed and feed the wax cloth again.
13. Again, make sure the wax cloth comes out of the folder evenly - it will be very hot so wear thick fabric or leather gloves to protect your hands.
14. Take the wax cloth out of the folder and let it rest and cool for a minute to make it safer to handle.
15. Move the wax cloth back to the front of the ironer. Position the front edge to the right side of the in-feed and feed the wax cloth again.
16. Again, make sure the wax cloth comes out of the folder evenly - it will be very hot so wear thick fabric or leather gloves to protect your hands.
17. Take the wax cloth out of the folder and let it rest and cool for a few minutes. When cooled store the wax cloth either on a hanger bar or folded up inside a steel drum.

Every 4 hours of operation

1. Wait for the ironer to warm up to at least 270ºF (135ºC).
2. Set the blower switch to off and set the speed to 10 to 15 ft/min (3 - 6 M/min).
3. Set the Folder to bypass or a waxing program.
4. Lower the rolls by setting all roll switches to down
5. Feed the wax cloth into of the ironer all the way to the right side with the front edge with the aluminum scouring pad facing down and the wax flap up do not add wax.
6. Make sure the wax cloth comes out of the folder evenly - it will be very hot so wear thick fabric or leather gloves to protect your hands.

7. Take the wax cloth out of the folder and let it rest and cool for a minute to make it safer to handle.
8. Move the wax cloth back to the front of the ironer. Position the front edge to the left side of the in-feed and feed the wax cloth again.
9. Again, make sure the wax cloth comes out of the folder evenly - it will be very hot so wear thick fabric or leather gloves to protect your hands.
10. Take the wax cloth out of the folder and let it rest and cool for a few minutes. When cooled store the wax cloth either on a hanger bar or folded up inside a steel drum.

4.2 Running the Ironer

Proper operation of the IM chest ironer requires intelligence and diligence. One must take time to find the speed and temperature combinations for the type of goods and moisture retention in their situation. Following is some common guidance:

4.2.1 Cotton Sheets

For these goods the temperature may be run as high as 410°F on the thermal fluid units which allows very high processing speeds depending on the weight of the sheets.

4.2.2 Poly-Cotton Blend Sheets

Because of the synthetic fiber content, these goods have lower water retention after centrifugal extraction than equivalent cotton flat goods. Also, because the melt point of polyester fiber can be between 340°F – 365°F (170°C – 185°C) it is bad practice to run these goods at higher temperatures. If the fibers melt they will cause a residue which is difficult to remove.

4.2.3 Dryness

Goods should be considered ”dry enough” coming out of the ironer when they feel dry 5 minutes after folding. This can be verified with a moisture retention test – flat goods should be dried only to 2% to 4% residual moisture retention. The operator must also understand there will be some inconsistency when drying goods of nonuniform fabric weight (like a mixture of old and new poly-cotton sheets). In these cases you must set up your process (temperature and rate) to accommodate this without damage to the goods or the ironer. Over drying the goods typically causes static cling problems in the folder and melted polyester residue deposits in the chests.

4.2.4 Taking A Break

Standard practice with all chest ironers is to raise the rolls and turn off the roll vacuum during breaks. The roll padding wears much faster when turning in an uncovered chest so its important to raise the rolls when no work is being done. It has been said (and is probably true) that leaving the rolls down for a 15 minute break produces equivalent roll padding wear as 4 hours of working time.

4.2.5 Running Small Pieces

For the same reason stated in the previous section it is important to maximize bed coverage when running small pieces. Feeding small pieces in 2 lanes and never moving them around increases wear on the padding in the unused areas of the padding, is an extremely inefficient work practice, causes many other operational problems, and is thus expensive. Doing this will require more man-hours per piece, more BTU's per piece, and reduce the life of your roll padding. If small pieces must be processed and a 2 lane folder is installed, bypassing the folder and having 2 operators feeding 4 lanes (and moving them around) or 3 operators feeding 6 lanes (and moving them around) will reduce the cost associated with running small pieces. On the back end use 2 or 3 people to stack the goods flat or folded in half. Additionally, reduce the ironer temperature to 330°F and reduce the speed accordingly so that the goods spend more time in the ironer. This technique will increase your throughput, drastically reduce the average BTU's and man-hours per piece, and increase the output quality and dryness consistency of difficult multilayer goods like pillow cases. A smart laundry manager knows that running the ironer faster and hotter does not always mean more work is being done.

4.2.6 Ironing Speed and Temperature

To determine the appropriate speed and temperature parameters for a given work type, one should first determine the Moisture Retention of the work being processed. Next is to determine the weight per square yard (or square meter) of the material being processed (this is described further in the Moisture retention instructions on page 13). With these two pieces of information it is a simple matter to consult the Work Rate Chart for a quick answer.

Chapter 5

Maintenance

5.1 Wrinkle Patterns

The following figures will help to troubleshoot ironing problems based upon the types of wrinkles left in the flatgoods upon exiting the ironer.

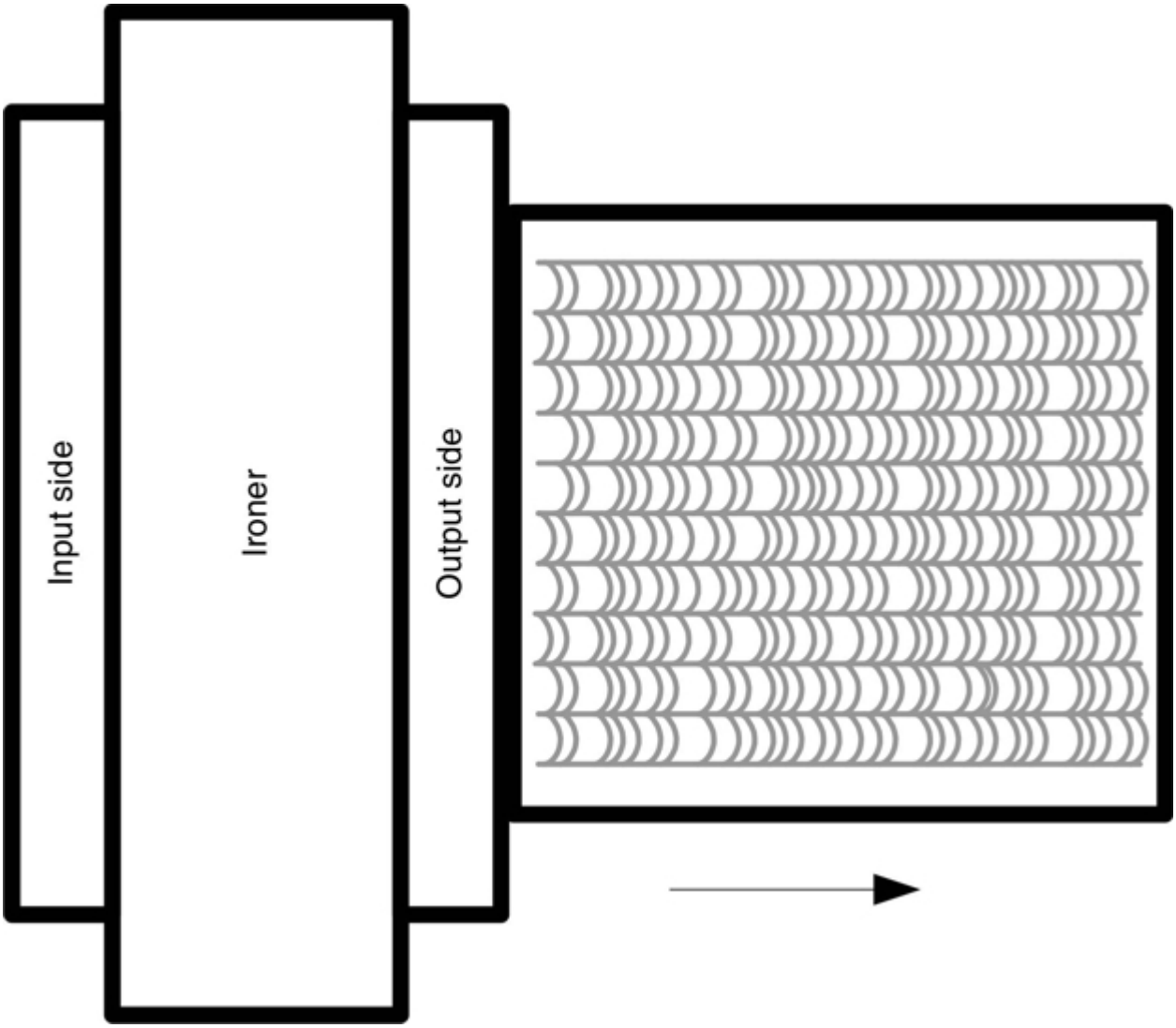


Figure 5.1: Wrinkle Pattern due to procession or excess roll speed differential

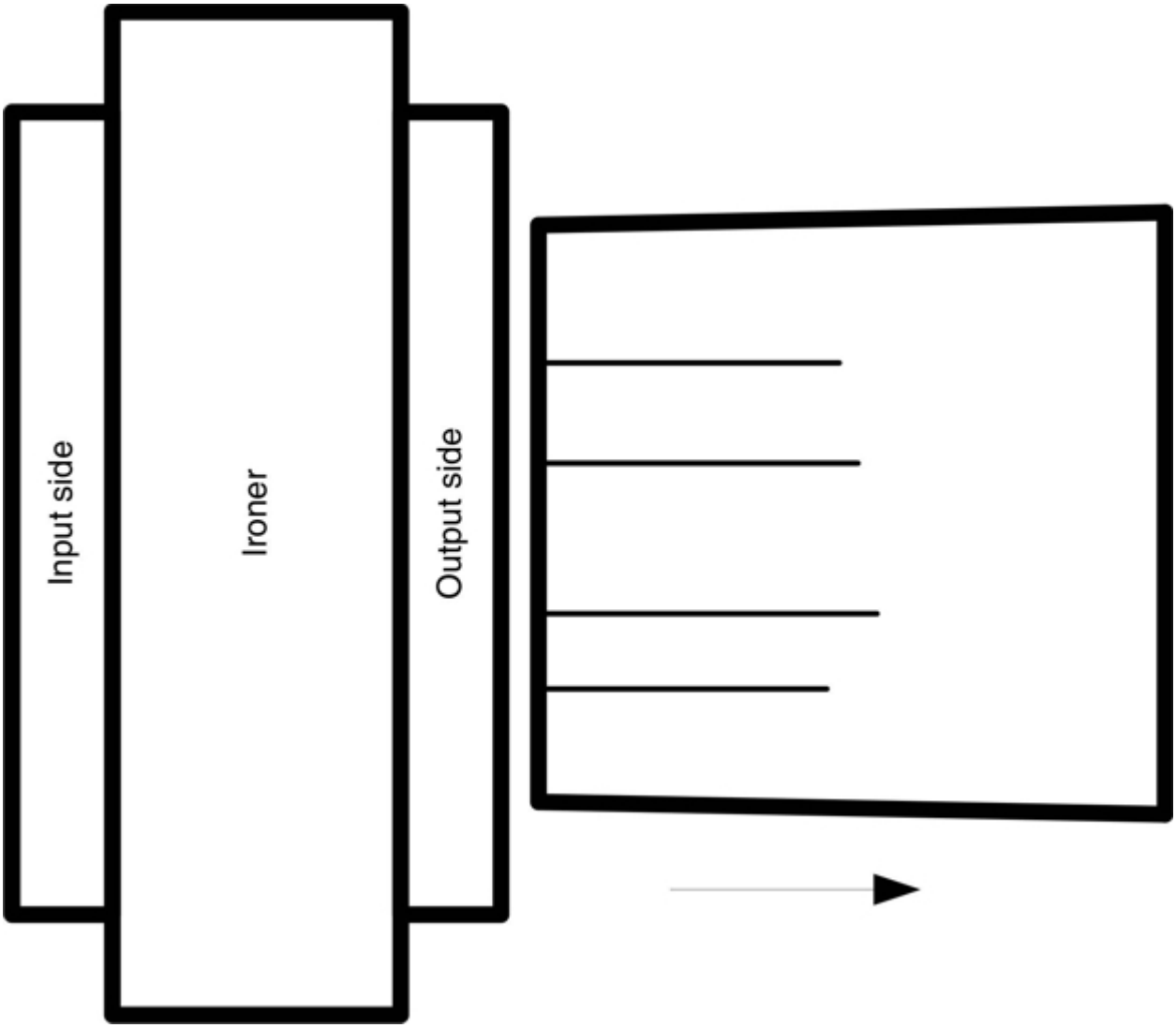


Figure 5.2: Wrinkle Pattern due to a slow infeed or too slow feeder speed

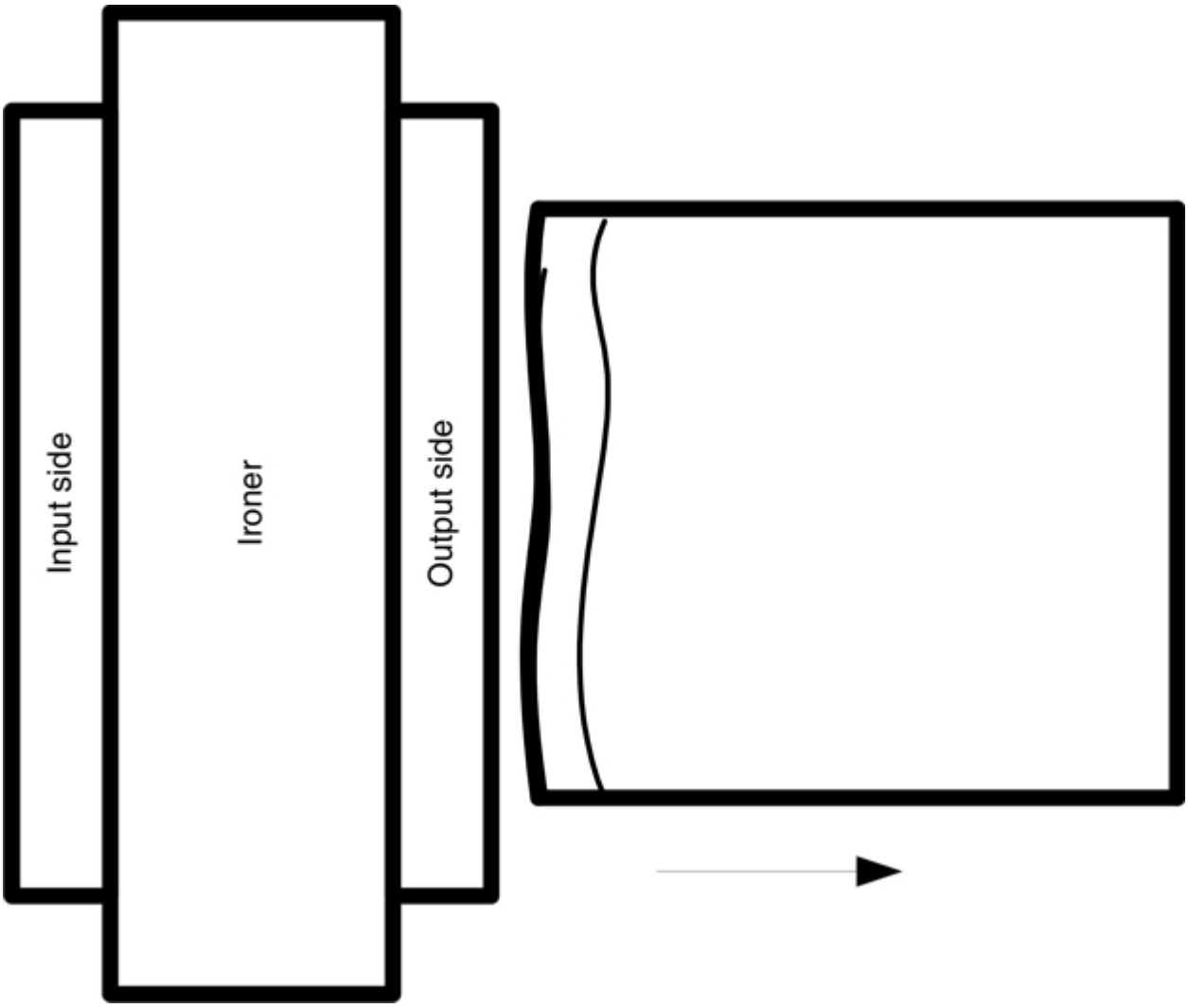


Figure 5.3: Wrinkle Pattern due the piece being held in the feeder causing the tail to pop forward into the input side of the ironer

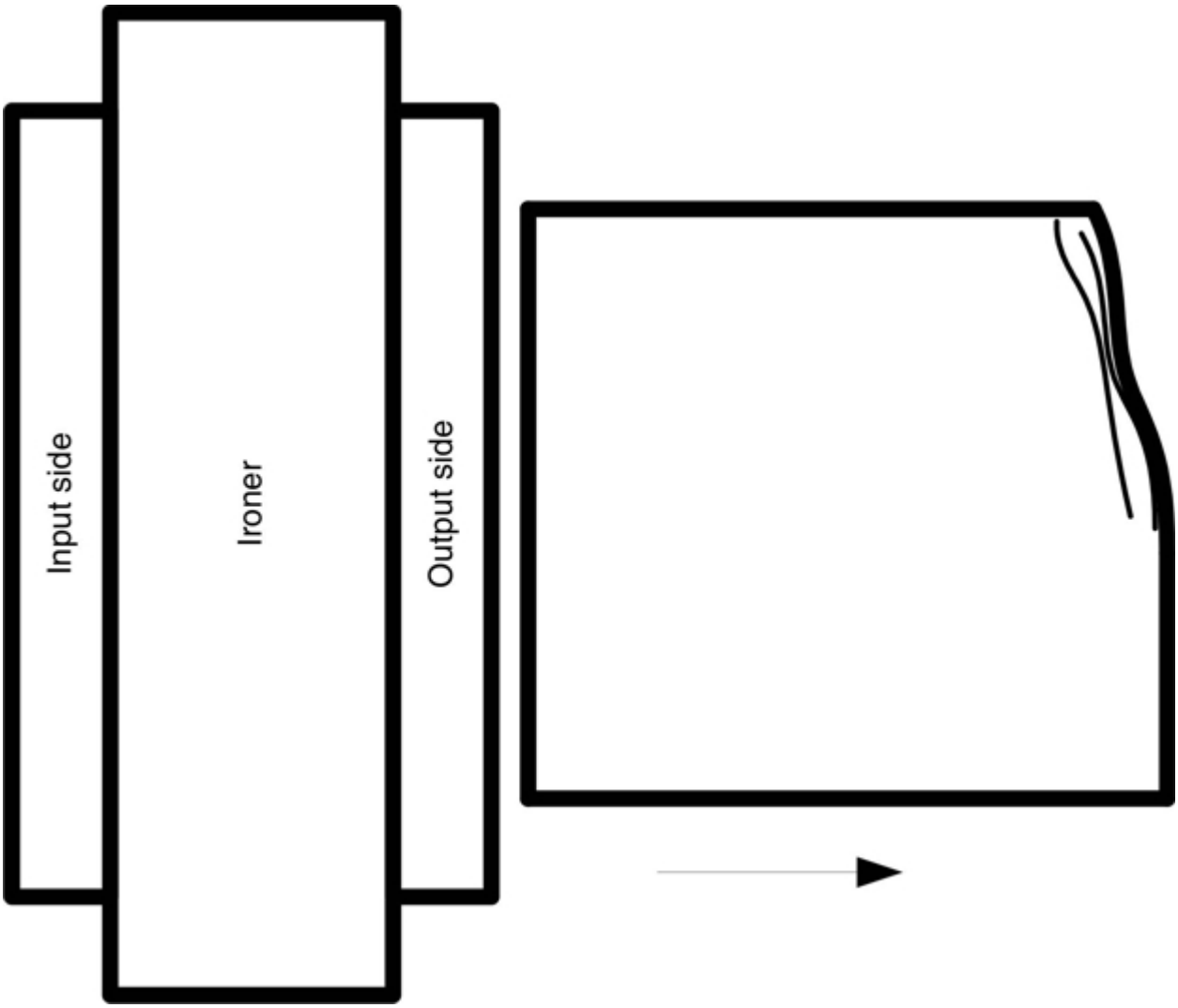


Figure 5.4: Wrinkle Pattern caused by infeed misalignment (goods catching on the leading edge of the chest) or bridge misalignment

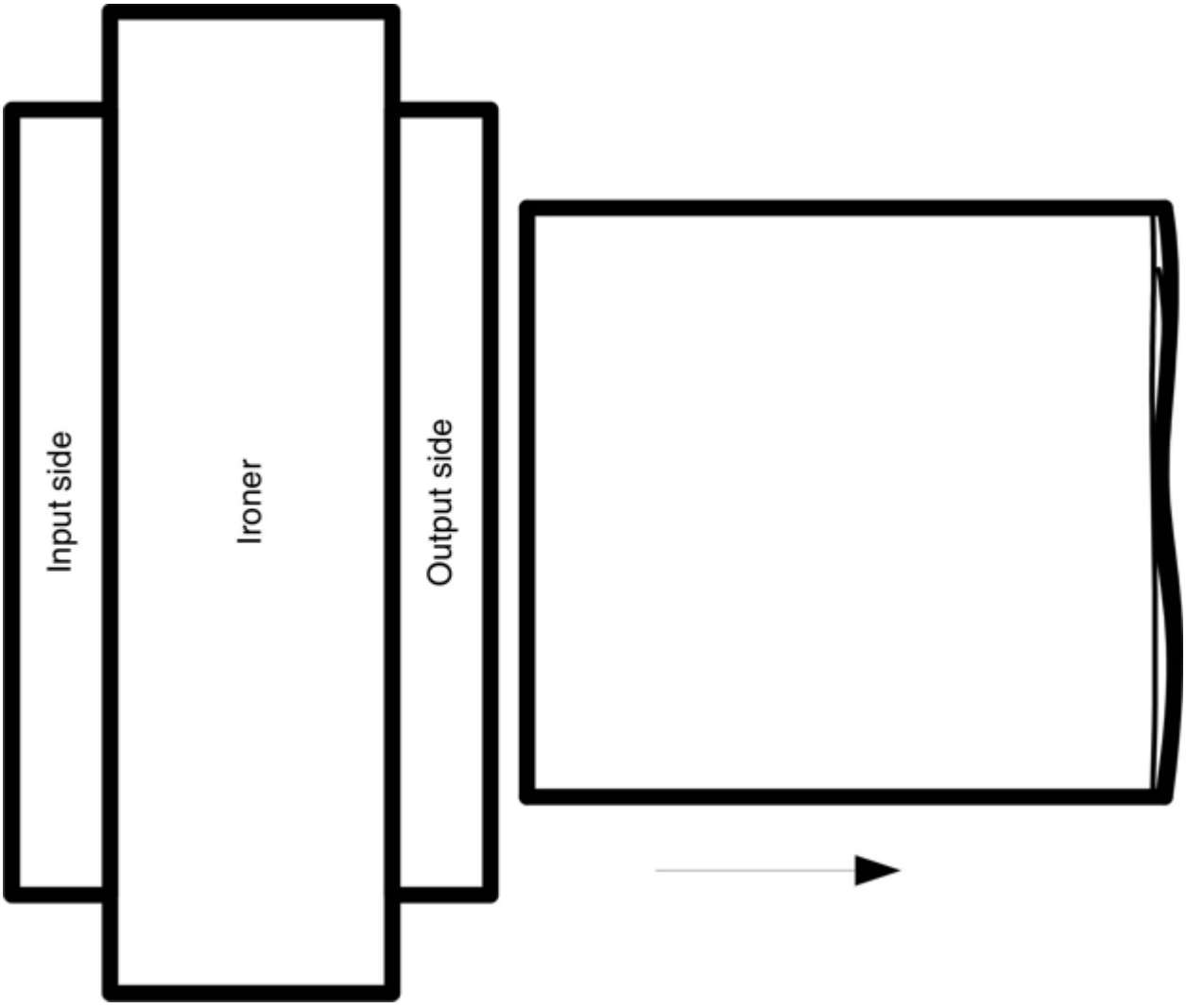


Figure 5.5: Wrinkle Pattern caused by residue in the first chest. This is characterized by wrinkling across the leading edge. There is often a yellow stain at the front edge as well.

5.2 Lubrication

All bearings should be lubricated with a high quality high temperature grease . Shell Darina EP2 or compatible is required. Mixing grease types can lead to catastrophic failure. Many types of grease bases (or soaps) are not compatible and can chemically react and fail. Lubricate bearings monthly, or every 200 hours of operation.

5.3 Chest Adjustment

The chests are supported at each corner by two rollers (see figure 5.6 on page 45). The chests are properly adusted at the factory and normally require no attention. The adjustment procedure is as follows:

NOTE: Do not attempt adjustments on this machine if you are not trained and authorized to do so. Follow all lockout and tagout procedures and remove power before servicing this machine.

1. Loosen transport bolts in longitudinal (front-to-back) direction only. The chests can now move freely in one direction. Do not loosen the axial transport bolts at this time.
2. After the ironer has been at temperature for at least 6 hours, tighten the longitudinal bolts so that a gap of about 2mm (.08″) remains and then tighten the lock nuts.

5.4 Drive Belt Adjustment

The transmission of power between the drive pulleys and the slip-on gear boxes for the rollers and the in feed conveyor occurs by means of a high-performance V-belt system.

The proper adjustment of this V-belt system is an important aspect of avoiding abnormal wear of the belts and to guarantee optimal power transmission. Excessive tensioning of the belts will cause premature wear of the belts and bearings (caused by high radial forces). Insufficient tension will cause premature wear of the belts and a slip between the rollers which will again cause disruption of the procession between the rollers and generally poor ironing performance.

The tension of the belts can be adjusted by means of moving the drive motor frame and/or adjusting the tension pulleys. After the initial set-up, the belts are to be checked after 100 operating hours.

The deflection force must always be measured perpendicular to the belt. The deflection is equal to 1 mm. per 100 mm. (i.e. – 1/8″ per 1 foot) strand length.

The deflection force and the deflection can be easily checked with a tension tester that is available from most auto parts stores. The tension tester consists of a calibrated spring measures on one side

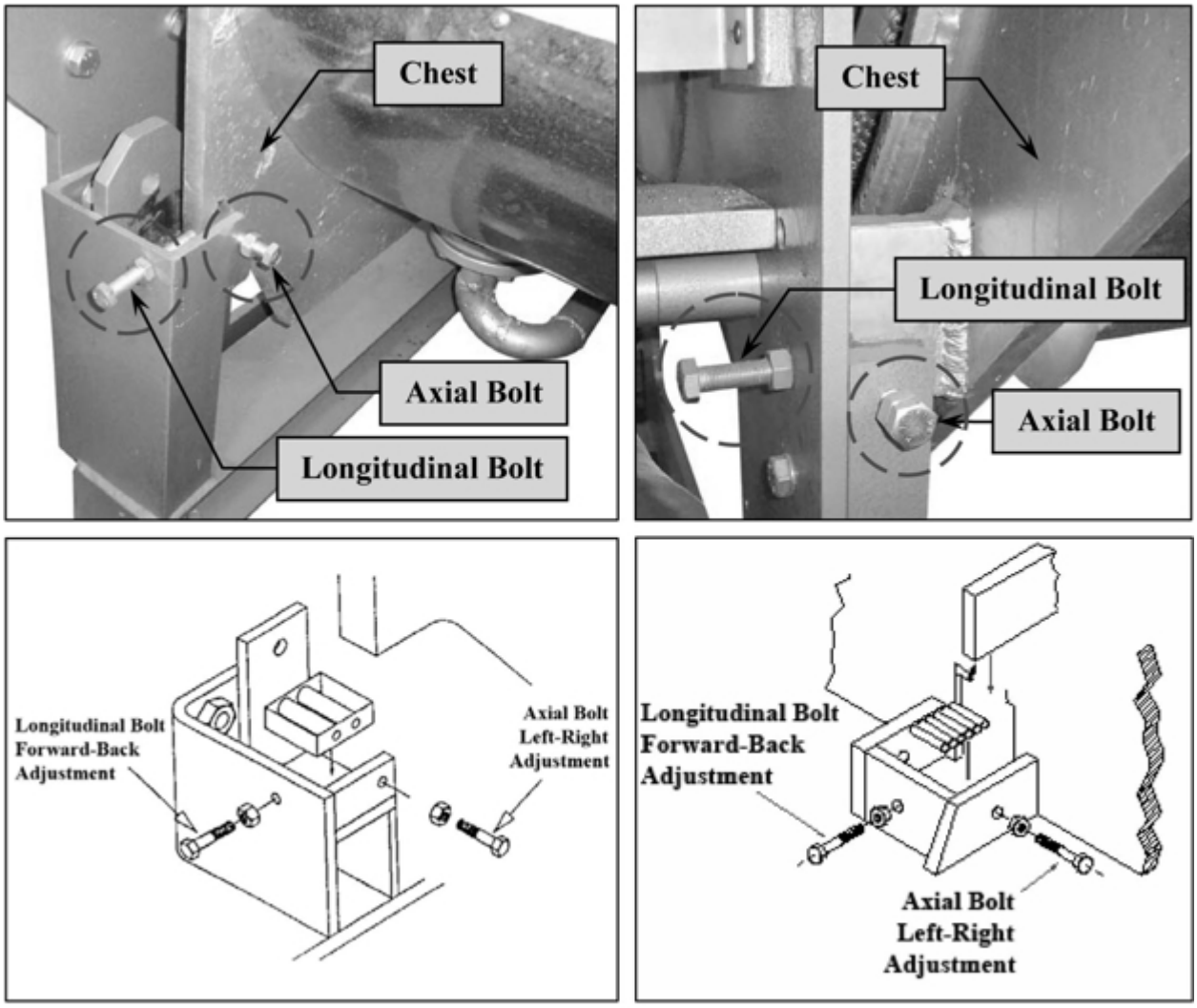


Figure 5.6: Chest Alignment

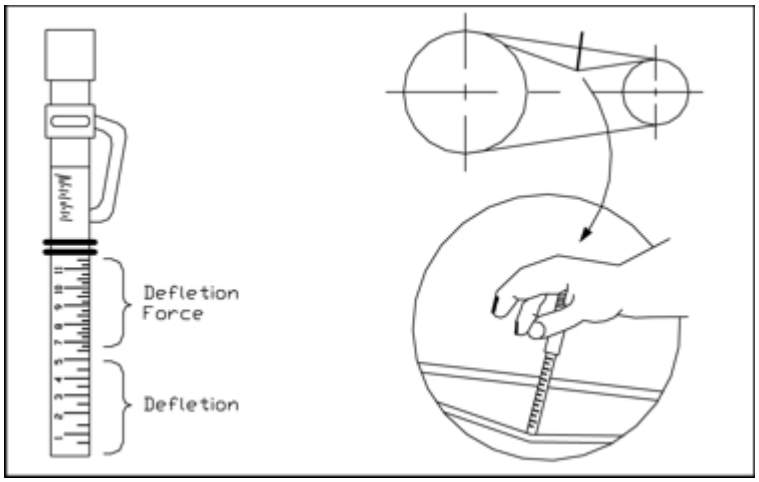


Figure 5.7: Drive Belt Deflection Tester

Table 5.1: Drive Motor to Intermediate Pulley Belt Deflection Table

Ironer Size	**Working Width**		**Deflection**		**Force**	
	mm	in	mm	in	N	lb
1x800	4000	157	7	9/32	16-24	3.6-5.4
2x800	4000	157	7	9/32	24-36	5.4-8.1
3x800	3500	138	7	9/32	17-25	3.8-5.6
3x800	3700	145	7	9/32	21-31	4.7-6.9
3x800	4000	157	7	9/32	21-31	4.7-6.9
1x1200	4000	157	7	9/32	24-36	5.4-8.1
2x1200	4000	157	7	9/32	17-25	3.8-5.6
3x1200	2700	106	7	9/32	21-31	4.7-6.9
3x1200	3000	118	7	9/32	35-37	7.8-8.3

the deflection and on the other side the deflection force. The measured values are indicated on a scale via o-rings. See figure 5.7 on page 46.

1. Slide the lower O-ring on the deflection scale to the required value, according to the tables. Set the upper O-ring to the ”0” line of the deflection force scale.
2. Set the tension tester vertically to the strand in its center. Apply force to the top of the tester so that the adjusted deflection value is reached. A steel straight edge should be helpful to read the scale.
3. The upper O-ring has now moved downwards and shows the deflection force. Read the value at the upper edge of the O-ring.

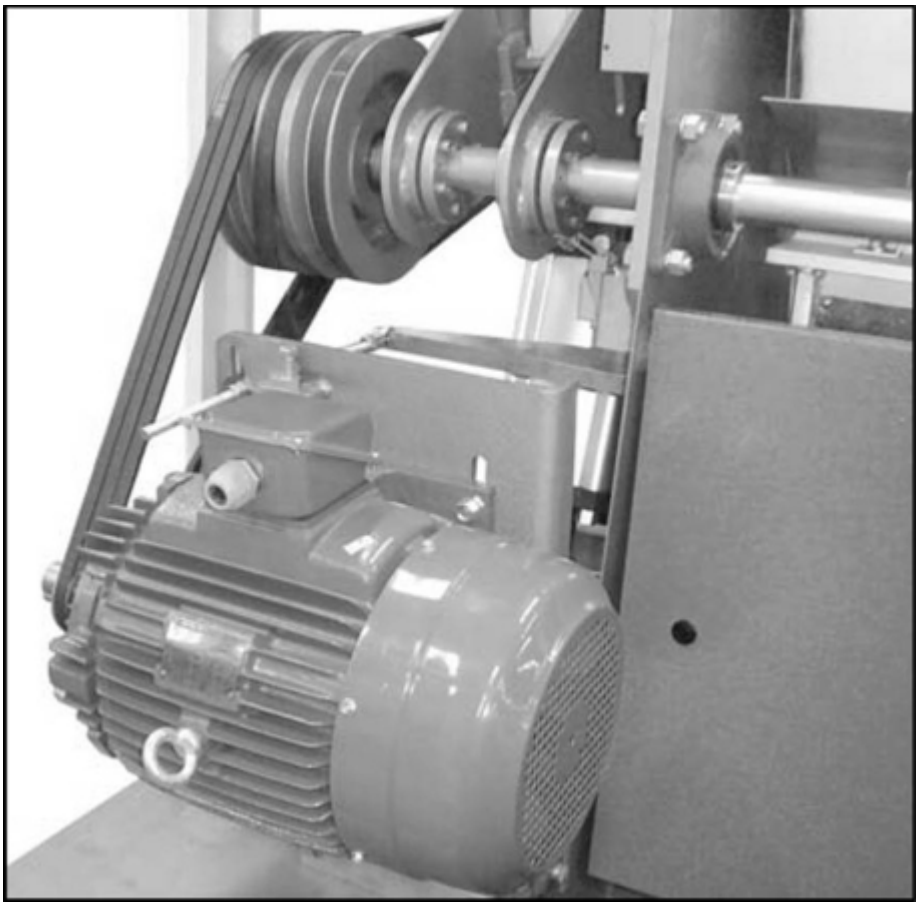


Figure 5.8: Drive Motor, Tensioner Pulley

5.4.1 Drive Motor to Intermediate Pulley Tension Adjustment

To adjust the belt tension between the drive motor and intermediate pulley, proceed as follows (refer to figure 5.8 on page 47 and the tension chart, table 5.1 on page 46:

1. Move the main power switch to the off position.
2. Remove last side cover on right hand side of ironer.
3. Loosen bolts at drive motor frame, tension to required value using the tensioning bolts.
4. Retighten all fasteners.
5. Replace cover and restart operation.

5.4.2 Intermediate Pulley to Variable Pulley Tension Adjustment

1. To adjust the belt tension proceed as follows (refer to figure 5.9 on page 49 and the tension chart, table 5.2 on page 48):

Table 5.2: Intermediate pulley to Variable pulley belt tension

Ironer Size	Working Width		Belt Size	Deflection		Force	
	mm	in	mm	mm	in	N	lb
800	3000+	118+	1500	5	5/16	16-24	3.6-5.4
1200	3000+	118+	1500	5	5/16	24-36	5.4-8.1

Table 5.3: Slip on gear to Infeed Roll Tension Chart

Ironer Size	Belt Size	Deflection		Force	
	mm	mm	in	N	lb
800	3350	15	19/32	4-5	0.9-1.1
1200	4120	17	16-Nov	4-5	0.9-1.1

2. Move the main power switch to the off position.
3. Remove side covers on right hand side of ironer.
4. Loosen bolt of idler located swing arm and tighten with the tensioning bolt.
5. Retighten all fasteners.
6. Replace covers and restart operation.

5.4.3 Slip on Gear to Infeed Roll Tension Adjustment

To adjust the belt tension proceeds as follows (refer to the tension chart, table 5.3 on page 48):

1. Move the main power switch to the off position.
2. Remove the first side cover on the right hand side.
3. The tensioner of the slip-on gear for the in feed roller is now accessible.
4. Loosen the nuts of the torque bar and adjust to required tension.
5. Retighten torque bar.
6. Replace first cover and restart operation.

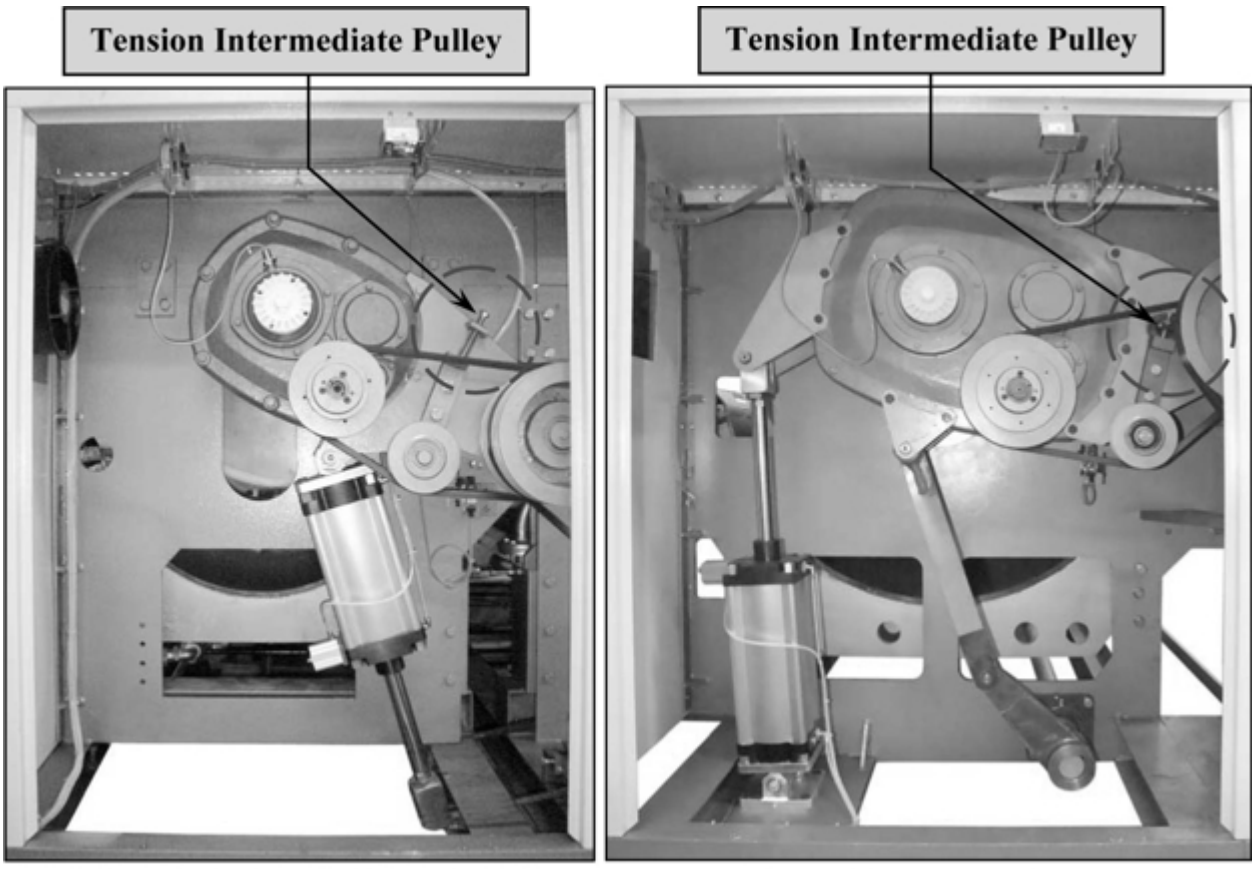


Figure 5.9: Tensioner Pulley Detail

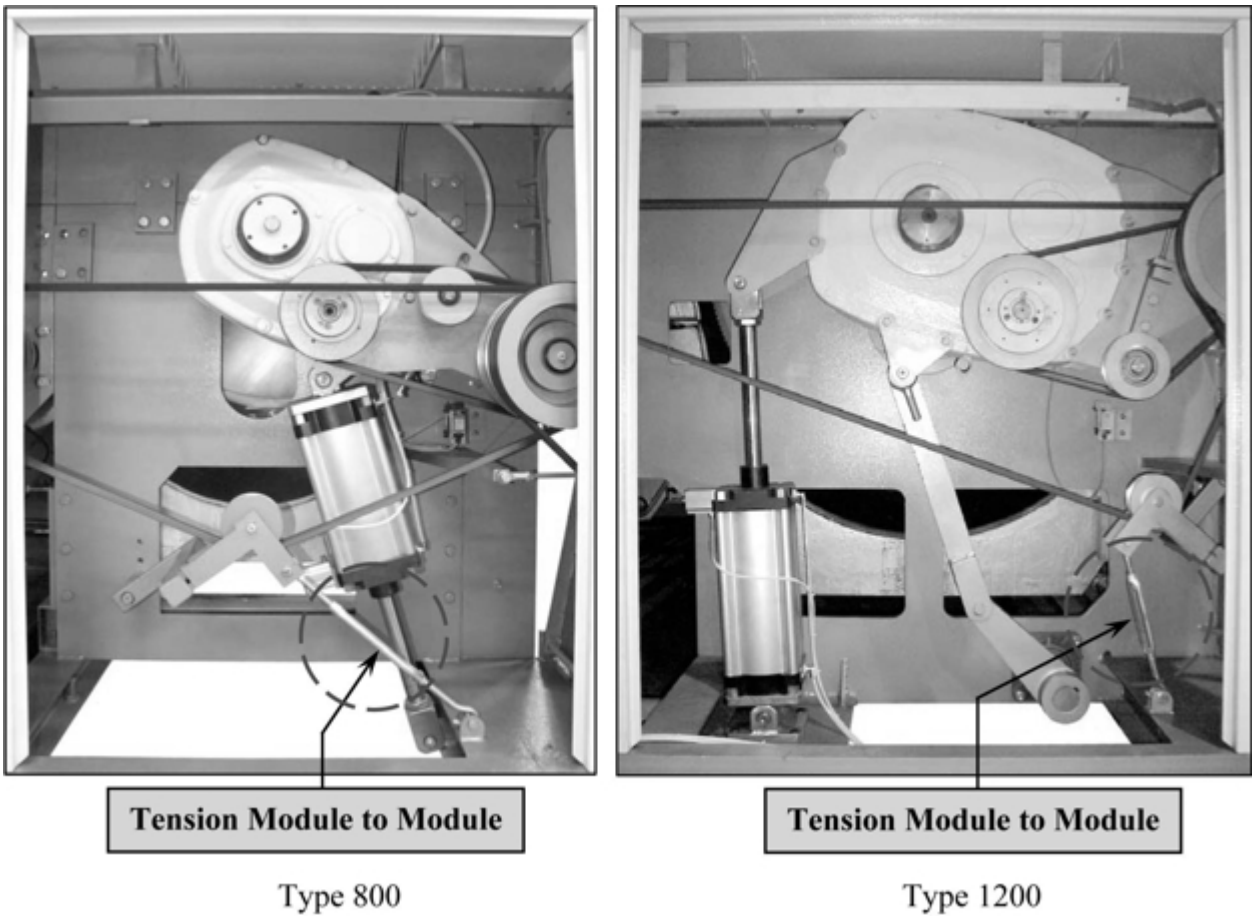


Figure 5.10: Roll to Roll Tension Adjustment

5.4.4 Roll to Roll Tension Adjustment

To adjust the roll to roll belt tension proceeds as follows (refer to figure 5.10 on page 50 and the tension chart, table 5.4 on page 51):

1. Move the main power switch to the off position.
2. Remove side covers on right hand side of ironer.
3. Loosen nuts of tensioner idler located on a turnbuckle.
4. Adjust tension in belts as required.
5. Retighten all fasteners.
6. Replace covers and restart operation.

Table 5.4: Roll to Roll Tension Chart

Ironer Size	Belt Size mm	Module Numbers	Deflection mm	in	Force N	lb
2x800	3150	1 to 2	13	1/2	12-18	3.6-5.4
3x800	3150	1 to 2	13	1/2	9-13	2.0-2.9
	3150	2 to 3	13	1/2	16-22	3.6-4.9
2x1200	4000	1 to 2	16	5/8	13-19	2.9-4.2
3x1200	4000	1 to 2	16	5/8	15-20	3.3-4.5
	4000	2 to 3	16	5/8	26-39	5.8-8.7

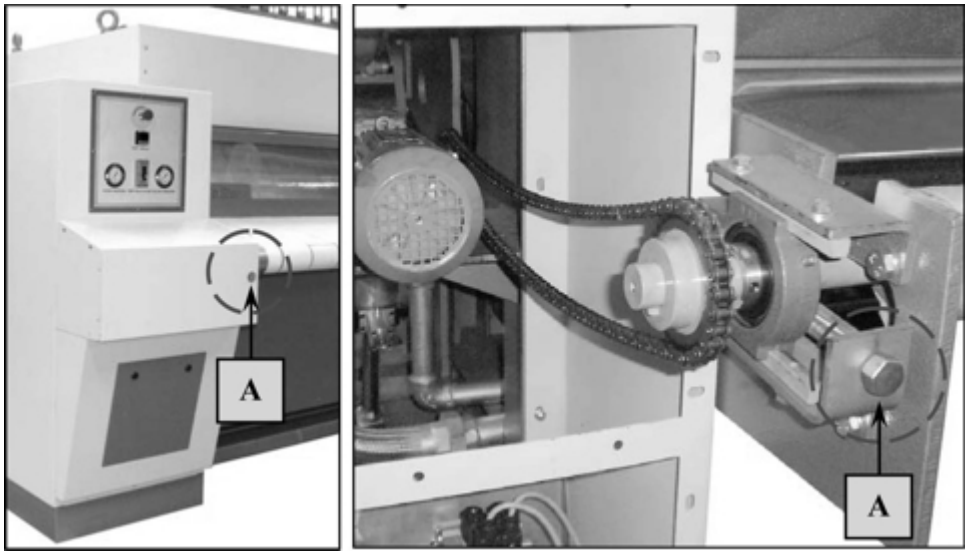


Figure 5.11: Infeed Belt Tension Adjustment

5.4.5 Feed Table Chain Adjustment

To properly tension the infeed belts, locate the access hole on either side of the infeed table (see figure 5.11 on page 51). To tighten the infeed belts, rotate the bolts on both sides clockwise. To loosen the infeed belts, rotate the bolts on both sides counterclockwise.

5.5 Roll Procession Adjustment

The rolls on a multi-roll ironer must rotate at ever increasing rates through the ironer for best quality. This is accomplished by adjusting each roll's speed relative to the previous roll. This speed difference is small but of utmost importance. Too much procession, and the sheets will be overly stretched and guide tapes will be frequently damaged. Too little procession will cause wrinkling of the goods and feeding problems. Adjusting the procession follows these basic steps:

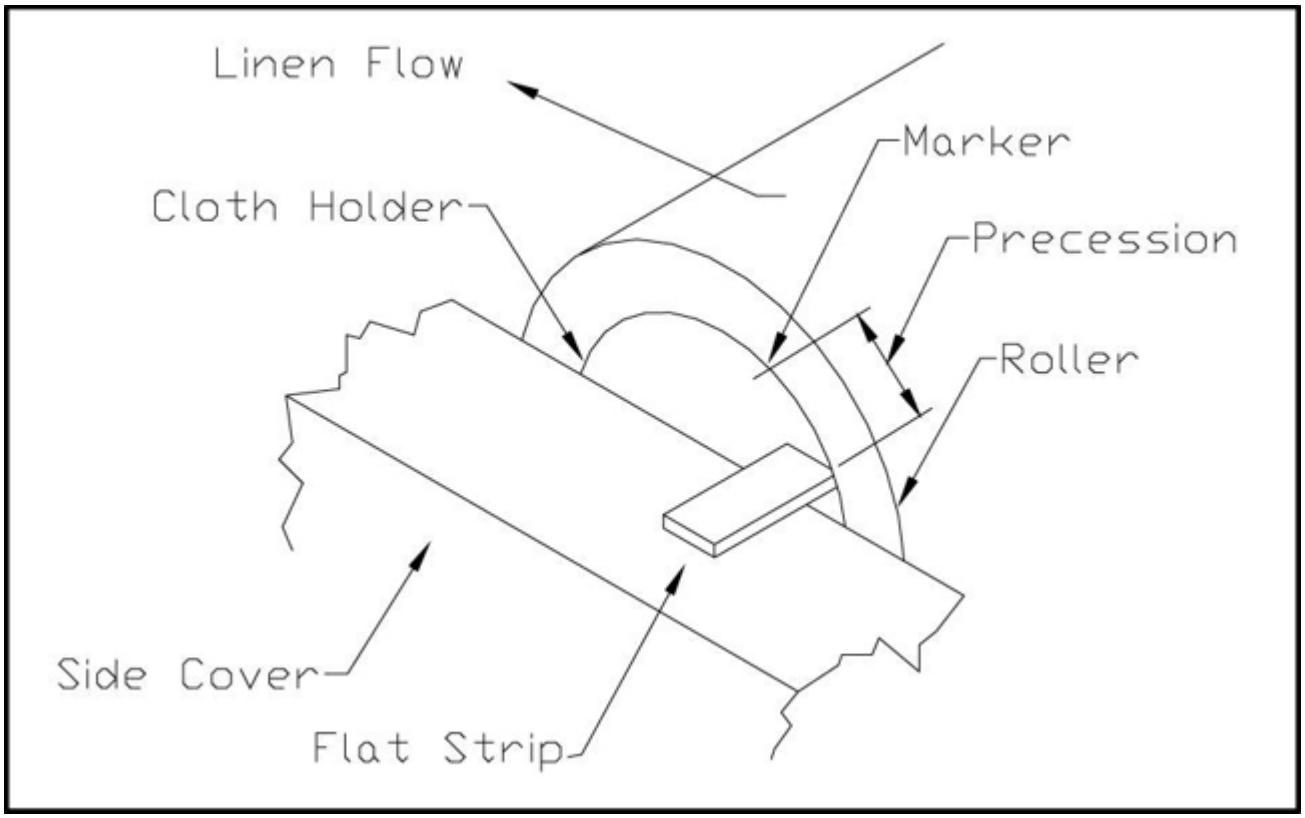


Figure 5.12: Measuring Roll Procession

Table 5.5: Roll Procession Chart

Ironer Size	Turns	Procession Length	
		mm	in
800	10	100-150	4-6
1200	10	150-200	6-8

1. Raise the rolls
2. Place a mark on the edge of each roll, and a corresponding mark on the frame of the machine, or a strip of metal near the roll, see figure 5.12 on page 52
3. Run the machine so that the first roll rotates 10 complete times, coming to rest at the mark
4. Move to the proceeding roll and measure the distance from the mark on the frame to the mark on the roll
5. Compare your results to the procession chart in table 5.5 on page 52

To adjust the roll procession:

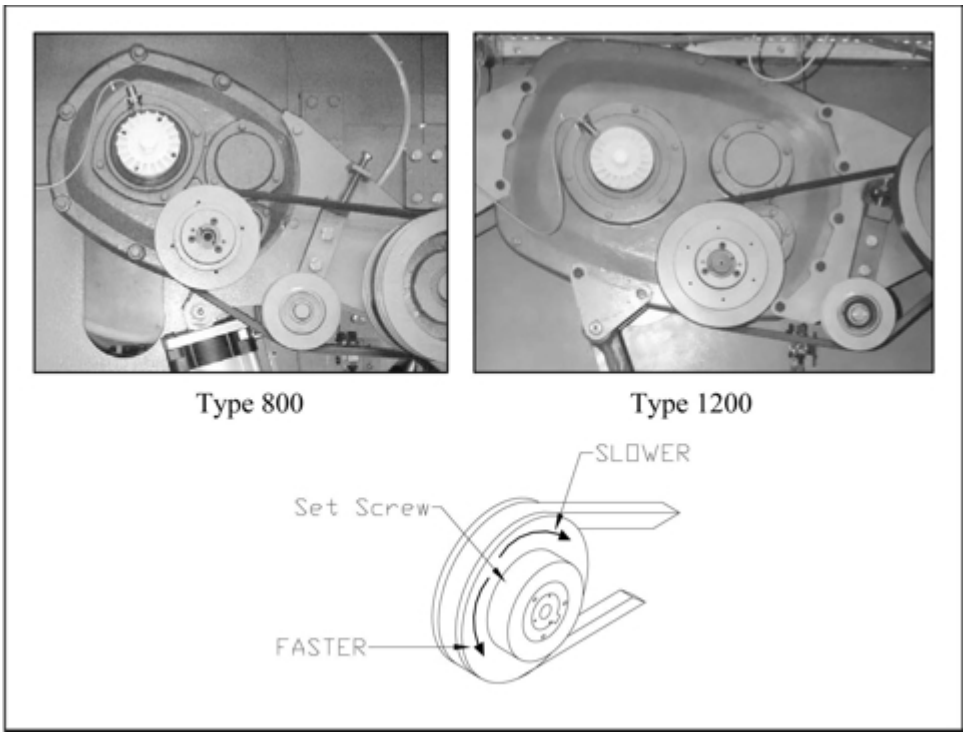


Figure 5.13: Roll Procession Adjustment

1. Move the main power switch to the off position.
2. Remove side covers on the drive side.
3. Loosen nuts at tension idler between the intermediate pulley and the variable pulley.
4. Loosen set screws at the variable pulley outer flange.
5. Turn outer flange as required in 30 degree (rotate 12 o'clock to 1 o'clock for 30 degrees of rotation) steps. See figure 5.13 on page 53
6. Line up two threaded holes on outer flange of variable pulley with the grooves on the hub, insert set screws and tighten.
7. Tension the belts by means of the tension idler and tighten all fasteners.

5.6 Roll Padding

5.6.1 Trimming the Roll Padding

The roll padding must be trimmed periodically. More often when a new pad is installed (two to three times a month), less when the padding is aged and ”settled” (once every two months).

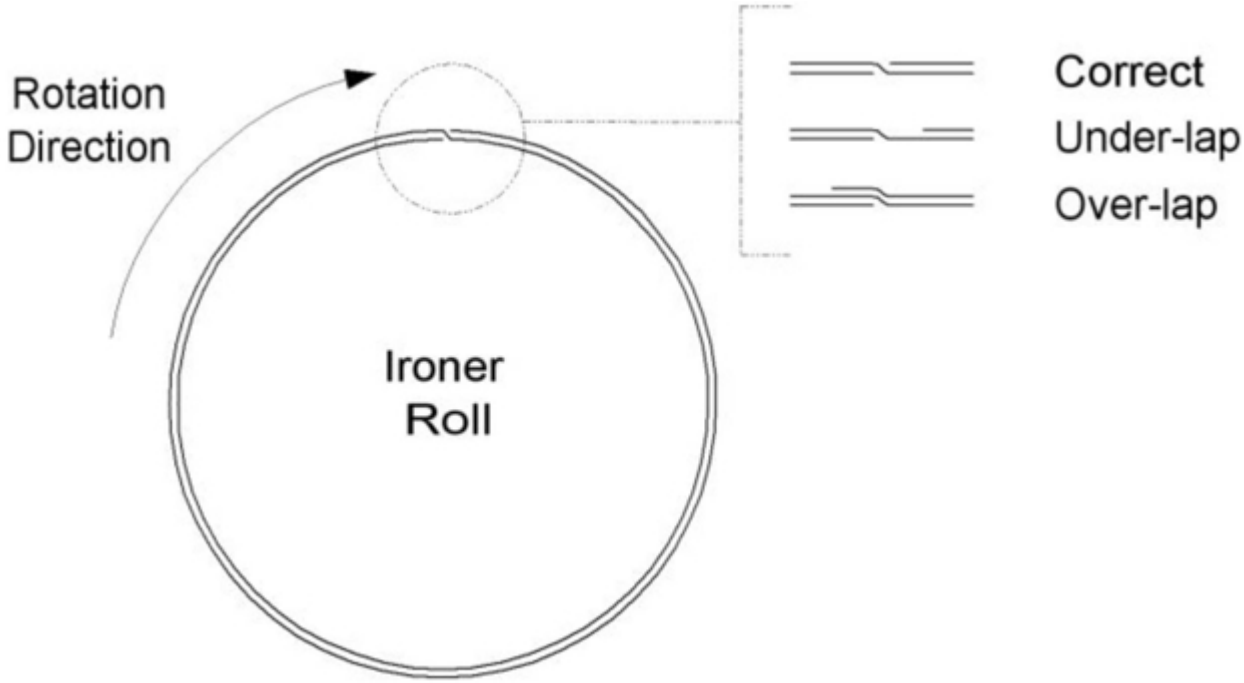


Figure 5.14: Correct overlap for roll pad trimming

Single roll ironers are particularly sensitive to improper padding overlap because they don't have a second roll to press the gap left by the first roll.

If the padding is overlapped, goods will typically show a highly polished strip followed by a damp or wrinkled strip across the width of the roll. In this case the padding should be trimmed. If too much is trimmed an underlap condition will result.

If the padding is underlapped, goods will usually show a damp or unpressed strip across the width of the roll. To correct this situation the bed pressure can be increased to accelerate the stretching (and wear) of the roll padding.

Padding should be trimmed so that the tail of the last wrap makes 2 perfect layers of padding around the cylinder. It is generally agreed in the industry that the padding should be trimmed back as close as possible to or just before (5-10mm or 0.25-0.5 inches)the overlap point. If the padding is trimmed before the overlap point a very small but generally unnoticeable underlap condition will result. Refer to figure 5.14 on page 54 for correct roll pad overlap.

5.6.2 Roll Pad Discoloration (Yellowing)

The reason pads yellow prematurely is bad chemistry in the washer. The main problems are:

1. Bleach carry over – this is caused by too much bleach or lack of rinsing.

Table 5.6: Replacement padding dimensions

Model	Width	Length	Replacement Wt.	Factory Wt. (Break-in)
IM800x3000	130″ (3.3m)	197″ (5.1m)	24 oz (800g/m2)	21 oz (700g/m2)
IM800x3300	142″ (3.6m)	197″ (5.1m)	24 oz (800g/m2)	21 oz (700g/m2)
IM1200x3000	130″ (3.3m)	295″ (7.5m)	24 oz (800g/m2)	21 oz (700g/m2)
IM1200x3300	142″ (3.6m)	295″ (7.5m)	24 oz (800g/m2)	21 oz (700g/m2)

2. High alkalinity – this is usually from adding too much sour to get the pH down to 6.0. The sour and alkali react in solution to form dissolved salts. This results in salt buildup in the roll padding – clogged up padding results in ineffective moisture removal and results in performance problems. To correct, add a rinse and reduce the sour you are dumping in.
3. Final pH too high. the final pH should be 5.5 to 6.0. This should be checked with a pH indicator a few times a day or once a shift.
4. Over-waxing or use of powdered wax.

5.7 Guide Tape

Functionally, guide tapes help pull material from one chest to the next and to keep goods from sticking to surfaces at transitions in the ironer. They are critical for ironer operation. It is normal to loose or break guide tapes occasionally - they must be continually replaced. Most laundries have maintenance people check the guide tapes (and do other maintenance) every morning before the machine is started up and heated for the day. Excessive tape breakage can be due to:

- Roll speed differential is too large. Reduce to 0.5%. See adjustment procedure in section 5.5.
- Guide tapes coming untied – use a better knot (see section 5.7.1).
- Tapes are snagging on a transition edge, check chest and bridge alignment.

5.7.1 Securing Tapes

There is much continuing debate about how to tie guide tapes in an ironer. The preferred method seems to be fusing - where a special tool is used to melt them together however this is not always possible. The widely preferred knot is the square knot (aka reef knot). However modern guide tape materials are somewhat slippery and can allow a properly composed square knot to pull out. Refer to figure 5.15 on page 56 for instructions on tying a proper square knot as well as the more preferred surgeons knot, which is simply a square knot with an extra turn.

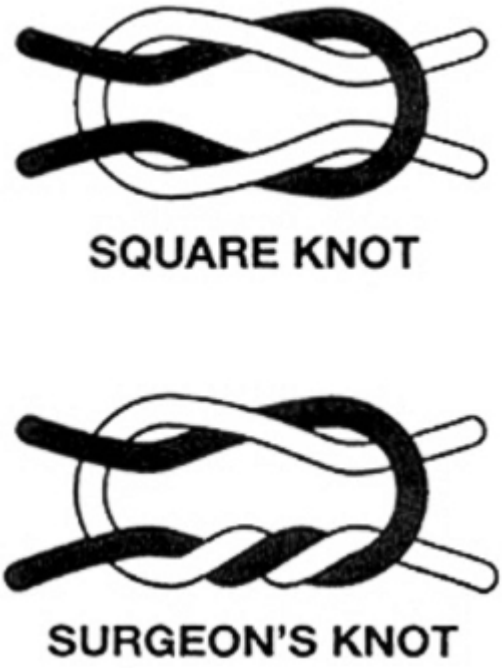


Figure 5.15: The surgeon's knot

5.7.2 Materials

Guide tapes come in various materials and widths and materials. All IM chest ironers use 3/4" width material should be used for guide tapes. Guide tapes for ironing machinery are primarily available in 3 versions of 2 materials – Polyester and Nomex. Nomex is a Dupont trade name for a type of Aramid fiber with a maximum service temperature of 220°C, perfect for high temperature ironing. Polyester (Polyethylene terephthalate) is a very common material, also used in poly-cotton sheets and other flat goods. Polyester typically softens at 338°F (170°C) and should not be used at temperatures much above this.

- Polyester – good for steam heated ironers.

- Polyester – Aramid Blend - Good for steam and thermal fluid ironers up to about 380°F (193°C).

- Nomex (Aramid) - This is the preferred material for all high speed high temperature ironers, particularly for Thermal fluid heated ironers operating in excess of 380°F (193°C).

5.7.3 Routing The Guide Tapes

When installing guide tapes they should be routed through the machine as shown in figure 5.16. There are many methods of installing tapes, but the most people prefer to tie new tape to an

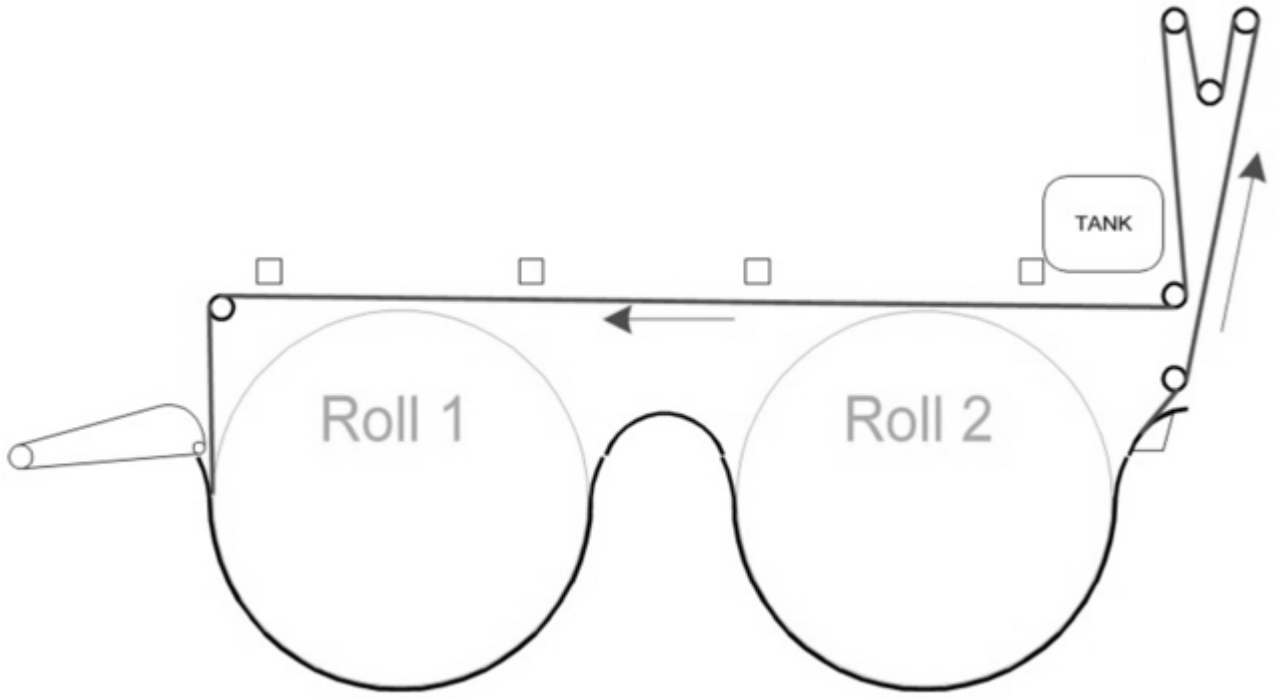


Figure 5.16: The guide tape feed route

existing one adjacent to the location where the tape is missing. You can then lower the rolls and jog the machine slowly to pull or ”thread” the new tape into the machine with an old one... with some practice you will become adept at keeping the tapes from becoming tangled. The new tape is then threaded through the tensioner at the location missing the tape.

5.7.4 Gearbox Lubrication

Type: Darmex 140 or equivalent Use an SAE 140 (ISO 460) Weight Synthetic Gear Oil for replacement if Darmex 140 is unavailable.

Interval: Change the gear oil after the first 500 hours of operation, then every 2000 hours of operation.

Capacity: IM800 - 7 liters (1.85 gal) per roll IM1200 - 12 liters (3.2 gal) per roll

Procedure:

1. Move the main power switch to the off position
2. Remove right side covers.
3. Drain oil from gear box while it is still warm.

4. Loosen filler cap and flush gear box with flushing oil.
5. Tighten drain plug (use new gasket).

5.7.5 Pump Setup and Alignment

When a new machine is started up, a new pump is commissioned, or when service involving draining the pump is performed the following procedures must be followed.

1. The pump and motor shafts must be properly aligned. The pump shaft must be set 0.010"-0.015" lower than the motor shaft to allow for thermal expansion of the pump body (see formula below).
2. The pump seals must be vented and filled with thermal oil. Remove the vent plug on top of the pump bearing housing and rotate the pump by hand several revolutions or until oil comes out of the vent. If oil does not come out, pour thermal oil into the vent slowly until it is completely full and no air is in the pump bearing housing. Replace the vent plug.
3. After the pump has been at operating temperature for 15 minutes the housing bolts must be retorqued to 30-35 Nm (22-25 ft-lb) to seat the main housing gasket. Failure to perform these procedures will result in premature seal failure. NEVER start the pump motor, even for a few seconds, until this has been done!

Pump service procedures can be found in the appendix.

5.7.6 Typical Pump Problems

In normal operation there should be no thermal fluid weeping from the leak-off hole in the pump. If there is fluid leaking, the pump seals have been damaged. Following is a description of common ways seals are damaged:

Mechanical seal failures on this type pump are normally attributable to installation or system operating errors more than true defects in the materials. The normal causes of failure (leaking seals) is misalignment which in turn is caused by:

1. Failure of the installing contractor to set the electric motor high in relation to the pump centerline when all equipment is cold. This thermal offset (0.00000635 x distance in inches from pump foot to pump centerline x thermal fluid operating temperature in degrees F) is required so that when the system is hot and operating the pump and motor have the same shaft centerlines and the mechanical seal faces are thus in line and tight.
2. A second cause of mis-alignment is severe pipe stress caused by using the pump as an anchorage point for the discharge pipe and header. (B&C uses flexible couplings to eliminate pipe stresses).

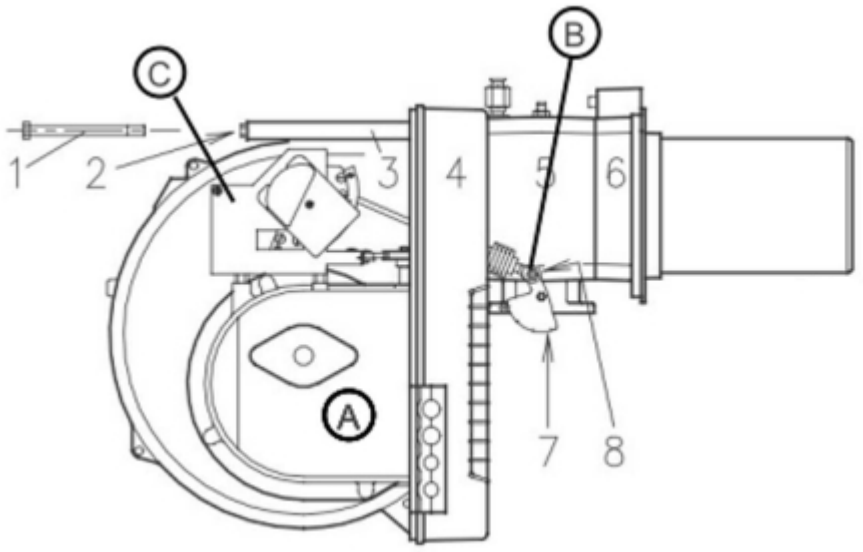


Figure 5.17: Riello Cleaning diagram

3. Another normal path of failure of the mechanical seal is failure to observe the fill and vent requirement for the main bearing bracket. If this operation is overlooked or not carried out properly the seal will start up dry as will the main bearing and failure is only a matter of time.

5.7.7 Burner Cleaning

To clean the blower cage on Riello Burners do the following:

1. Remove the damper servo gas control arm (B)from the gas butterfly cam by unscrewing the standoff post.
2. Remove the damper servo mounting cradle (C) screws.
3. Remove the blower intake cover (A) shown in figure 5.17.
4. You should have access to the inside of the blower cage. It can be easily cleaned from the inside with a shop-vac and a brush.
5. Reinstall the intake cover.
6. Reinstall the damper servo mounting cradle.
7. Reinstall the damper servo gas control arm, making sure it is mounted in the same hole you removed it from.

To clean the flame holder and flame rod assembly:

1. Disconnect power, Gas, and Air services from the machine.
2. Remove the pilot gas line from the top of the burner and put it in a safe place.
3. Remove the cover screw (1) and remove the burner cover (2).
4. Remove the head bolt (5) and disconnect the damper linkage (3) from the gas butterfly (4).
5. Slide the burner head back about 2 inches on the rods (6) and then disconnect the flame sense and ignition electrode connectors.
6. Now slide the burner head back to the end of the rods and then pivot it up as shown in figure 5.18 and insert the retainer pin (9) in the hole. This will hold the burner head up for easier access.
7. Remove the brass test port (8) from the top of the burner this is also the fastener that holds the flame holder assembly (7) in place. See bottom right figure in figure 5.18.
8. Carefully lift (slightly) the flame holder assembly (7) and slide it out of the flame burner body. See bottom right figure in figure 5.18.
9. The flame holder, flame rod, and ignition electrode can now be accessed for easy service and cleaning.
10. Refer to figure 5.18 or the Appendix for more detailed information.
11. Assembly is the reverse of this process.

Figure 5.19 shows the ignition electrode and Flame rod position adjustments. This is a top view of the burner.

- The flame rod should be 1/8 inch (3 mm) from the face of the flame holder (a.k.a. diffuser plate).
- The ignition electrode should be 1/8 inch (3 mm) from the back of the flame holder (a.k.a. diffuser plate).
- This Ignition pilot tube should be 5/16 inch (8 mm) from the back of the flame holder (a.k.a. diffuser plate).

See the Appendix for more detailed information.

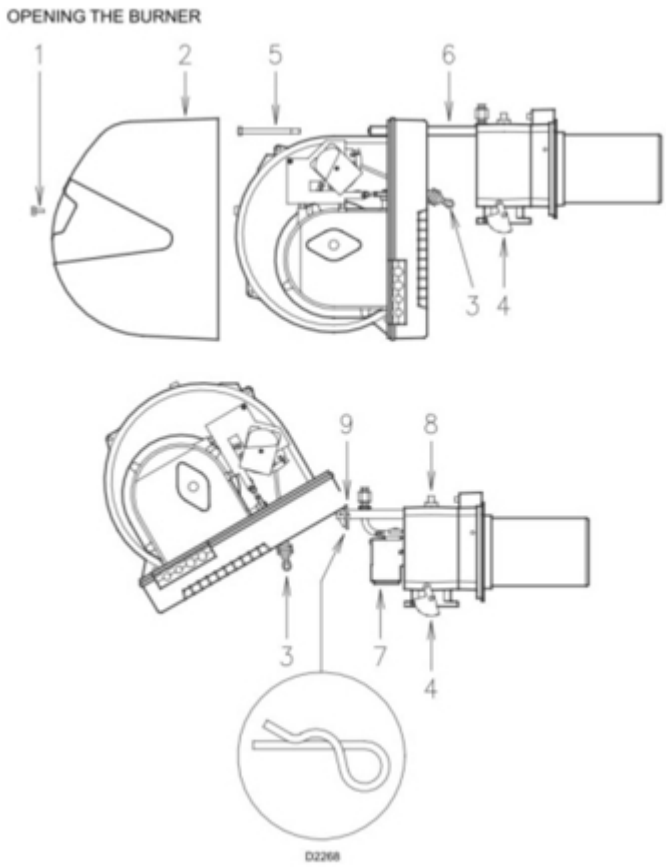


Figure 5.18: Riello burner dissasembly

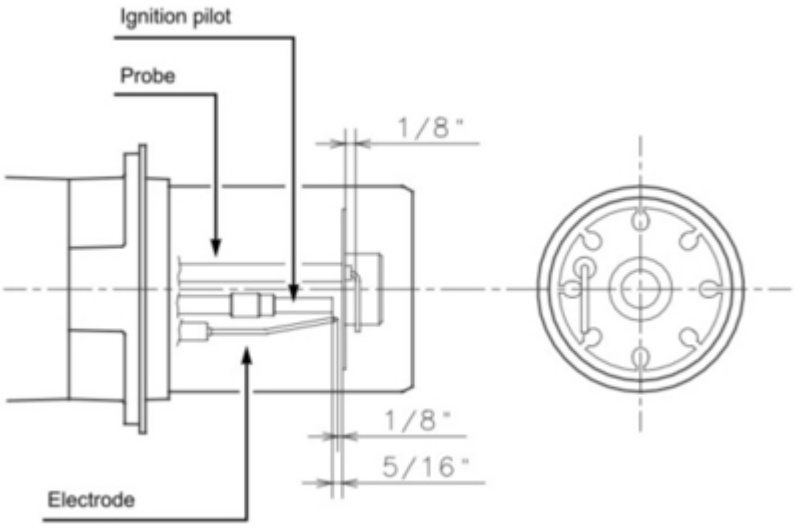


Figure 5.19: Riello Igniter detail

5.8 Thermal Fluid Maintenance

5.8.1 Fluid Life

The thermal fluid should be sampled and analyzed 1 to 2 times a year to monitor it for deterioration. However, in many settings the best practice is to change the thermal fluid annually. For analysis contact you thermal fluid supplier. Remember, the higher the working temperature, the shorter the fluid life will be. Careful and conservative laundry managers can potentially have fluid life of 2 years or more.

5.8.2 System Cleaning

Most thermal fluid suppliers recommend cleaning the system in the ironer with a cleaning solvent when your fluid is changed. This is a good practice as it will keep your system of carbon occlusions and other potential problematic foreign material. To clean the system you will in general proceed as follows:

1. Drain the system and clean the filter screen
2. Refill with a system cleaner, purge, and operate according to the supplier's recommendations
3. Drain the system and clean the filter screen
4. Refill with new Thermal Fluid

5.8.3 Fluid Filter Screen

The screen should be checked and cleaned bi-annually. Accumulation of carbon chunks, metal filings, or other abnormal debris can indicate problems before they become catastrophic. We recommend making notes on the condition of the screen in a maintenance log so you can compare results of the inspections. To clean the filter screen first drain all fluid from the system (if changing the fluid) or proceed as follows:

1. Cool the ironer to 60C or lower (perform the procedure first thing in the morning when the machine is cool if possible).
2. Close valves A, B, and C. This isolates the pump and filter screen for service so a minimal amount of fluid is lost during the procedure. Refer to the thermal fluid system diagram for valve nomenclature details.
3. Remove the plug in the bottom of the filter screen cover and drain the fluid into a metal or oil safe plastic container at least 2 gallons in volume.
4. Remove the 4 bolts holding the filter screen cover plate on the bottom of the assembly.

5. Remove the screen, examine any particulate that have accumulated and clean the screen thoroughly with a wire brush.

6. Reinstall the screen, cover (use a new gasket), screws, and plug. Open valves A, B, and C. Refer to the thermal fluid system diagram for valve nomenclature details.

7. Purge the air from the system as described in the Thermal Fluid Filling procedure starting at step 10, found earlier in this manual.

5.8.4 Pump Service

For pump service instructions and parts information see the thermal fluid pump manual in the Appendix. To drain the pump for service proceed as follows:

1. Cool the ironer to 60C or lower (perform the procedure first thing in the morning when the machine is cool if possible).

2. Close valves A, B, and C. This isolates the pump and filter screen for service so a minimal amount of fluid is lost during the procedure. Refer to the thermal fluid system diagram for valve nomenclature details.

3. Remove the plug in the bottom of the filter screen cover and drain the fluid into a metal oil safe plastic container at least 2 gallons in volume.

4. Service the pump as needed. It is recommended that you also clean the filter screen at this time.

5. Reassemble the pump and reinstall the screen if removed.

6. Double check your work! Is everything assembled properly and sealed?

7. Open valves A, B, and C. Refer to the thermal fluid system diagram for valve nomenclature details.

8. Purge the air from the system as described in the Thermal Fluid Filling procedure starting at step 10, found earlier in this manual.

5.8.5 Thermal Fluid Draining

Before draining the thermal fluid, make sure you have a container for it. The container size needed will vary with the the particular model of your ironer. To drain the system follow this procedure:

1. Cool the ironer to 60C or lower (perform the procedure first thing in the morning when the machine is cool if possible).

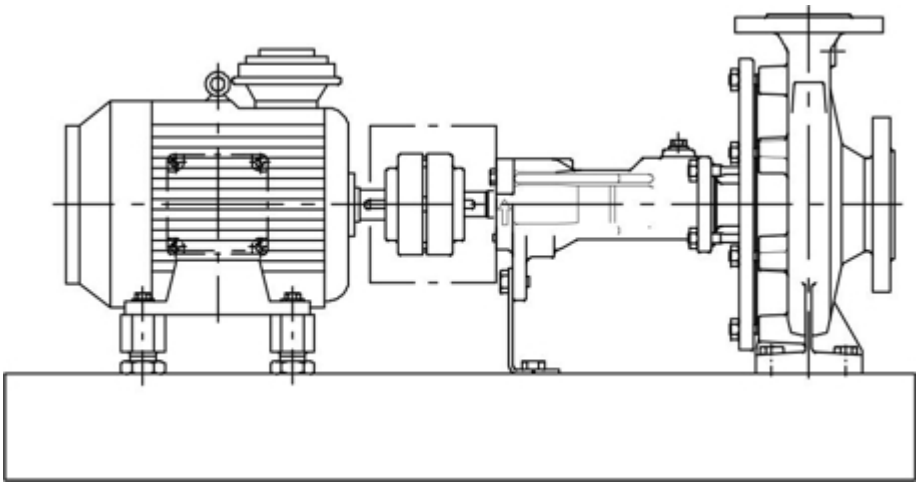


Figure 5.20: Typical thermal pump assembly

2. Close Valve A.
3. Connect a suitable hose barb and hose to the fluid outlet at Valve E. An oil rated inline pump may be needed.
4. When all connections are made and secured open Valve E and then Valve A. Fluid will flow into the pump.
5. Energize the pump and pump the oil out of the ironer and into your containers.
6. Remember that these containers will become very heavy so make provisions for getting them on a barrel truck of some type - think ahead!
7. When no more oil can be pumped out, remove the inline pump from the drain line and connect the ends together. Leave the open hose end in your barrel or container.
8. Close valves A and B.
9. Install a connector for a compressed air line to the bleed port at Valve D and open the valve.
10. Connect 40 psi clean and very dry compressed air supply to this port at Valve D.
11. Double check your connections. You will blow compressed air into the bleed port, this will push most of the oil out of the boiler coils, back through the pump, and out of the drain.
12. Disconnect the air line, close valves D and E, open valves A, B, and C.

5.9 Quarterly Safety System Test

Understanding and regularly testing the safety functions of the ironer is critical to continued safe operation and recognition of potential hazards before they result in accidents. The following sections are intended to be used in conjunction with the IM-Thermal Safety Check List worksheet, shown in tables 5.7 and 5.8.

Table 5.7: IM Family Quarterly Safety System Test Log

	INSPECTION DATE	__/__/____	__/__/____	__/__/____	__/__/____	__/__/____
	Item	Startup				
	Tested By					
	Test Date					
1	Infeed Safety Bar					
2	LF E-Stop					
3	RF E-Stop					
4	LR E-Stop					
5	RR E-Stop					
6	Access Cover Interlocks					
7	Electrical Panel Disconnect					
8	Main Stop Button					
9	Main Temperature Control					
10	Temperature limit Control					
11	Pump Shutdown Control					
12	Temperature High Limit Lockout					
13	Temperature High Limit Reset					
14	Burner Fault Lamp					
15	Burner Remote Fault Reset					
16	PS2 operation					
17	PS2 setting					
18	Nominal High Pressure Reading					
19	PS3 operation					
20	PS3 setting					
21	Nominal Low Pressure Reading					

Table 5.8: IM Family Quarterly Safety System Test Log

	INSPECTION DATE	__/__/____	__/__/____	__/__/____	__/__/____	__/__/____
	Item	Startup				
22	High Pressure Reading					
23	Expansion Tank Valve Handle Switch					
24	Line Voltage					
25	Main Electrical Ground Connection					
26	Pump Current					
27	Roll 1 Vacuum Current					
28	Roll 2 Vacuum Current					
29	Roll Drive Current (rolls down, 100fpm)					
30	Control Primary Current					
31	Control 24V Secondary Current					
32	Control 110V Secondary Current					
33	Gas Pressure No Load					
34	Gas Pressure High Fire					
35	Low Pressure Switch					
36	High pressure Switch					
37	Blower Pressure Switch					
38	LFL Fault					
39	Combustion Analysis (annual)					
40	Primary Gas Valve Tightness					
41	Secondary Gas Valve Tightness					
42	Gas Plumbing Leak Check					
43	Pilot regulator inspection					
44	Lift cylinders					
45	Lock pins					

1. **Infeed Safety Barrier** - Test Daily - Test the bar by starting the machine and then pushing the barrier so that the bottom edge swings back 1-2 inches. The machine must shut down in this travel.

2. **Left Front E-Stop** - Test by starting the machine and then pressing the button. The machine must stop.

3. **Right Front E-Stop** - Test by starting the machine and then pressing the button. The machine must stop.

4. **Left Rear E-Stop** - Test by starting the machine and then pressing the button. The machine must stop.

5. **Right Rear E-Stop** - Test by starting the machine and then pressing the button. The machine must stop.

6. **Access Cover Interlocks** - Open each cover and make certain that the machine stops when the cover is opened. Tapped, bypassed, or otherwise nonfunctional switches must be corrected. Switches are located on each roll access cover and on the electrical control cabinet.

7. **Electrical Panel Disconnect** - Check that the disconnect is complete, the switch head is functional and the lockout operates correctly. Check that the trip level of the disconnect is set properly (if equipped) and record the setting.

8. **Main Stop Button** - Right front panel - Test by pushing the button when the machine is running. All functions of the machine should stop except the pump if the pump mode switch is in the Automatic position.

9. **Main Temperature Control** - Check that the control's process temperature matches the Limit and Pump shutdown controls within 2°C or 10°F when the machine is warmed up and no goods have been fed for several minutes. Make sure the temperature reading is not jumpy or otherwise unstable.

10. **Temperature Limit Control** – Check that the control's process temperature matches the Main and Pump shutdown controls within 2°C or 10°F. Make sure the temperature reading is not jumpy or otherwise unstable. Make sure that the setpoint cannot be changed by pushing the up and down buttons.

11. **Pump Shutdown Control** – Check that the control's process temperature matches the Limit and Main controls within 2°C or 10°F. Make sure the temperature reading is not jumpy or otherwise unstable. Verify that the pump shuts down when the machine cools below the setpoint.

12. **Temperature High Limit Lockout** - Unlock the high limit control and change the setpoint to some number below the process temperature or carefully touch a jumper to wire numbers 1 and 102 located on the rear of the control. The machine should lock out the burner operation and the Temperature Limit Lamp must light. Power the machine down with the main branch disconnect (external to the machine) - The machine must remain locked out when power is restored. If the lockout setpoint was changed, restore it to its original valve and relock the control.

13. **Temperature High Limit Reset** - After the previous step press the High Limit reset button to verify that it clears the high limit condition.

14. **Burner Fault Lamp** - At the rear of the machine press the button in the cover of the Riello Burner. The burner will fault and the button will be illuminated. At the front of the machine verify that the Burner Fault Lamp illuminates and audible alarm sounds if installed.

15. **Burner Remote Fault Reset** - at the front of the machine press the Burner fault reset button to verify that the fault is cleared and operation of the burner is restored.

16. **PS2 (High pressure switch) Operation** – Slowly Close Valve C in the oil system while the machine is running and the pump is energized. When the High pressure reading drops just below 50 PSI the burner should shut down. After the burner shuts down, open Valve C and verify that the burner operates properly.

17. **PS2 High Pressure Switch Setting** - Record the setpoint and differential settings indicated on the face of the pressure switch for deadband and threshold.

18. **Normal High Pressure Reading** – Record the high pressure gauge reading when the machine is operated cold (oil below 50°C). This is the gauge next to the high pressure switch.

19. **PS3 (Low Pressure Switch) Operation** – Slowly Close Valve B in the oil system while the machine is running and the pump is energized. When the low pressure reading rises above the setpoint (typically 20 PSI) the burner should shut down. After the burner shuts down, open Valve B and verify that the burner operates properly.

20. **PS3 Low Pressure Switch Setting** - Record the setpoint and differential settings indicated on the face of the pressure switch for deadband and threshold

21. **Normal Low Pressure Reading** – Record the low pressure gauge reading when the machine is operated cold (oil below 50°C). This is the gauge next to the low pressure switch.

22. **High Pressure Gauge reading** – Record the high pressure gauge reading when the machine is operated cold (oil below 50°C). This is the gauge located in the side panel just downstream from Valve C.

23. **Expansion Tank Valve Handle Switch (Valve A)** - make sure the warning hang tag is present on the valve. Unlock and close the valve the machine should shut down when the valve is closed. Verify that it will not restart. Open the valve and lock it open verify that the machine restarts normally.

24. **Line Voltage** - use a reliable calibrated AC Voltmeter to measure the electrical service voltage from L1-L2, L2-L3, L1-L3. Do not measure line to ground. The 3 voltage readings should be within 2%. If an imbalance exists have it corrected immediately. Record the median line voltage.

25. **Main Ground Connection** - This is a high leakage current device, hence an excellent ground connection is critical. Check the screws securing the PE lug to the main panel using a screwdriver make certain that they are very tight. Using a screwdriver make sure the PE ground conductor from the service is securely tightened into the PE lug. Check the conductor for

oxidation. If the conductor is heavily oxidized, remove it, clean it, and replace using oxgard paste to prevent future oxidation in the connection. Verify that there is no paint between the lug and the panel.

26. **Pump Current** – While the machine is running and the oil pump is on with the oil at a temperature lower than 50°C, use a calibrated reliable AC Current clamp meter to measure the operating current in each conductor to the motor. Measurement should be made in the 3 conductors after contactor K5M labeled U5, V5, and W5. The 3 readings should be within 2A of each other if an imbalance exists have it corrected. Record the average of the 3 readings on the sheet.

27. **Roll 1 Vacuum Current** - While the machine is running and the roll vacuum switch turned on, use a calibrated reliable AC Current clamp meter to measure the operating current in each conductor to the motor. Measurement should be made in the 3 conductors after contactor K2M labeled U3, V3, W3. The 3 readings should be within 1A of each other if an imbalance exists have it corrected. Record the average of the 3 readings on the sheet.

28. **Roll 2 Vacuum Current** - While the machine is running and the roll vacuum switch turned on, use a calibrated reliable AC Current clamp meter to measure the operating current in each conductor to the motor. Measurement should be made in the 3 conductors after contactor K3M labeled U4, V4, W4. The 3 readings should be within 1A of each other if an imbalance exists have it corrected. Record the average of the 3 readings on the sheet.

29. **Roll Drive Current** - With the machine a temperature lower than 50C, set the speed reference switch to ”internal” or ”pot” position. Lower the rolls and increase the speed slowly using the potentiometer on the panel to a stable reading of 100fpm or 30.5mpm. Read the roll drive current from the display on the inverter and record it in the log sheet.

30. **Control Primary Current** – While the machine is running and the roll vacuum switch turned on, use a calibrated reliable AC Current clamp meter to measure the operating current at the primary side of the control transformer at RT or ST and record it in the log sheet.

31. **Control 24V Secondary Current** – While the machine is running and the roll vacuum switch turned on, use a calibrated reliable AC Current clamp meter to measure the operating current at the 24V ACH side of the control transformer in the conductor labeled ”24VACL” and record it in the log sheet.

32. **Control 120V Secondary Current** – While the machine is running and the roll vacuum switch turned on, use a calibrated reliable AC Current clamp meter to measure the operating current at the 120V ACH side of the control transformer in the conductor labeled ”120VACL” and record it in the log sheet.

33. **Gas Pressure No Load** - Read the gas pressure on the gauge at the front of the machine when the burner if off. Verify the reading with a manometer if possible and record the pressure in the log sheet.

34. **Gas Pressure High Fire** - Read the gas pressure on the gauge at the front of the machine when the burner operating at high fire. Verify the reading with a manometer if possible and record the pressure in the log sheet.

35. **Low Pressure Switch** - verify operation of the low gas pressure switch by recording its setting in the log sheet and then increasing the setting dial to a pressure above the regulator setting while the burner is operating. When the switch trips the low gas pressure light on the front of the ironer should light and the burner should shut down. Restore the switch to its original setting and press the reset button on the switch body. The low gas pressure lamp on the front of the ironer should turn off and burner operation should resume.

36. **High Pressure Switch** - verify operation of the high gas pressure switch by recording its setting in the log sheet and then lowering the setting dial to a pressure below the regulator setting while the burner is operating. When the switch trips the burner should shut down. Restore the switch to its original setting and press the reset button on the switch body, burner operation should resume.

37. **Blower Pressure Switch** - The blower pressure switch on the burner body should be set according to the procedure in the burner manual at start-up. Record the setting in the log sheet.

38. **LFL Fault** - While the burner is energized press the fault window in on the Siemen's LFL combustion control and verify that the LFL's orange fault lamp lights up and stays on. Press the window again to extinguish the fault lamp and reset the control. If any abnormal operation is observed replace the LFL.

39. **Combustion Analysis** - it is prudent and required in many locations that a qualified technician perform a combustion analysis on the burner annually to verify safe operation. A combustion analysis must also be performed at start-up and the results recorded in B&C's "IM Family Burner Startup Report" worksheet shown in Table 5.9. Initial the log sheet if a proper combustion analysis has been performed.

40. **Primary Gas Valve Tightness** - This test should be performed by a trained technician following prudent and required safety measures. This test verifies that the gas valve is sealing properly. When the test is completed record the result in the sheet.

41. **Secondary Gas Valve Tightness** - This test should be performed by a trained technician following prudent and required safety measures. This test verifies that the gas valve is sealing properly. When the test is completed record the result in the sheet.

42. **Gas Plumbing Leak Check** - using a rich soap solution or a gas leak test solution, check all joints in the main and pilot gas lines for leaks. Also check the gas gauge line to the front of the machine. Correct any leaks found.

43. **Pilot Regulator Inspection** - inspect the pilot regulator for body cracks and diaphragm leaks. Inspect the regulator vent line and make sure that it is not clogged and is free flowing. If a main regulator is installed on the machine perform the same inspection on it.

44. **Lift cylinders** - operate the ironer lift cylinders. Make sure they all operate smoothly and evenly with no jerking or sticking. When the rolls are up remove the top air line from each cylinder and check for abnormal air leakage indicating that the lift cylinder piston seals are damaged.

45. **Lock Pins** - have an assistant operate the lift cylinders and pay attention to the lock pin on each cylinder. When the rolls are lowered the lock pins should pull out quickly and smoothly with no sticking 4 to 6 seconds before the rolls lower. If the time is shorter check the setting of timers KT2 and KT3.

Table 5.9: Burner Startup Report Form

Date:	
Tested By:	
Customer:	
Location:	
Machine Model:	
Machine Serial Number:	
Voltage:	
Test Equipment:	
Calibration Date:	
Burner Model:	
Burner Serial Number:	
Fuel:	
Service Pressure	
Max:	
Min:	
Flame Sense Type:	
Pilot Regulator Setting:	
Main Regulator Setting:	
Gas Ring Setting:	
Air Screw Setting:	

Parameter	Pilot	Low Fire	Mid. 1	Mid. 2	Mid. 3	High Fire
Cam Position (deg.)						
O2 (%)						
CO (PPM)						
Stack Temp (C)						
Comb. Eff. (%)						
Stack Pressure (inWC)						
Flame Sense I. (uA)						
Delivery Pressure (inWC)						
Approximate BTU/hr						

Exhaust Blower Setting:

Chapter 6

Appendix

6.1 Proper Drum Storage

6.1.1 Recommended Storage Life

Most lubricants have supplier recommended shelf lives based largely upon the lubricant's additive package. For example, lubricants containing rust inhibitors may lose performance after as little as six months in storage. Conversely, some turbine fluids with a light additive dose may be shelved for up to three years. Shelf life information is available from your lubricant supplier and/or manufacturer for each product used. Employ a FIFO (First In, First Out) rotation of stored fluids to ensure that lubricant storage life is not accidentally exceeded. And, learn how to read the coded date on the container label. Shelf life is based on ideal storage conditions for your fluids. Most manufacturers provide a recommended storage procedure to maximize lubricant shelf life. The following conditions have been proven to adversely affect a lubricant's storage life:

Varying Temperatures – Temperature fluctuations will cause movement of air between the atmosphere and the head-space of the container (thermal siphoning). For partially full containers, with greater head-space, this air movement is increased. Although the drum is sealed and does not leak lubricant through the bung, a rigid container still inhales air when the temperature drops and exhales as the temperature rises. Along with the air, moisture and small airborne particles enter the oil container possibly leading to degradation of the base stock and additives. Also, water might condense within the drum, drop to the bottom and get pumped to the machine during a top-off.

Temperature Extremes – Extreme hot or cold can cause chemical degradation. As mentioned earlier, rust inhibitors may suffer significant performance losses after only six months of normal storage. Depending upon the formulation, a rust inhibitor may have poor solubility in base oils leading to precipitation during storage. This precipitation is greatly accelerated during cold storage.

Humid Environment – Petroleum-based lubricants are hygroscopic. When exposed to humid air, they naturally absorb airborne moisture. The moisture immediately begins to degrade the additive package and accelerates oxidation of the lubricant's base stock once it is put into service.

6.1.2 Storage

Indoor Storage – Pails, drums and totes must be stored in a clean and dry location. Storage temperatures should remain moderate at all times. Lubricants in storage should be located away from all types of industrial contamination including dust and humidity. Bungs must be kept tight at all times and drum covers should be used whenever drums are stored in the upright position (bungs at 3 and 9 o'clock positions). Ideally, lubricants are stored in the horizontal position on proper storage racks allowing the containers to be rotated and used on a first-in, first-out basis

Outdoor Storage – While indoor storage is recommended, this is not always possible due to environmental, financial or space constraints. If lubricants must be stored outdoors, track lubricant consumption carefully and replenish inventories "just-in-time" to minimize exposure to adverse conditions. If lubricants must be stored outside, shelter them from rain, snow and other elements. Lay drums on their sides with the bungs in a horizontal (3 and 9 o'clock) position below the lubricant level. This will greatly reduce the risk of the seals drying out and the ingestion of moisture caused by breathing. If the drums must be placed upright in outdoor storage, employ drum covers or tilt drums to drain the moisture that gathers on the top around the bungs.

Opened containers – Once the seal is broken and the container is put into use, care must be taken to ensure control over contamination ingress. If equipped with a proper pressure relief, bulk tanks should use filter breathers to control contamination ingestion. Drums and pails should be capped when not in use. If your drums are frequently used, bung breather filters may be your best solution.

6.1.3 Eliminate Confusion with Proper Labeling

Lubricant Identification – Two common consequences of lubricant mismanagement are cross contamination and lubricant confusion. All drums must be clearly labeled and stenciled to ensure proper product identification. Avoid using labeling methods that are not legible or may wear out over time. Take extra care in the labeling of containers that must be stored outdoors since the elements may damage the label. Color coding labels simplifies the process, reducing the risk of misapplication. If a color coding system is employed, be sure alpha or numeric information is also present to account for color blindness.

6.1.4 Clean Delivery

Even when taking the best care possible to store lubricants, they are subject to contamination ingression when filling or topping up systems. Therefore it is absolutely necessary that the lubricant be filtered with an appropriate filter element prior to entering your equipment. Here are some lubricant dispensing tips:

- Be sure that the proper transfer equipment is being used for the lubricant being dispensed. Whether you are topping up your system directly or filling a smaller portable container, be sure that the lubricant has been filtered.

- It is recommended that the oil be cycled through a high efficiency filter element with a beta rating matching your equipment requirements. If your storage method exposes the lubricant to moist environments, two-stage filtering with a water absorbing filter element is highly recommended.
- When transferring lubricants to portable containers, be sure to avoid the use of galvanized containers since the additive in the lubricant may react with the zinc plating, forming metal soaps that clog small openings and orifices in industrial machinery.
- Avoid using open or dirty containers for transfer purposes. Use properly identified, capped containers for low volume transfers.

6.1.5 Conclusion

An effective proactive maintenance program mandates effective storage and delivery of lubricants. Protecting your lubricants, and ultimately your equipment, from the harmful effects of contamination and lubricant degradation begins with proper in-plant storage. To ensure suitable storage of lubricants, containers should be stored indoors in a dry location where temperatures remain moderate at all times. Clearly identify lubricants and machine application to avoid confusion and the misapplication of products. And, be sure that the proper transfer equipment and procedures are employed for that specific lubricant. These simple steps can substantially impact the useful life of your lubricants and your equipment.

Ref: Wills, George, *Lubrication Fundamentals*, Marcel Dekker, Inc., 1980.

6.2 Paratherm HE MSDS

Paratherm Corporation
Material Safety Data Sheet

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

Product Name: Paratherm HE® Heat Transfer Fluid

Company Identification: Paratherm Corporation
4 Portland Road
West Conshohocken, PA 19428 USA

Product Information: 610-941-4900
info@paratherm.com

Emergency Telephone: 610-941-4900
Chemtrec (USA): 800-424-9300
Chemtrec (outside USA): 703-527-3887

SECTION 2 HAZARDS IDENTIFICATION

Emergency Overview
Almost water white oil with minimal odor when new.
May turn dark and develop characteristic petroleum odor when product is used.
Combustible liquid.

Potential Health Effects:

Eye: Non-irritating to eyes on direct contact before use. Used product may be mildly irritating to eyes.

Skin: Non-irritating on direct single or repeated and prolonged contact when new. Repeated or prolonged contact of used product may cause skin irritation.

Ingestion: No harmful effects are expected from ingesting unused product or small amounts of used product. Ingestion of used product may cause abdominal discomfort.

Inhalation: Exposure to smoke or mist while product is in use may cause irritation to upper respiratory tract and lungs.

SECTION 3 COMPOSITION/ INFORMATION ON INGREDIENTS

COMPONENTS	CAS NUMBER	AMOUNT
Hydrotreated heavy paraffinic distillate	64742-54-7	100%

SECTION 4 FIRST AID MEASURES

Eye: Flush eyes with water. If symptoms persist, seek medical attention. If fluid is hot, treat burns and seek medical assistance.

Skin: Wash exposed areas with warm water and soap. If fluid is hot, submerge injured area in cold water. Seek medical attention for severe burns.

Ingestion: If abdominal discomfort occurs, seek medical attention.

Inhalation: If smoke or mist is generated when fluid is in use, remove victim from exposure. If breathing has stopped or is irregular, administer artificial respiration and supply oxygen if available. If victim is unconscious, remove to fresh air and seek medical attention.

SECTION 5 FIRE FIGHTING MEASURES

Extinguishing Media: Water fog, foam, dry chemical, or carbon dioxide (CO2) should be used. Do not use direct water stream

Fire Fighting Instructions: Do not enter any enclosed or confined fire space without proper protective equipment, including self-contained breathing apparatus. Water spray may be useful in minimizing or dispersing vapors and to protect personnel. Cool equipment (including drums) exposed to fire with water if it can be done with minimal risk. Avoid spreading burning liquid with water used for cooling purposes.

Combustion Products: Airborne solids, liquids, and gases including carbon monoxide, carbon dioxide, and unidentified organic compounds.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Protective Measures: This material may burn but will not ignite readily. Eliminate all sources of ignition in vicinity of spilled material. Use personal protection recommended in Section 8.

Spill Management: Contain release to prevent further contamination of soil, surface water or groundwater. Use appropriate techniques such as non-combustible absorbent materials. Store collected material in a suitable, labeled container. Dispose of contaminated materials in a manner consistent with applicable regulations. If heated material is spilled, allow it to cool to ambient before proceeding with disposal methods. Keep area around hot, spilled material well ventilated.

Reporting: Report spills to appropriate local authorities. This product is classified as an "Oil" under Section 311 of Clean Water Act. Discharge or spills that produce a visible sheen on surface water or in waterways/sewers that lead to surface water must be reported to appropriate authorities.

SECTION 7 HANDLING AND STORAGE

Precautionary Measures: Product is not hazardous. Use good personal hygiene practices. Fire extinguishers should be kept readily available. Clean up any spill promptly.

Storage: Store closed containers away from heat, sparks, open flames, or oxidizing materials. Do not transfer to unmarked containers. Protect metal drums from direct sunlight and water.

SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure Limits:

Component: Heavy paraffinic distillate

OSHA PEL:	5 mg/m^3 TWA
ACGIH TLV:	5 mg/m^3 TWA
	10 mg/m^3 STEL
NIOSH:	2500 mg/m^3 IDLH
As oil mist if generated:	5 mg/m^3 NOHSC TWA

Engineering Controls: Use in a well-ventilated area

Personal Protective Equipment:

Eye/Face Protection: Where splashing is possible, wear safety glasses with side shields.

Skin Protection: No protection required for short duration exposure to unused fluid. For prolonged or repeated exposure to used fluid, synthetic rubber (nitrile) protective covers (boots, aprons, gloves) may be desirable. If material will be handled while hot, wear insulated clothing. Use good personal hygiene practices before and after fluid handling.

Respiratory Protection: No respiratory protection is normally required. If a mist or smoke is generated during use, wear a NIOSH certified organic vapor respirator with a dust and mist filter.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Almost water white before use
Odor: none
pH: NA
Density: 7.18 lb/gal @ 75 ºF
Flashpoint: > 440ºF Cleveland Open Cup
Vapor Pressure: <1mm @70F
Vapor Density (Air = 1): >1
Evaporation Rate (BuAc = 1): <1
Boiling Point: >500ºF
Solubility: Insoluble in water.
Pour Point: -10ºF

SECTION 10 STABILITY AND REACTIVITY

Chemical Stability: Stable under normal storage and handling conditions.

Conditions to Avoid: None

Incompatibility With Other Materials: May react with strong oxidizing agents.

Hazardous Polymerization: Hazardous polymerization will not occur.

Hazardous Decomposition Products: None known.

SECTION 11 TOXICOLOGICAL INFORMATION

Acute Toxicity:

Meets IP346 criteria of less than 3% PAH. No other data available. Not known to have any toxic effects.

Carcinogenicity:

NTP: No
IARC: No
OSHA: No

SECTION 12 ECOLOGICAL INFORMATION

Environmental Toxicity: Product is insoluble in water. Aquatic toxicology testing performed in Water Accommodated Fraction (WAF)

Invertebrates:	Water Flea (Daphnia magna) – 100% survival in WAF
	Mysid Srhimp (Mysidopsis bahia) – 100% survival in WAF
Fish:	Fathead Minnow (Pimphales promelas) **–** 100% survival in WAF

Biodegradability: Product is not expected to be biodegradable

SECTION 13 DISPOSAL CONSIDERATIONS

Uncontaminated material can be burned for fuel value in an approved facility or can be removed by a licensed waste oil recycler. Used product that has been contaminated with a regulated material may need to be incinerated. Refer to state and local regulations for more detailed information.

SECTION 14 TRANSPORT INFORMATION

US DOT: Not regulated

IATA & IMDG: Not regulated

SECTION 15 REGULATORY INFORMATION

United States

RCRA Hazardous Waste Number and Classification: Not applicable
TSCA Inventory Status: Included
SARA Title III Section 313 and 40 CFR 372: Not subject to reporting requirements
Clean Air Act Section 112: Not classified as a Hazardous Air Pollutant (HAP)
California Proposition 65: This product does not contain materials which the state of California has found to cause cancer, birth defects, or other reproductive harm.

International

Canada (WHMIS): Not controlled

This material is listed on the following inventories;
Australia (AICS)
Canada (DSL)
China
Europe (EINECS)
Korea (Existing and Evaluated Chemical Substances)
Philippines (PICCS)
Japan (ENCS)

SECTION 16 OTHER INFORMATION

Recommended Use: Heat transfer agent

Date of Revision: 9/18/07

Reason for Revision: New

NFPA RATINGS: Health: 0 Flammability: 1 Reactivity: 0
0-Least, 1-Slight, 2-Moderate, 3-High, 4-Extreme

Abbreviations that may have been used in this document

TLV	-	Threshold Limit Value	TWA	-	Time Weighted Average
STEL	-	Short-term Exposure Limit	PEL	-	Permissible Exposure Limit
IDLH		Immediate Danger to Life and Health	CAS	-	Chemical Abstract Service Number
NOHSC		Nat'l Occup. Health & Safety Comm.	TLV		Threshold Limit Value
<	-	Less Than	>	-	Greater Than
<=	-	Less Than or Equal To	>=	-	Greater Than or Equal To

Prepared according to the OSHA Hazard Communication Standard (29 CFR 1910.1200) and the ANSI MSDS Standard Z400.1).

The above information is based on the data of which we are aware and is believed to be correct as of the date hereof. Since this information may be applied under conditions beyond our control and with which we may be unfamiliar and since data made available subsequent to the date hereof may suggest modifications of the information, we do not assume any responsibility for the results of its use. This information is furnished upon condition that the person receiving it shall make his own determination of the suitability of the material for his particular purpose.

6.3 Shell Thermia MSDS

Thermia® Oil C
MSDS# 61260E
Version 10.0
Effective Date 07/08/2008
According to OSHA Hazard Communication Standard, 29 CFR 1910.1200

Material Safety Data Sheet

1. MATERIAL AND COMPANY IDENTIFICATION

Material Name	:	**Thermia® Oil C**
Uses	:	Heat transfer oil.
Manufacturer/Supplier	:	**SOPUS Products** PO Box 4427 Houston, TX 77210-4427 USA
MSDS Request	:	877-276-7285

Emergency Telephone Number

Spill Information	:	877-242-7400
Health Information	:	877-504-9351

2. COMPOSITION/INFORMATION ON INGREDIENTS

The highly refined mineral oil contains <3% (w/w) DMSO-extract, according to IP346.
Highly refined mineral oils and additives.

3. HAZARDS IDENTIFICATION

Emergency Overview

Appearance and Odour	:	Amber. Dark grey. Liquid at room temperature. Semi-solid at room temperature. Slight hydrocarbon.
Health Hazards	:	Not classified as dangerous for supply or conveyance.
Safety Hazards	:	Not classified as flammable but will burn.
Environmental Hazards	:	Not classified as dangerous for the environment.

Health Hazards	:	Not expected to be a health hazard when used under normal conditions.
Health Hazards		
Inhalation	:	Under normal conditions of use, this is not expected to be a primary route of exposure.
Skin Contact	:	Prolonged or repeated skin contact without proper cleaning can clog the pores of the skin resulting in disorders such as oil acne/folliculitis.
Eye Contact	:	May cause slight irritation to eyes.
Ingestion	:	Low toxicity if swallowed.
Other Information	:	Used oil may contain harmful impurities.
Signs and Symptoms	:	Oil acne/folliculitis signs and symptoms may include formation of black pustules and spots on the skin of exposed areas. Ingestion may result in nausea, vomiting and/or diarrhoea.
Aggravated Medical Condition	:	Pre-existing medical conditions of the following organ(s) or organ system(s) may be aggravated by exposure to this material: Skin.
Environmental Hazards	:	Not classified as dangerous for the environment.

Additional Information	:	Under normal conditions of use or in a foreseeable emergency, this product does not meet the definition of a hazardous chemical when evaluated according to the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

4. FIRST AID MEASURES

General Information	:	Not expected to be a health hazard when used under normal conditions.
Inhalation	:	No treatment necessary under normal conditions of use. If symptoms persist, obtain medical advice.
Skin Contact	:	Remove contaminated clothing. Flush exposed area with water and follow by washing with soap if available. If persistent irritation occurs, obtain medical attention.
Eye Contact	:	Flush eye with copious quantities of water. If persistent irritation occurs, obtain medical attention.
Ingestion	:	In general no treatment is necessary unless large quantities are swallowed, however, get medical advice.
Advice to Physician	:	Treat symptomatically.

5. FIRE FIGHTING MEASURES

Clear fire area of all non-emergency personnel.

Flash point	:	Typical 210 °C / 410 °F (COC) >= 260 °C / 500 °F (Cleveland Open Cup)
Upper / lower Flammability or Explosion limits	:	Typical 1 - 10 %(V)(based on mineral oil)
Auto ignition temperature	:	> 320 °C / 608 °F
Specific Hazards	:	Hazardous combustion products may include: A complex mixture of airborne solid and liquid particulates and gases (smoke). Carbon monoxide. Unidentified organic and inorganic compounds.
Suitable Extinguishing Media	:	Foam, water spray or fog. Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only.
Unsuitable Extinguishing Media	:	Do not use water in a jet.
Protective Equipment for Firefighters	:	Proper protective equipment including breathing apparatus must be worn when approaching a fire in a confined space.

6. ACCIDENTAL RELEASE MEASURES

Avoid contact with spilled or released material. For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. See Chapter 13 for information on disposal. Observe all relevant local and international regulations.

Protective measures	:	Avoid contact with skin and eyes. Use appropriate containment to avoid environmental contamination. Prevent from spreading or entering drains, ditches or rivers by using sand, earth, or other appropriate barriers.
Clean Up Methods	:	Slippery when spilt. Avoid accidents, clean up immediately.

Prevent from spreading by making a barrier with sand, earth or other containment material. Reclaim liquid directly or in an absorbent. Soak up residue with an absorbent such as clay, sand or other suitable material and dispose of properly.

Additional Advice : Local authorities should be advised if significant spillages cannot be contained.

7. HANDLING AND STORAGE

General Precautions : Use local exhaust ventilation if there is risk of inhalation of vapours, mists or aerosols. Properly dispose of any contaminated rags or cleaning materials in order to prevent fires. Use the information in this data sheet as input to a risk assessment of local circumstances to help determine appropriate controls for safe handling, storage and disposal of this material.

Handling : Avoid prolonged or repeated contact with skin. Avoid inhaling vapour and/or mists. When handling product in drums, safety footwear should be worn and proper handling equipment should be used.

Storage : Keep container tightly closed and in a cool, well-ventilated place. Use properly labelled and closeable containers. Storage Temperature: 0 - 50 °C / 32 - 122 °F

Recommended Materials : For containers or container linings, use mild steel or high density polyethylene.

Unsuitable Materials : PVC.

Additional Information : Polyethylene containers should not be exposed to high temperatures because of possible risk of distortion.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Limits

Material	Source	Type	ppm	mg/m3	Notation
Oil mist, mineral	ACGIH	TWA(Mist.)		5 mg/m3	
Oil mist, mineral	ACGIH	STEL(Mist.)		10 mg/m3	

Exposure Controls : The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Select controls based on a risk assessment of local circumstances. Appropriate measures include: Adequate ventilation to control airborne concentrations. Where material is heated, sprayed or mist formed, there is greater potential for airborne concentrations to be generated.

Personal Protective Equipment : Personal protective equipment (PPE) should meet recommended national standards. Check with PPE suppliers.

Respiratory Protection : No respiratory protection is ordinarily required under normal conditions of use. In accordance with good industrial hygiene

		practices, precautions should be taken to avoid breathing of material. If engineering controls do not maintain airborne concentrations to a level which is adequate to protect worker health, select respiratory protection equipment suitable for the specific conditions of use and meeting relevant legislation. Check with respiratory protective equipment suppliers. Where air-filtering respirators are suitable, select an appropriate combination of mask and filter. Select a filter suitable for combined particulate/organic gases and vapours [boiling point >65 °C (149 °F)].
Hand Protection	:	Where hand contact with the product may occur the use of gloves approved to relevant standards (e.g. Europe: EN374, US: F739) made from the following materials may provide suitable chemical protection: PVC, neoprene or nitrile rubber gloves. Suitability and durability of a glove is dependent on usage, e.g. frequency and duration of contact, chemical resistance of glove material, glove thickness, dexterity. Always seek advice from glove suppliers. Contaminated gloves should be replaced. Personal hygiene is a key element of effective hand care. Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturizer is recommended.
Eye Protection	:	Wear safety glasses or full face shield if splashes are likely to occur.
Protective Clothing	:	Skin protection not ordinarily required beyond standard issue work clothes.
Monitoring Methods	:	Monitoring of the concentration of substances in the breathing zone of workers or in the general workplace may be required to confirm compliance with an OEL and adequacy of exposure controls. For some substances biological monitoring may also be appropriate.
Environmental Exposure Controls	:	Minimise release to the environment. An environmental assessment must be made to ensure compliance with local environmental legislation.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Amber. Dark grey. Liquid at room temperature. Semi-solid at room temperature.
Odour	:	Slight hydrocarbon.
pH	:	Not applicable.
Initial Boiling Point and Boiling Range	:	> 280 °C / 536 °F estimated value(s)
Pour point	:	Typical -12 °C / 10 °F
Dropping point		Typical 220 °C / 428 °F
Flash point	:	Typical 210 °C / 410 °F (COC) >= 260 °C / 500 °F (Cleveland Open Cup)
Upper / lower Flammability or Explosion limits	:	Typical 1 - 10 %(V) (based on mineral oil)
Auto-ignition temperature	:	> 320 °C / 608 °F
Vapour pressure	:	< 0.5 Pa at 20 °C / 68 °F (estimated value(s))
Density	:	Typical 867 g/cm3 at 15 °C / 59 °F

Water solubility	:	Negligible.
n-octanol/water partition coefficient (log Pow)	:	> 6 (based on information on similar products)
Kinematic viscosity	:	Typical 30 mm2/s at 40 °C / 104 °F
Vapour density (air=1)	:	> 1 (estimated value(s))
Evaporation rate (nBuAc=1)	:	Data not available

10. STABILITY AND REACTIVITY

Stability	:	Stable.
Conditions to Avoid	:	Extremes of temperature and direct sunlight.
Materials to Avoid	:	Strong oxidising agents.
Hazardous Decomposition Products	:	Hazardous decomposition products are not expected to form during normal storage.

11. TOXICOLOGICAL INFORMATION

Basis for Assessment	:	Information given is based on data on the components and the toxicology of similar products.
Acute Oral Toxicity	:	Expected to be of low toxicity: LD50 > 5000 mg/kg , Rat
Acute Dermal Toxicity	:	Expected to be of low toxicity: LD50 > 5000 mg/kg , Rabbit
Acute Inhalation Toxicity	:	Not considered to be an inhalation hazard under normal conditions of use.
Skin Irritation	:	Expected to be slightly irritating. Prolonged or repeated skin contact without proper cleaning can clog the pores of the skin resulting in disorders such as oil acne/folliculitis.
Eye Irritation	:	Expected to be slightly irritating.
Respiratory Irritation	:	Inhalation of vapours or mists may cause irritation.
Sensitisation	:	Not expected to be a skin sensitiser.
Repeated Dose Toxicity	:	Not expected to be a hazard.
Mutagenicity	:	Not considered a mutagenic hazard.
Carcinogenicity	:	Product contains mineral oils of types shown to be non-carcinogenic in animal skin-painting studies. Highly refined mineral oils are not classified as carcinogenic by the International Agency for Research on Cancer (IARC). Other components are not known to be associated with carcinogenic effects.
Reproductive and Developmental Toxicity	:	Not expected to be a hazard.
Additional Information	:	Used oils may contain harmful impurities that have accumulated during use. The concentration of such impurities will depend on use and they may present risks to health and the environment on disposal. ALL used oil should be handled with caution and skin contact avoided as far as possible.

12. ECOLOGICAL INFORMATION

Ecotoxicological data have not been determined specifically for this product. Information given is based on a knowledge of the components and the ecotoxicology of similar products.

Acute Toxicity	:	Poorly soluble mixture. May cause physical fouling of aquatic

organisms. Expected to be practically non toxic: LL/EL/IL50 > 100 mg/l (to aquatic organisms) (LL/EL50 expressed as the nominal amount of product required to prepare aqueous test extract). Mineral oil is not expected to cause any chronic effects to aquatic organisms at concentrations less than 1 mg/l.

Mobility	:	Liquid under most environmental conditions. Floats on water. If it enters soil, it will adsorb to soil particles and will not be mobile.
Persistence/degradability	:	Expected to be not readily biodegradable. Major constituents are expected to be inherently biodegradable, but the product contains components that may persist in the environment.
Bioaccumulation	:	Contains components with the potential to bioaccumulate.
Other Adverse Effects	:	Product is a mixture of non-volatile components, which are not expected to be released to air in any significant quantities. Not expected to have ozone depletion potential, photochemical ozone creation potential or global warming potential.

13. DISPOSAL CONSIDERATIONS

Material Disposal	:	Recover or recycle if possible. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste classification and disposal methods in compliance with applicable regulations. Do not dispose into the environment, in drains or in water courses.
Container Disposal	:	Dispose in accordance with prevailing regulations, preferably to a recognised collector or contractor. The competence of the collector or contractor should be established beforehand.
Local Legislation	:	Disposal should be in accordance with applicable regional, national, and local laws and regulations.

14. TRANSPORT INFORMATION

US Department of Transportation Classification (49CFR)
This material is not subject to DOT regulations under 49 CFR Parts 171-180.

IMDG
This material is not classified as dangerous under IMDG regulations.

IATA (Country variations may apply)
This material is not classified as dangerous under IATA regulations.

15. REGULATORY INFORMATION

The regulatory information is not intended to be comprehensive. Other regulations may apply to this material.

Federal Regulatory Status

Notification Status

EINECS	All components listed or polymer exempt.
TSCA	All components listed.
DSL	All components listed.

SARA Hazard Categories (311/312)
No SARA 311/312 Hazards.

State Regulatory Status

California Safe Drinking Water and Toxic Enforcement Act (Proposition 65)

This material does not contain any chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

16. OTHER INFORMATION

NFPA Rating (Health, Fire, Reactivity)	:	0, 1, 0
MSDS Version Number	:	10.0
MSDS Effective Date	:	07/08/2008
MSDS Revisions	:	A vertical bar (|) in the left margin indicates an amendment from the previous version.
MSDS Regulation	:	The content and format of this MSDS is in accordance with the OSHA Hazard Communication Standard, 29 CFR 1910.1200.
MSDS Distribution	:	The information in this document should be made available to all who may handle the product.
Disclaimer	:	The information contained herein is based on our current knowledge of the underlying data and is intended to describe the product for the purpose of health, safety and environmental requirements only. No warranty or guarantee is expressed or implied regarding the accuracy of these data or the results to be obtained from the use of the product.

6.4 Thermal Fluid Pump

Operating Instructions
1220.8-10 G2

Etanorm SYA

**Thermal Oil /
Hot Water Pumps**

Works No.: _____

Type Series: Etanorm SYA

These operating instructions contain fundamental information and precautionary notes. Please read the manual thoroughly prior to installation of unit, electrical connection and commissioning. It is imperative to comply with all other operating instructions referring to components of individual units.

It is imperative to keep the operating instructions close to the unit or on the unit itself!

KSB Aktiengesellschaft
67225 Frankenthal, Johann-Klein-Str. 9, 67227 Frankenthal (Germany)

Contents

Index

1 General

Caution This KSB pump has been developed in accordance with state-of-the-art technology; it is manufactured with utmost care and subject to continuous quality control.
These operating instructions are intended to facilitate familiarization with the pump and its designated use.
The manual contains important information for reliable, proper and efficient operation. Compliance with the operating instructions is of vital importance to ensure reliability and a long service life of the pump and to avoid any risks.
These operating instructions do not take into account local regulations; the operator must ensure that such regulations are strictly observed by all, including the personnel called in for installation.
This pump / unit must not be operated beyond the limit values specified in the technical documentation for the medium handled, capacity, speed, density, pressure, temperature and motor rating. Make sure that operation is in accordance with the instructions laid down in this manual or in the contract documentation. (Contact the manufacturer, if required.)
The name plate indicates the type series / size, main operating data and works number; please quote this information in all queries, repeat orders and particularly when ordering spare parts.
If you need any additional information or instructions exceeding the scope of this manual or in case of damage please contact KSB's nearest customer service centre.
For noise characteristics please refer to section 4.5.

2 Safety

These operating instructions contain fundamental information which must be complied with during installation, operation and maintenance. Therefore this operating manual must be read and understood both by the installing personnel and the responsible trained personnel / operators prior to installation and commissioning, and it must always be kept close to the location of operation of the machine / unit for easy access.

Not only must the general safety instructions laid down in this chapter on "Safety" be complied with, but also the safety instructions outlined under specific headings.

2.1 Marking of Instructions in the Manual

The safety instructions contained in this manual whose non-observance might cause hazards to persons are specially marked with the general hazard sign, namely

safety sign in accordance with DIN 4844 - W9.

The electrical danger warning sign is

safety sign in accordance with DIN 4844 - W8.
The word

Caution

is used to introduce safety instructions whose non-observance may lead to damage to the machine and its functions.
Instructions attached directly to the machine, e.g.
- arrow indicating the direction of rotation
- markings for fluid connections

must always be complied with and be kept in perfectly legible condition at all times.

2.2 Personnel Qualification and Training

All personnel involved in the operation, maintenance, inspection and installation of the machine must be fully qualified to carry out the work involved.
Personnel responsibilities, competence and supervision must be clearly defined by the operator. If the personnel in question is not already in possession of the requisite know-how, appropriate training and instruction must be provided. If required, the operator may commission the manufacturer / supplier to take care of such training. In addition, the operator is responsible for ensuring that the contents of the operating instructions are fully understood by the responsible personnel.

2.3 Non-compliance with Safety Instructions

Non-compliance with safety instructions can jeopardize the safety of personnel, the environment and the machine itself. Non-compliance with these safety instructions will also lead to forfeiture of any and all rights to claims for damages.

In particular, non-compliance can, for example, result in:

- failure of important machine / unit functions
- failure of prescribed maintenance and servicing practices
- hazard to persons by electrical, mechanical and chemical effects
- hazard to the environment due to leakage of hazardous substances.

2.4 Safety Awareness

It is imperative to comply with the safety instructions contained in this manual, the relevant national health and safety regulations and the operator's own internal work, operation and safety regulations.

2.5 Safety Instructions for the Operator / User

- Any hot or cold components that could pose a hazard must be equipped with a guard by the operator.
- Guards which are fitted to prevent accidental contact with moving parts (e.g. coupling) must not be removed whilst the machine is operating.
- Leakages (e.g. at the shaft seal) of hazardous media handled (e.g. explosive, toxic, hot) must be contained so as to avoid any danger to persons and the environment. Pertinent legal provisions must be adhered to.
- Electrical hazards must be eliminated. (In this respect refer to the relevant safety regulations applicable to different countries and/or the local energy supply companies.)

2.6 Safety Instructions for Maintenance, Inspection and Installation Work

The operator is responsible for ensuring that all maintenance, inspection and installation work be performed by authorized, qualified specialist personnel who are thoroughly familiar with the manual.
The pump must have cooled down to ambient temperature. Pump pressure must have been released and the pump must have been drained.

Work on the machine must be carried out only during standstill. The shutdown procedure described in the manual for taking the machine out of service must be adhered to without fail.

Pumps or pump units handling media injurious to health must be decontaminated.

Immediately following completion of the work, all safety-relevant and protective devices must be re-installed and/or re-activated.

Please observe all instructions set out in the chapter on "Commissioning" before returning the machine to service.

2.7 Unauthorized Modification and Manufacture of Spare Parts

Modifications or alterations of the machine are only permitted after consultation with the manufacturer. Original spare parts and accessories authorized by the manufacturer ensure safety. The use of other parts can invalidate any liability of the manufacturer for consequential damage.

2.8 Unauthorized Modes of Operation

The warranty relating to the operational reliability and safety of the pump / unit supplied is only valid if the machine is used in accordance with its designated use as described in the following sections of these operating instructions. The limits stated in the data sheet must not be exceeded under any circumstances.

3 Transport and Interim Storage

3.1 Transport

Transport of the unit requires proper preparation and handling. Always make sure that the pump or the unit remains in horizontal position during transport and cannot slip out of the transport suspension arrangement. Do not use lifting slings on the free shaft end of the pump or on the motor eyebolt.

⚠ If the pump / unit slips out of the suspension arrangement, it may cause personal injury and damage to property.

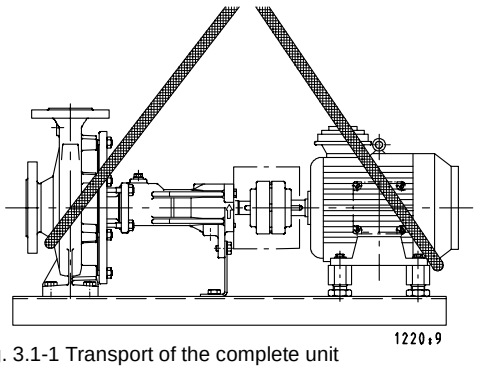


Fig. 3.1-1 Transport of the complete unit

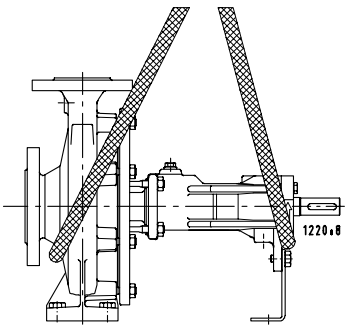


Fig. 3.1-2 Transport of the pump

3.2 Interim Storage / Preservation

When the unit is temporarily put into storage, only the wetted low alloy components (e.g. nodular cast iron JS1025 [1)], etc.) must be preserved. Commercially available preservatives can be used for this purpose. Please observe the manufacturer's instructions for application/removal.

The unit / pump should be stored in a dry room where the atmospheric humidity is as constant as possible.
If stored outdoors, the unit and crates must be covered by waterproof material to avoid any contact with humidity.

Caution Protect all stored goods against humidity, dirt, vermin and unauthorized access!

All openings of the assembled unit components are closed and must only be opened when required during installation.

All blank parts and surfaces of the pump are oiled or greased (silicone-free oil and grease) to protect them against corrosion.

4 Description of the Product and Accessories

4.1 Technical Specification

Volute casing pumps for heat transfer (DIN 4754) or hot water circulation systems.

4.2 Designation

EN 80 - 160 66 (6239) S Y A

- EN 80 - 160: Type series Etanorm, Pump size, e.g.
- 66 (6239): Actual impeller diameter - 100 mm, e.g. 166 mm = (angular reduction of impeller vanes, e.g. Etanorm 80-160 actual diameter 162/139 mm) =
- S: Casing material nodular cast iron JS 1025 [1)]
- Y: Heat transfer oil/Hot water variant
- A

1) to EN 1563 = GJS-400-18-LT

4.3 Design Details

Pump

Design:	horizontal volute casing pump, single-stage, with ratings and main dimensions to EN 733, with bearing bracket in back pull-out design. Volute casing with integrally cast pump feet, with replaceable casing wear rings.	
Bearings:	coupling side:	grease-lubricated deep-groove ball bearing
	impeller side:	product-lubricated carbon bearing
Shaft seal:	mechanical seal	

4.4 Permissible Forces and Moments at the Pump Nozzles

Etanorm SYA	t = 20 °C			t = 300 °C		
	F_{Vmax} [kN]	F_{Hmax} [kN]	M_{tmax} [kNm]	F_{Vmax} [kN]	F_{Hmax} [kN]	M_{tmax} [kNm]
32-125.1	3.65	2.59	0.58	3.15	2.24	0.50
32-160.1	3.56	2.51	0.51	3.08	2.17	0.44
32-200.1	3.60	2.43	0.51	3.11	2.10	0.44
32-160	3.56	2.51	0.51	3.08	2.17	0.44
32-200	3.65	2.43	0.51	3.11	2.10	0.44
32-250	3.65	2.43	0.51	3.11	2.10	0.44
40-160	3.81	2.67	0.81	3.29	2.31	0.70
40-200	3.81	2.67	0.81	3.29	2.31	0.70
40-250	4.21	2.92	0.58	3.64	2.52	0.50
40-315	4.09	2.84	0.55	3.54	2.46	0.48
50-160	3.97	2.67	1.11	3.43	2.31	0.96
50-200	4.21	2.92	1.11	3.64	2.52	0.96
50-250	4.58	3.32	0.87	3.96	2.87	0.75
50-315	4.54	3.24	0.84	3.92	2.80	0.73
65-160	4.42	3.04	1.16	3.82	2.63	1.00
65-200	5.27	3.89	1.79	4.55	3.36	1.55
65-250	5.27	3.89	1.79	4.55	3.36	1.55
65-315	5.43	4.05	1.62	4.69	3.50	1.40
80-160	5.43	4.05	1.91	4.69	3.50	1.65
80-200	6.08	4.74	2.44	5.25	4.10	2.10
80-250	6.16	4.78	2.44	5.32	4.13	2.10
80-315	6.28	4.86	2.78	5.43	4.20	2.40
100-160	7.70	6.28	3.60	6.65	5.43	3.10
100-200	7.70	6.28	3.60	6.65	5.43	3.10
100-250	7.86	6.48	3.47	6.79	5.60	3.00
100-315	7.57	6.16	3.18	6.54	5.32	2.75
125-200	9.50	8.50	5.10	8.21	7.34	4.40
125-250	9.84	8.71	5.10	8.50	7.53	4.40
125-315	9.32	8.10	4.75	8.05	7.00	4.10
125-400	9.23	7.90	4.63	7.97	6.83	4.00
150-315	10.53	9.72	5.67	9.10	8.40	4.90
150-400.1	10.53	9.72	5.67	9.10	8.40	4.90

The values indicated apply to pumps made of nodular cast iron JS 1025 [3].

3) to EN 1563 = GJS-400-18-LT

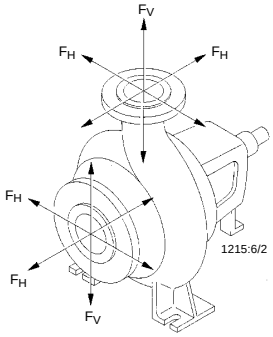


Fig. 4.4-1 Forces and moments at the pump nozzles

The following condition must be met:

$$\left[\frac{\Sigma\ |F_V|}{|F_{Vmax}|}\right]^2 + \left[\frac{\Sigma\ |F_H|}{|F_{Hmax}|}\right]^2 + \left[\frac{\Sigma\ |M_t|}{|M_{tmax}|}\right]^2 \leq 1$$

$\Sigma\ |F_V|$, $\Sigma\ |F_H|$ and $\Sigma\ |M_t|$ are the sums of the absolute values of the respective loads acting on the nozzles. These sums neither take into account the direction of the forces and moments nor their distribution among the nozzles.

4.5 Noise Characteristics

Rated power input P_N	Surface sound pressure level $\overline{L}_{pA}$			
	Pump only		Pump with motor	
(kW)	1450 1/min dB [1]	2900 1/min dB [1]	1450 1/min dB [2]	2900 1/min dB [2]
0,55	46	48	50	56
0,75	48	50	52	58
1,1	50	52	55	60
1,5	51	53	56	62
2,2	53	55	58	64
3,0	55	57	60	66
4,0	57	59	62	67
5,5	58	60	63	69
7,5	60	62	65	70
11,0	62	64	66	72
15,0	63	66	68	74
18,5	64	67	69	75
22,0	65	68	70	75
30,0	67	69	71	77
37,0	68	71	72	77
45,0	69	72	73	78
55,0	70	73	73	79
75,0	72	74	75	80
90,0	73	75	75	80
110,0	74	76	76	81

1) Measured at a distance of 1 m from the pump outline (to DIN 45 635 part 1 and 24)

2) Measured at a distance of 1 m from the complete unit outline (to DIN 45 635, part 1 and 24)

The above noise characteristics apply to non-cavitating pump operation in the $Q_{opt.}$ range.

4.6 Accessories

Drive

Surface cooled IEC three phase squirrel cage motor

Caution

When the pump is driven by an electric motor, the motor's cooling air must flow in axial direction towards the pump end. Air velocity ≥ 3 m/s, measured at the drive side bearing end plate. When the pump is driven by an I.C. engine, only such air-cooled engines shall be used whose cooling air is drawn in and discharged over the coupling/flywheel.

Coupling

Design: Flexible coupling with or without spacer

Baseplate: Channel section steel or folded steel plate for the complete unit (pump and motor) in torsion-resistant design

Drive, coupling and baseplate can be supplied by KSB or the operator.

5 Installation at Site

5.1 Safety Regulations

Electrical equipment operated in hazardous locations must comply with the explosion protection regulations. This is indicated on the motor rating plate.
If the equipment is installed in hazardous locations, the applicable local explosion protection regulations and the regulations of the test certificate supplied with the equipment and issued by the responsible approval authorities must be observed and complied with. The test certificate must be kept close to the location of operation for easy access (e.g. foreman's office).

5.2 Checks to be Carried out Prior to Installation

All structural work required must have been prepared in accordance with the dimensions stated in the dimension table / installation plan.
The concrete foundations shall have sufficient strength (min. B 15) to DIN 1045.
Make sure that the concrete foundation has set firmly before placing the unit on it. Its surface shall be truly horizontal and even.

5.3 Installing the Pump/Unit

After placing the unit on the foundation, align it with the help of a spirit level placed on the shaft/discharge nozzle. The correct distance between the coupling halves as specified in the installation plan must be observed. Shims shall be fitted between the baseplate/foundation frame and the foundation itself; they shall always be inserted to the left and right of the foundation bolts and in close proximity to these bolts. For a bolt-to-bolt clearance of more than 800 mm, additional shims must be inserted halfway between the adjoining holes. All shims must lie perfectly flush.

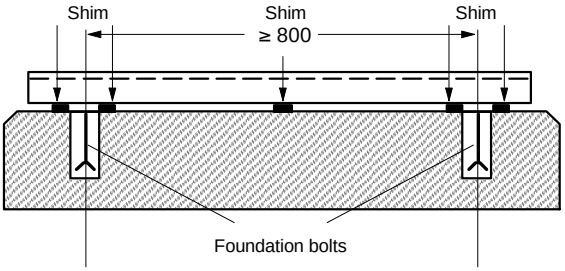


Fig. 5.3-1: Fitting required shims

Tighten the foundation bolts evenly and firmly.
Baseplates up to 400 mm wide made of channel section steel are torsion-resistant in their own right and need not be grouted.
After fastening, baseplates more than 400 mm wide made of folded steel plate must be grouted up to the upper edge via the holes Ø 120 mm) in the folded plate, using low-shrinkage concrete.

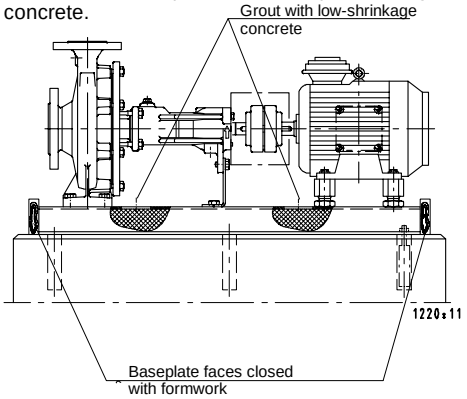


Fig. 5.3-2 Grouting the baseplate

5.3.1 Aligning the Pump/Drive

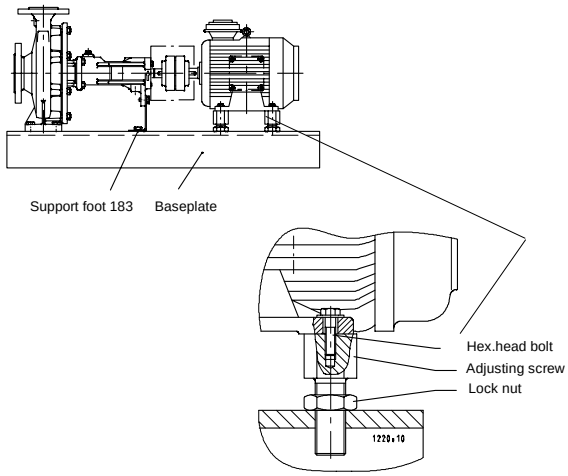
Caution After fastening the baseplate on the foundation, the coupling must be thoroughly checked and the pump set be realigned (at the motor), if required.

Prior to checking the alignment/realignment, loosen support foot 183 and re-tighten without transmitting any stresses or strains.

Coupling check and realignment must be effected even if pump and motor are supplied completely assembled and aligned on a common baseplate.

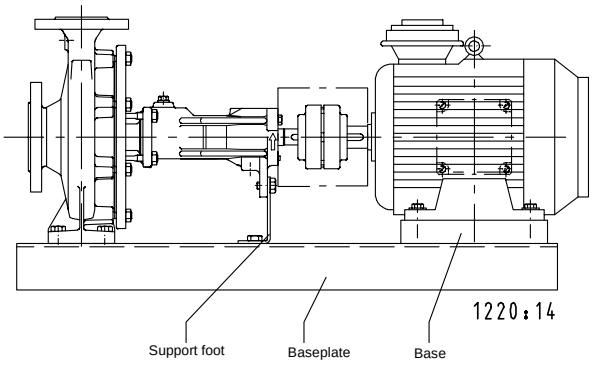
Motors with adjusting screw:

In order to realign the coupling, first loosen the 4 hex. head bolts on the motor as well as the lock nuts.
Turn adjusting screw by hand or by means of an open-jawed wrench until the coupling alignment is correct. Then re-tighten the 4 hex. head bolts and the lock nuts.



Motors without adjusting screw:

Differences in height between the pump axis and the motor axis must be compensated by fitting suitable bases. If the pump axis and the motor axis have the same height, both the pump and the motor are mounted directly on the baseplate. To realign the coupling, loosen the four hex. head bolts at the motor. Alignment is adjusted by fitting suitable sheet metal bases ZN 9 under the motor feet until alignment is correct.
Then re-tighten the four hex. head bolts.



The pump set is correctly aligned, if a straight-edge placed axially on both coupling halves is the same distance from each shaft at all points around the circumference. Make sure to turn the measuring point by hand all the time. In addition, the distance between the two coupling halves must remain the same all around the circumference. Use a gauge to verify, for example (see Figures 5.3-4 and 5.3-5).

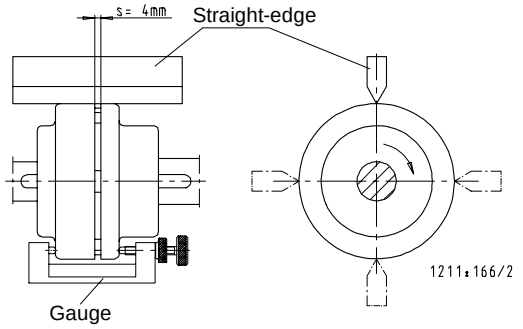


Fig. 5.3-4: Aligning a flexible coupling without spacer sleeve

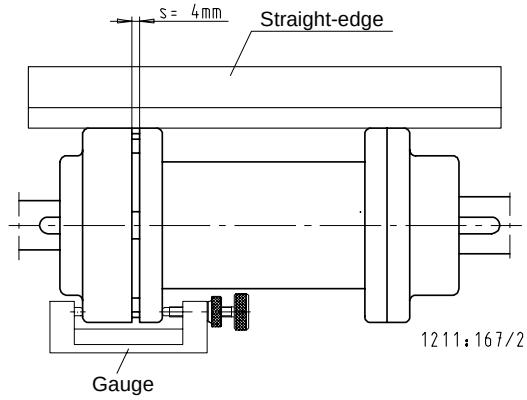


Fig. 5.3-5: Aligning a flexible spacer-type coupling

The radial and axial deviation between the two coupling halves shall not exceed 0.1 mm.
This must also be ensured at operating temperature and under actual inlet pressure.

Caution Improper alignment of the unit can cause damage to both the coupling and the unit itself!

5.3.2 Place of Installation

The volute casing and the discharge cover take on roughly the same temperature as the medium handled. The discharge cover and the bearing bracket must not be insulated.
Take the necessary precautions to avoid burns.

5.4 Connecting the Piping

Caution Never use the pump itself as an anchorage point for the piping.

The piping-induced forces and moments acting on the pump flanges (e.g. due to torsion or thermal expansion) must not exceed the permissible forces and moments specified in section 4.4.

The inlet line must be laid with a downward slope towards the pump to avoid the formation of air pockets.

The pipelines must be anchored in close proximity to the pump and connected without transmitting any stresses or strains. The pump must not bear the weight of the pipelines.

The nominal diameters of short pipelines shall be at least equal to the nominal diameters of the pump nozzles. For long pipelines the most economical nominal diameter has to be determined from case to case.

Adapters to larger diameters should have a diffuser angle of approx. 8° in order to avoid any increase in pressure losses.

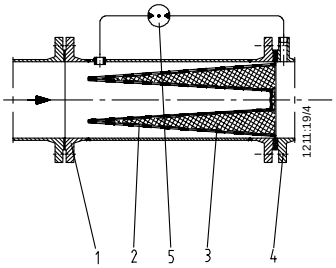
It is recommended to install check and shut-off elements in the system, depending on the type of plant and pump.

Thermal expansions of the pipelines must be compensated by appropriate measures so as not to impose any extra loads on the pump.

An excessive, impermissible increase in the pipeline forces may cause leaks on the pump where the medium handled can escape into the atmosphere.
Danger of life when hot media are handled!

The flange covers on the pump suction and discharge nozzles must be removed prior to installation in the piping.

Before commissioning new installations, thoroughly clean, flush and blow through all vessels, pipelines and connections. Often welding beads, scale and other impurities only come off after a certain period of operation. Fit a strainer in the suction line to prevent them from entering the pump. The total cross section of the holes in the strainer shall be three times the cross section of the pipeline in order to avoid excessive pressure loss across the strainer due to clogging. Conical strainers with laid-in wire mesh having a mesh width of 1.25 mm and a wire diameter of 0.4 mm, of corrosion-resistant material, shall be used.



1 Strainer housing
2 Fine screen
3 Perforated plate
4 Pump suction nozzle
5 Differential pressure gauge

Fig. 5.4-1 Conical strainer for the suction line

5.4.1 Auxiliary Connections

The dimensions and locations of the auxiliary connection required for the pump (leakage connection) are indicated on the installation plan or piping layout.

Caution This connection is required for proper functioning of the pump and is therefore of vital importance!

5.5 Final Check

Re-check the alignment as described in section 5.3.1. It must be easy to rotate the coupling/shaft by hand.

Caution The alignment check must be repeated at operating temperature.

Check the integrity and proper functioning of all connections.

5.6 Contact Guard

In compliance with the **accident prevention regulations** the pump must not be operated without a coupling guard. If the customer specifically requests not to include a coupling guard in our delivery, then the operator must supply one.

5.7 Connection to Power Supply

Connection to the power supply must be effected by a trained electrician only.

The applicable DIN VDE regulations 0100 and, for explosion-proof units, 0165 shall be complied with.

Check available mains voltage against the data on the motor rating plate and select appropriate start-up method.

Make sure to observe the technical regulations stipulated by the local energy supply company when connecting the pump to the power supply.

We strongly recommend to use a motor protection switch.

DIN VDE 0170/0171 stipulates that explosion-proof motors, type of protection IP 54, "increased safety" Ex EEx, temperature class T3, must always be connected via a motor protection switch.

5.7.1 Connecting the Motor

In compliance with DIN VDE 0530 - Part 8, the three-phase motors are always wired for clockwise rotation (looking at the motor shaft stub). The pump's direction of rotation is anticlockwise (looking at the suction flange).

For the motor's direction of rotation to match the pump's direction of rotation, the motor must be connected as shown in fig. 5.7-1 or 5.7-2, as applicable.

Δ connection (low voltage)

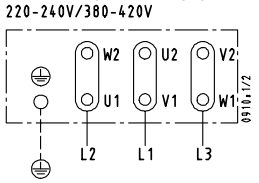


Fig. 5.7.1 Connection diagram for three-phase motors, Δ connection

Y connection (high voltage)

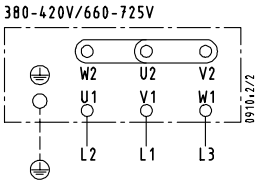


Fig. 5.7.2 Connection diagram for three-phase motors, Y connection

If required, connect the PTC resistors as per DIN 44081/44082 with the tripping unit in accordance with fig. 5.7.3.

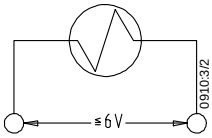


Fig. 5.7-3 Connecting the PTC resistors

5.7.2 Setting the Time Relay

Make sure that in the case of three-phase motors with star-delta starting method, switching over from star to delta will be effected at very short intervals. Prolonged switch-over intervals will result in pump damage.

Setting of the time relay for star-delta starting:

Motor rating	Y time to be set
≤ 30 kW	< 3 sec.
> 30 kW	< 5 sec.

5.7.3 Checking the Direction of Rotation

The direction of rotation of the motor must correspond to the direction indicated by the arrow on the volute casing of the pump (clockwise, when viewed from the motor end). This can be verified by switching the pump on and then off again immediately.

If the pump runs in the wrong direction of rotation, interchange any two phases L1, L2 or L3 of the power cable in the motor terminal box.

6 Commissioning, Start-up / Shutdown

6.1 Commissioning

Caution Before starting up the pump make sure that the following requirements have been checked and fulfilled.

- Make sure that the unit has been properly connected to the electric power supply and is equipped with all protection devices.
- Make sure that the pump has been primed with the liquid to be pumped.
- Verify the correct direction of rotation.
- Make sure all auxiliary lines are connected and functioning.

6.1.1 Lubricants

The grease-lubricated deep-groove ball bearing has been packed with grease in the factory.

6.1.2 Shaft Seal

See sections 7.4.4 and 7.5.2.

6.1.3 Priming the Pump and Checks to Be Carried out

Before start-up, the volute casing, the bearing bracket and the inlet line must be vented and primed with the liquid to be pumped.

The pump can be primed with clean liquid from the system through the inlet line. Vent the volute casing by opening the discharge side shutoff valve. Vent and prime the bearing bracket by removing screwed plug 903.3. Rotate the shaft several times by hand during priming to ensure that the bearing bracket is completely vented (fluid escapes).

After priming, screw the plug back into the vent hole.

Depending on the system pressure and the temperature of the medium handled, hot medium may escape or spurt out as liquid or steam when the vent plug is removed.

Danger of scalding!

Protect electric components from escaping liquid!

Caution **Dry-running will result in increased wear and must be avoided!**

6.1.4 Start-up

Always make sure that the shut-off element in the discharge line is closed before the pump is started up. Only after the pump has reached full rotational speed shall the shut-off element be opened slowly and adjusted to comply with the duty point.

If the system is completely primed, start-up can take place with the shut-off valve on the discharge side open even when commissioning a new pump.

During operation, the pump inlet pressure must fall below the atmospheric pressure.

Do not touch the pump, risk of burning!

Caution After the operating temperature has been reached and/or in the event of leakage, switch off the unit and re-tighten the hex. nuts 920.1 and 920.2.
For tightening torques please refer to section 7.5.3.

6.1.5 Shutdown

Close the shut-off element in the discharge line.

If the discharge line is equipped with a non-return or check valve, the shut-off element may remain open, provided there is back pressure in the line.

Make sure the shut-off element in the inlet line is open when switching off the pump.

Switch off the drive, making sure that the unit runs smoothly down to a standstill.

Depending on the type of installation, the pump should have a sufficient run-down period - with the heat source shut off - until the medium handled has cooled down sufficiently to avoid a heat build-up in the pump.

In the case of a prolonged shutdown, the shut-off valve in the inlet line must be closed. Close the auxiliary lines.

In the event of frost and/or prolonged shutdowns, the pump (if handling water) must be drained or otherwise protected against freezing.

6.2 Operating Limits

6.2.1 Temperature of the Medium Handled

Caution Do not operate the pump at temperatures exceeding those specified on the data sheet or the name plate.

6.2.2 Switching Frequency

To prevent high temperature increases in the motor and excessive loads on the pump, coupling, motor, seals and bearings, the switching frequency must not exceed 15 start-ups per hour (h).

6.2.3 Minimum Flow

If the plant configuration is such that the pump might be operated against a closed discharge side valve, a minimum flow of ~ 25 % of $Q_{opt.}$ has to be ensured during this interval.

6.2.4 Minimum Permissible Speeds

For pump control systems with continuously variable speed adjustment: n_{min} = 800 1/min.

6.2.5 Density of the Medium Handled

The power input of the pump will increase in proportion to the density of the medium handled. To avoid overloading of the motor, pump and coupling, the density of the medium must comply with the data specified on the purchase order.

6.3 Shutdown / Storage / Preservation

Each KSB pump leaves the factory carefully assembled. If commissioning is to take place some time after delivery, we recommend that the following measures be taken for pump storage.

6.3.1 Storage of New Pumps

- New pumps are supplied by our factory duly prepared for storage.
  Maximum protection for up to 12 months, if the pump is properly stored indoors.
- Store the pump in a dry location.

6.3.2 Measures to Be Taken for Prolonged Shutdown

1. **The pump remains installed; periodic check of operation**

   In order to make sure that the pump is always ready for instant start-up and to prevent the formation of deposits within the pump and the pump intake area, start up the pump set regularly once a month or once every 3 months for a short time (approx. 5 minutes) during prolonged shutdown periods. Prior to an operation check run ensure that there is sufficient liquid available for operating the pump.

2. **The pump is removed from the pipe and stored**

   Before putting the pump into storage carry out all checks specified in section 7.1. Then apply appropriate preservatives:
   - Spray-coat the inside wall of the pump casing, and in particular the impeller clearance areas, with a preservative. Spray the preservative through the suction and discharge nozzles. It is advisable to close the nozzles (for ex. with plastic caps or similar).

6.4 Returning to Service after Storage

Before returning the pump to service carry out all checks and maintenance work specified in sections 7.1 and 7.2.

In addition, the instructions laid down in the sections on ”Commissioning” (6.1) and ”Operating Limits” (6.2) must be observed.

Upon completion of the work, all safety-related and protective equipment must be properly refitted and/or reactivated before starting the pump set.

7 Maintenance / Repair

7.1 General Instructions

The operator is responsible for ensuring that all maintenance, inspection and installation work is carried out by authorized, duly qualified staff who are thoroughly familiar with these operating instructions.

A regular maintenance schedule will help avoid expensive repairs and contribute to trouble-free, reliable operation of the pump with a minimum of maintenance expenditure and work.

Work on the unit must only be carried out with the electrical connections disconnected. Make sure that the pump set cannot be switched on accidentally.

Pumps handling liquids posing health hazards must be decontaminated. When draining the medium see to it that there is no risk to persons or the environment. All relevant laws must be adhered to.

7.2 Maintenance / Inspection

7.2.1 Supervision of Operation

After partial or complete drainage of the system, top up the bearing bracket as described in section 6.1.3.

Caution **An insufficiently filled bearing bracket may cause damage to the plain bearing and the mechanical seal.**

Caution The pump must run quietly and free from vibrations at all times.

The pump must never be allowed to run dry.

Max. admissible ambient temperature: 40 °C.

The bearing temperature may exceed ambient temperature by up to 50 °C but must never rise above +90 °C (measured on the outside of the bearing bracket).

Prolonged operation against a closed shut-off element is not permitted, in order to avoid a heat build-up in the liquid handled.

Minimum flow required see 6.2.3.

The shut-off element in the suction line must not be closed during operation.

The mechanical seal shows only slight or invisible (vapour) leakage during operation. It is maintenance-free.
Monitor the suction strainer and clean it whenever it shows signs of clogging, to prevent the development of vacuum in the pump's bearing bracket and thus the risk of dry-running of the bearing and mechanical seal.

The outside of the bearing bracket must be kept free from dirt in order to make sure that the heat at the sealing chamber is reduced by the motor cooling air.

Any stand-by pumps installed must be switched on and then immediately off again once a week to keep them operational.

Attention shall be paid to the correct functioning of the auxiliary connections.

Caution If the flexible coupling elements begin to show signs of wear, they must be replaced in due time.

7.2.2 Lubrication and Lubricant Change

7.2.2.1 Lubrication

The deep-groove ball bearing is grease-lubricated. For the required quantity refer to section 7.2.2.3.

7.2.2.2 Grease Quality / Grease Change

The bearings are packed with high-quality lithium-soap grease. Under normal conditions the fill should last for 15,000 operating hours or 2 years. Under unfavourable operating conditions, e.g. high room temperature, high atmospheric humidity, dust-laden air, aggressive industrial atmosphere etc., the bearings should be checked earlier and cleaned and re-lubricated, if required.

Use a high-quality lithium-soap grease, free of resin and acid, not liable to crumble and with good rust-preventive characteristics. The grease should have a penetration number between 2 and 3, corresponding to a worked penetration between 220 and 295 mm/10. Its drop point must not be below 175 °C. The bearing cavities must only be half-filled with grease.

If required, the bearings may be lubricated with greases of other soap bases. Since greases of differing soap bases must not be mixed, the bearings must be thoroughly cleaned beforehand. The re-lubrication intervals required must then be adjusted to the greases used.

Caution The generally applicable legal provisions for the disposal of lubricants must be adhered to.

7.2.2.3 Deep-groove ball bearings / Lubricant quantity

Shaft unit [1)]	Code	Lubricant per bearing
25	6305 Z C3	approx. 5 g
35	6307 Z C3	approx. 10 g
55	6311 Z C3	approx. 15 g

1) For shaft unit / pump size combinations refer to section 7.6.1.

7.3 Drainage / Disposal

If the pump was used for handling liquids posing health hazards, see to it that there is no risk to persons or the environment when draining the medium. All relevant laws must be heeded. If required, wear safety clothing and a protective mask.

The flushing liquid used and any liquid residues in the pump must be properly collected and disposed of without posing any risk to persons or the environment.

7.4 Dismantling

Caution Before dismantling, secure the pump so as to make sure it cannot be switched on accidentally.

The shut-off elements in the suction and discharge lines must be closed and absolutely tight. Hot oil escaping or spurting out may self-ignite. The operator is responsible for the perfect functioning of the shut-off valves.
Special care must be taken when repairing pumps installed in an on-duty system.

The pump must have cooled down to ambient temperature. Pump pressure must have been released and the pump must have been drained.

Dismantling and reassembly must always be carried out in accordance with the general drawing/exploded view.

7.4.1 Fundamental Instructions and Recommendations

Repair and maintenance work to the pump must only be carried out by specially trained personnel, using **original spare parts** (see 2.7).
Observe the safety regulations laid down in section 7.1. Any work on the motor shall be governed by the specifications and regulations of the respective motor supplier. Dismantling and reassembly must always be carried out in the sequence shown in the exploded views on page 19 or 21.

In case of damage please contact KSB's nearest customer service centre (see enclosed directory of addresses).

7.4.2 Preparations for Dismantling

1 Interrupt power supply.
2 Disconnect all auxiliary supply lines.
3 Remove the coupling guard.
4 **Coupling design without spacer sleeve**
4.1 **Dismantling of pump unit:**
4.1.1 Disconnect the motor from the mains supply.
4.1.2 Disconnect the motor from the baseplate.
4.1.3 Shift the motor to decouple it from the pump.
4.1.4 Detach the discharge and suction nozzles from the pipeline.
4.1.5 Remove the pump from the baseplate.
4.2 **Volute casing remains on the baseplate and in the pipeline when the unit is dismantled:**
4.2.1 Disconnect the motor from the mains supply.
4.2.2 Disconnect the motor from the baseplate.
4.2.3 Shift the motor to decouple it from the pump.
4.2.4 Detach support foot 183 from the baseplate and undo hex. nut 920.1 on the discharge cover.
4.2.5 Pull the bearing bracket with discharge cover and cpl. rotor out of the casing (back pull-out unit).
5 **Spacer type coupling design**
5.1 **Dismantling the pump unit:**
5.1.1 Disconnect the motor from the mains supply.
5.1.2 Remove the coupling spacer.
5.1.3 Detach the discharge and suction nozzles from the pipeline.
5.1.4 Remove the pump from the baseplate.
5.2 **Volute casing remains on the baseplate and in the pipeline when the unit is dismantled:**
5.2.1 Disconnect the motor from the mains supply.
5.2.2 Remove the coupling spacer.
5.2.3 Detach support foot 183 from the baseplate and undo hex. nut 920.1 on the discharge cover.
5.2.4 Pull the bearing bracket with discharge cover and cpl. rotor out of the casing (back pull-out unit).

Caution On larger pumps suspend or support the bearing bracket end in order to prevent the back pullout unit from tilting.
After a prolonged period of operation the individual components may be hard to pull off the shaft. If this is the case, use a brand name penetrating agent and/or - if possible - an appropriate pull-off device.

Under no circumstances use force.

7.4.3 Pump

The pump shall be dismantled in the sequence given in the exploded views shown on page 19 or 21, respectively.
We recommend to place a drip pan under the whole length of the pump, which collects the medium flowing out during dismantling.

Caution **The generally applicable legal provisions for disposal must be adhered to!**

⚠ When replacing joint rings 411.3 and 411.4 made of CrNi graphite, please note that the supporting material consists of a thin CrNi metal foil (see fig. 7.4-1) which may cause cutting injuries.
Always remove these joint rings with suitable tools, taking adequate precautions.

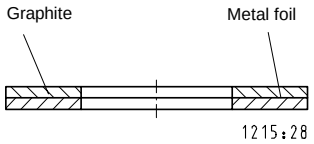


Fig. 7.4-1 Joint ring with metal foil

7.4.4 Mechanical seal

In order to replace the mechanical seal, the pump must be dismantled.

7.5 Reassembly

7.5.1 Pump

The pump must be reassembled in accordance with the rules of sound engineering practice.
Reassembly shall be effected in the reverse order of dismantling. Make sure to reassemble the pump in the correct sequence.

Additional instructions:
- Place joint ring 411.4 **on discharge cover sealing face**, to prevent it from slipping out of position.
- Replace all joint rings and gaskets affected by dismantling.
- Use specified deep-groove ball bearing 321 only.
- Pack bearing with grease (see 7.2.2.3)
- When fitting the deep-groove ball bearing, ensure the side with the cover plate points towards the pump side (see figs. 7.5-1, 7.5-2, 7.5-3)

Etanorm SYA SU 25 1)

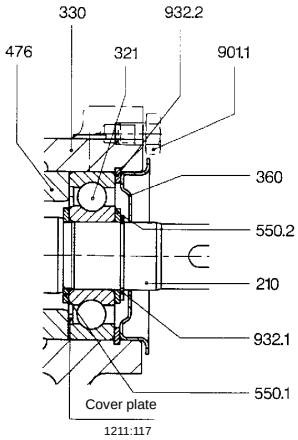


Fig.7.5-1 Mounting the deep-groove ball bearing,shaftunit 25[1)]

1) For shaft unit/pump size combinations see section 7.6.1

Etanorm SYA, SU 35 1)

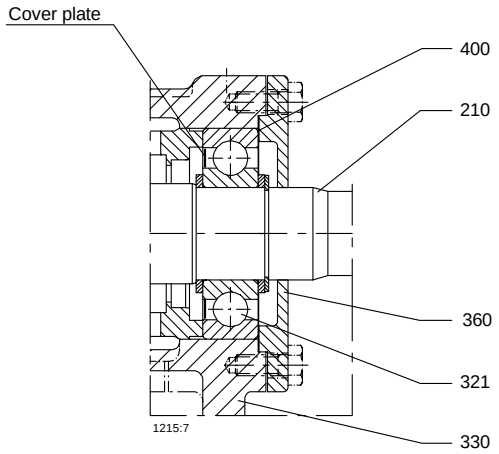


Fig. 7.5-2 Mounting the deep-groove ball bearing SU 35 1)

1) For shaft unit/pump size combinations see 7.6.1

Etanorm SYA, SU 55 1)

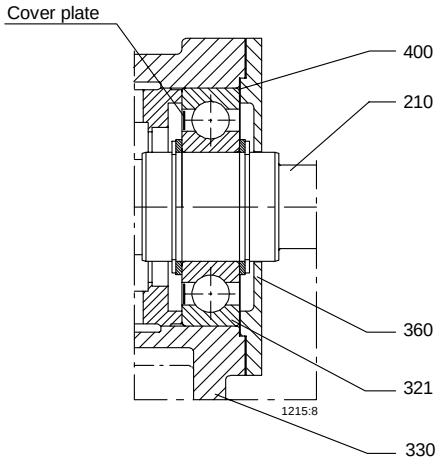


Fig. 7.5-3 Mounting the deep-groove ball bearing SU 55 1)

1) For shaft unit/pump size combinations see 7.6.1

Caution **Replacing the plain bearing**

- **Removing the shaft and the plain bearing**
  Remove shaft 210 from bearing bracket 330 towards the coupling.
  Press plain bearing 310 out of the bearing bracket.

- **Mounting the plain bearing**
  Carefully press plain bearing 310 into bearing bracket 330 up to the stop.

Maximum clearance at plain bearing:		As-new clearance at plain bearing:
SU 25 1)	0.35 mm	0.08 - 0.13
SU 35, 55 1)	0.4 mm	0.08 - 0.13

- If the sealing area between the impeller neck and the casing wear ring is worn, causing an excessive sealing clearance ≥ 0.9 mm, the casing wear rings (502.1 and 502.2, if fitted) must be replaced. The as-new clearance between casing wear ring and impeller is 0.3 mm on diameter.

1) For shaft unit/pump size combinations see 7.6.1

7.5.2 Mechanical seal

Reassembly is effected in reverse order to dismantling.
The following rules shall be observed when mounting the mechanical seal:
Extreme care and cleanliness.
The protective wrapping of the contact faces must only be removed immediately before assembly takes place.
Take care not to damage the seal faces and the O-rings.
Clean the shaft and the seat ring holder and carefully remove any deposits.

7.5.3 Tightening Torques

7.5.3.1 Pump

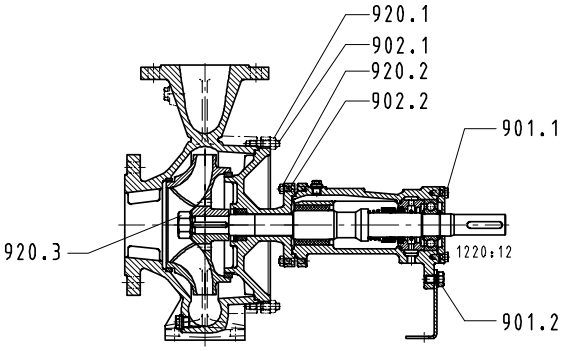


Fig. 7.5-4 Bolt tightening points, pump

Part No.	Thread size [mm]	Tightening torque [1] M_A [Nm]
901.1	M 8	20 - 25
	M 10	30 - 35
901.2	M 12	40 - 50
902.1 / 920.1	M 10	30 - 35
	M 12	40 - 50
902.2 / 920.2	M 8	20 - 25
	M 10	30 - 35
920.3	M 12 x 1,5	20 - 50
	M 24 x 1,5	60 - 170
	M 30 x 1,5	80 - 280

7.5.3.2 Pump/Motor Assembly

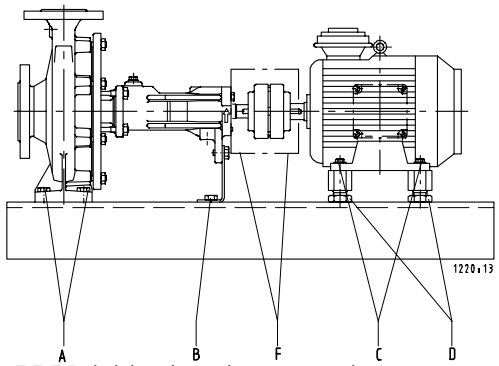


Fig. 7.5-5 Bolt tightening points, pump unit

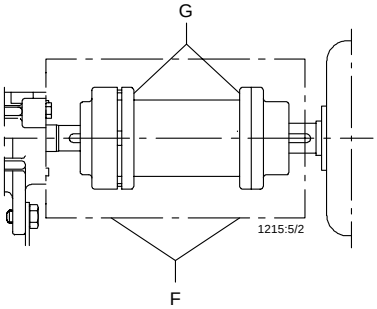


Fig. 7.5-6 Bolt tightening points, spacer-type coupling

Pump on baseplate

Position	Thread size [mm]	Tightening torque [1] M_A [Nm]
A	M12	20 - 30
	M16	30 - 75
	M20	50 - 145
B	M12	20 - 30

Motor on baseplate

Position	Thread size [mm]	Tightening torque [1] M_A [Nm]
C	M6	5 - 10
	M8	5 - 10
	M10	10 - 15
	M12	20 - 30
	M16	30 - 75
	M20	50 - 145
	M24	75 - 250
D	M24 x 1.5	75 - 250

Coupling and coupling guard

Position	Thread size [mm]	Tightening torque [1] M_A [Nm]
F	M6	5 - 10
G	M6	13
	M8	18
	M10	44

1) for unlubricated threads

7.6 Spare Parts Stock

7.6.1 Interchangeability of Etanorm SYA, Etabloc SY, Etaline SY Components and Interchangeability of Component Parts

Etanorm SYA	Shaft unit	Etabloc SY	Etaline SY	Description														
				Volute casing	Discharge cover	Support foot 1)	Shaft 1)	Impeller	Plain bearing	Deep-groove ball bearing 1)	Bearing bracket 1)	Bearing housing 2)	Bearing cover 1)	Mechanical seal	Seal cover 2)	Seat ring holder 1)	Casing wear ring suction side	Casing wear ring discharge side
				Part No.														
				102	163	183	210	230	310	321	330	350	360	433	471	476	502.1	502.2
32-125.1	25	32-125.1/.		O	1	1	1	O	O	1	1	1	1	1	1	1	1	X
32-160.1	25	32-160.1/.	40-160/..	O	1	2	1	1	O	1	1	1	1	1	1	1	1	3
32-200.1	25	32-200.1/.	40-200/..	O	2	3	1	2	O	1	1	1	1	1	1	1	1	3
32-160	25	32-160/..	50-160/..	O	1	2	1	1	O	1	1	1	1	1	1	1	1	3
32-200	25	32-200/..	50-200/..	O	2	3	1	2	O	1	1	1	1	1	1	1	1	3
32-250	25			O	3	4	1	O	2	1	1		1	1		1	1	10
40-160	25	40-160/..	65-160/..	O	1	2	1	O	O	1	1	1	1	1	1	1	2	3
40-200	25	40-200/..	65-200/..	O	2	3	1	O	O	1	1	1	1	1	1	1	O	3
40-250	25			O	3	4	1	O	2	1	1		1	1		1	2	10
40-315	35			O	O	7	2	O	3	2	2		2	2		2	2	13
50-160	25	50-160/..	80-160/..	O	1	3	1	O	O	1	1	1	1	1	1	1	3	3
50-200	25	50-200/..	80-200/..	O	2	3	1	O	O	1	1	1	1	1	1	1	3	3
50-250	25			O	3	4	1	O	2	1	1		1	1		1	3	10
50-315	35			O	7	7	2	O	3	2	2		2	2		2	4	11
65-160	25	65-160/..	100-160/..	O	4	3	1	O	O	1	1	1	1	1	1	1	4	5
65-200	25	65-200/..		O	O	4	1	O	O	1	1	1	1	1	1	1	4	5
65-250	35			O	O	5	2	O	3	2	2		2	2		2	5	13
65-315	35			O	7	7	2	O	3	2	2		2	2		2	5	11
80-160	25	80-160/..	100-170/..	O	4	4	1	O	O	1	1	1	1	1	1	1	6	5
80-200	35			O	5	O	2	O	3	2	2		2	2		2	6	11
80-250	35			O	6	5	2	O	3	2	2		2	2		2	6	11
80-315	35			O	7	6	2	O	3	2	2		2	2		2	6	11
100-160	35			O	5	5	2	O	3	2	2		2	2		2	7	11
100-200	35			O	5	5	2	O	3	2	2		2	2		2	7	11
100-250	35			O	6	7	2	O	3	2	2		2	2		2	7	11
100-315	35			O	7	6	2	O	3	2	2		2	2		2	7	11
125-200	35			O	O	6	2	O	3	2	2		2	2		2	8	O
125-250	35			O	O	6	2	O	3	2	2		2	2		2	8	O
125-315	55			O	8	9	3	O	3	3	3		3	3		3	8	12
125-400	55			O	9	8	3	O	3	3	3		3	3		3	8	12
150-315	55			O	8	9	3	O	3	3	3		3	3		3	9	12
150-400.1	55			O	10	8	3	O	3	3	3		3	3		3	9	X

1) Etanorm SYA only
2) Etabloc SY/Etaline SY only

1 / 1 Same number means same component

○ Components differ

X Component not fitted

7.6.2 Ordering Spare Parts

When ordering spare parts please always quote the following data stated on the pump name plate, e.g.:

Type series: Etanorm SYA 80-160

Works No.: 4-919-451 777

or on the volute casing, e.g. EN 80-160 | 60 SYA |

7.6.3 Recommended Spare Parts Stock for 2 Years' Continuous Operation

Part No.	Description	Number of pumps (including stand-by pumps)						
		2	3	4	5	6 and 7	8 and 9	10 and more
		Quantity of spare parts						
210	Shaft	1	1	1	2	2	2	20 %
230	Impeller (incl. casing wear ring 502.2)	1	1	1	2	2	2	20 %
321	Deep-groove ball bearing	1	1	2	2	3	4	100 %
330	Bearing bracket cpl. 1)	-	-	-	-	-	1	2 off
433	Mechanical seal	1	1	2	2	2	3	25 %
502.1	Casing wear ring	1	1	1	2	2	2	20 %
-	Gaskets / Joint ring (set) 2)	4	6	8	8	9	12	150 %

1) Bearing bracket 330, cpl., including

Part No.	Description	Part No.	Description
210	Shaft	476	Seat ring holder
310	Plain bearing	550.1/.2/.3	Disc
321	Deep-groove ball bearing	901.1	Hex. head bolt
330	Bearing bracket	903	Screwed plug
360	Bearing cover	916	Plug
411.1	Joint ring	920.3	Hex. nut
412.1/.2	O-ring	930	Spring washer
433	Mechanical seal	932.1/.2	Circlip

2) Gasket / Joint ring (set), consisting of:

Part No.	Description
400	Gasket
411.1/.3/.4	Joint ring

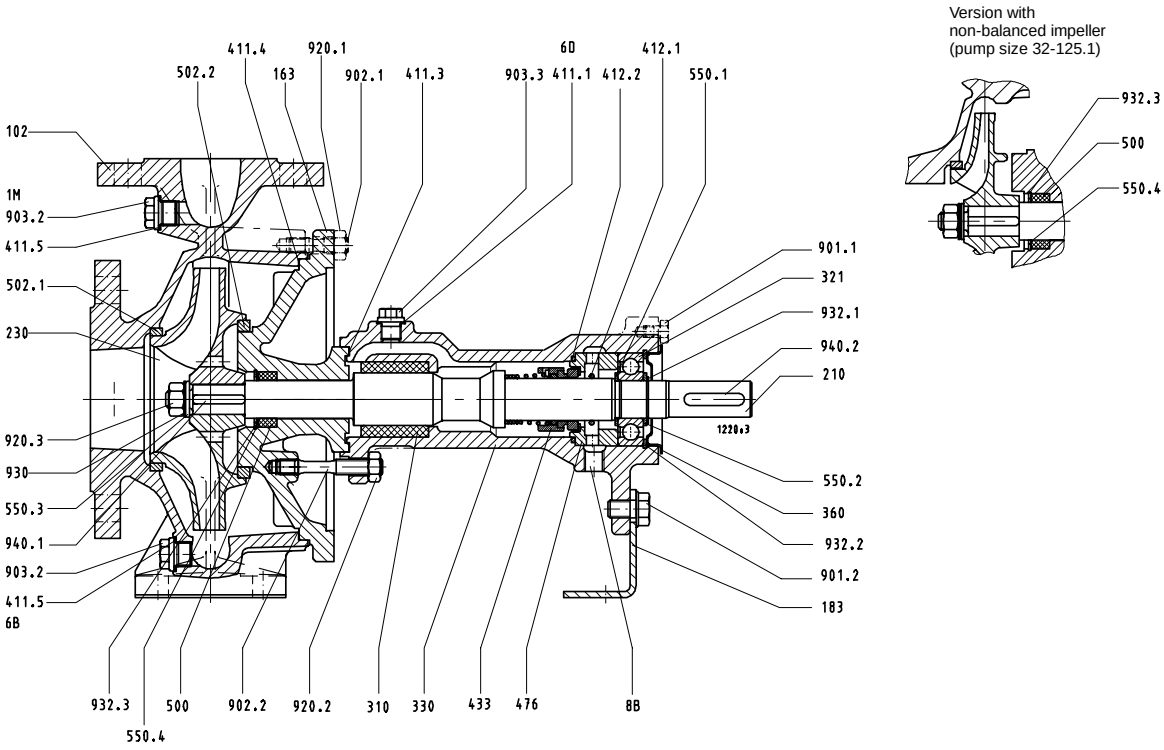
8 Trouble-shooting

Pump delivers insufficient flow rate	Motor is overloaded	Excessive pump discharge pressure	Increase in bearing temperature	Leakage at the pump	Excessive leakage at the shaft seal	Vibrations during pump operation	Excessive rise of temperature inside the pump	Cause	Remedy [1]
*								Pump delivers against an excessively high discharge pressure.	Re-adjust duty point.
*								Excessively high back pressure.	Check plant for impurities. Fit a larger impeller. [2] Increase the speed (turbine, I.C. engine)
*						*	*	Pump or piping are not completely vented or primed.	Vent and/or prime. Clean vent hole.
*								Supply line or impeller clogged.	Remove deposits in the pump and/or piping.
*								Formation of air pockets in the piping.	Alter piping layout. Fit a vent valve.
*						*	*	$NPSH_{available}$ (positive suction head) is too low.	Check/alter liquid level. Install pump at a lower level. Fully open shut-off valve in the suction line. Change suction line, if the friction losses in the suction line are too high. Check any strainers installed. Observe permissible rate of pressure fall.
*								Reverse rotation.	Interchange two of the phases of the power supply cable.
*								Speed is too low.	Increase speed. [2]
*						*		Wear of internal pump parts.	Replace worn components by new ones.
	*	*				*		Pump back pressure is lower than specified in the purchase order.	Adjust duty point accurately. In case of persistent overloading, turn down impeller, if necessary. [2].
	*							Density or viscosity of the fluid pumped is higher than stated in the purchase order.	[2]
	*	*						Speed is too high.	Reduce speed. [2]
				*				Defective gasket.	Replace the gasket between the volute casing and the discharge cover.
					*			Worn shaft seal.	Fit new shaft seal.
			*		*	*		The unit is misaligned.	Re-align.
			*		*	*		Pump is warped or sympathetic vibrations in piping.	Check pipeline connections and secure fixing of pump; if required, reduce the distances between the pipe clamps. Fix the pipelines using anti-vibration material.
			*					Increased axial thrust. [2]	Clean the balancing holes in the impeller. Replace the casing wear rings.
			*			*		Insufficient or excessive quantity of lubricant or unsuitable lubricant.	Top up, reduce or change lubricant.
			*					Non-compliance with specified coupling distance.	Correct distance according to the installation plan.
*	*							Motor is running on two phases only.	Replace the defective fuse. Check the electric cable connections.
						*		Rotor is out of balance.	Clean the impeller. / Re-balance the impeller.
						*		Defective bearings.	Fit new bearings.
						*	*	Insufficient rate of flow.	Increase the minimum rate of flow.

1) The pump pressure must be released before attempting to remedy faults on parts which are subjected to pressure.
2) Contact KSB.

9 Related Documents

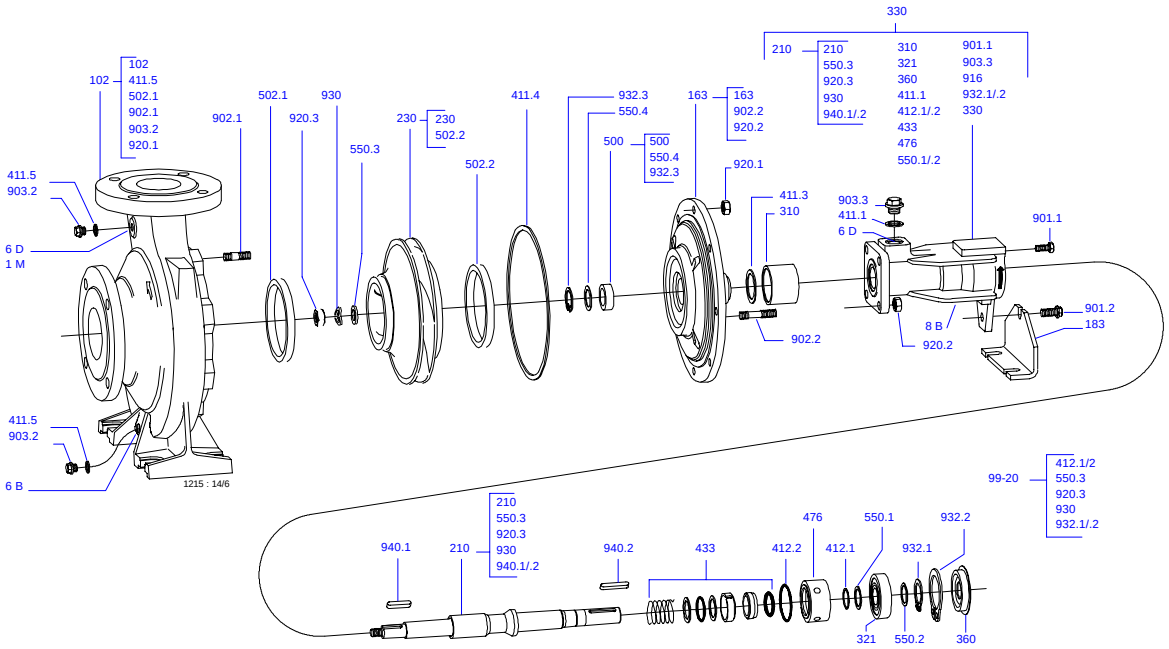
9.1 General Drawing and List of Components of Etanorm SYA, SU 25 [1)]



1) For shaft unit / pump size combinations refer to section 7.6.1.

Part No.	Description	Part No.	Description	Part No.	Description
102	Volute casing	411.1/.3/.4/.5	Joint ring	903.1/.2/.3	Screwed plug
163	Discharge cover	412.1/.2	O-ring	916	Plug
183	Support foot	433	Mechanical seal	920.1-/.3	Hex. nut
210	Shaft	476	Seat ring holder	930	Spring washer
230	Impeller	500	Ring	932.1-/.3	Circlip
310	Plain bearing	502.1/.2	Casing wear ring	940.1/.2	Key
321	Deep-groove ball bearing	550.1-/.4	Disc	99-20	Repair kit
330	Bearing bracket	901.1/.2	Hex. head bolt	1 M	Pressure gauge connection
360	Bearing cover	902.1/.2	Stud with reduced shank	6 B	Medium drain
				6 D	Medium venting
				8 B	Leakage drain

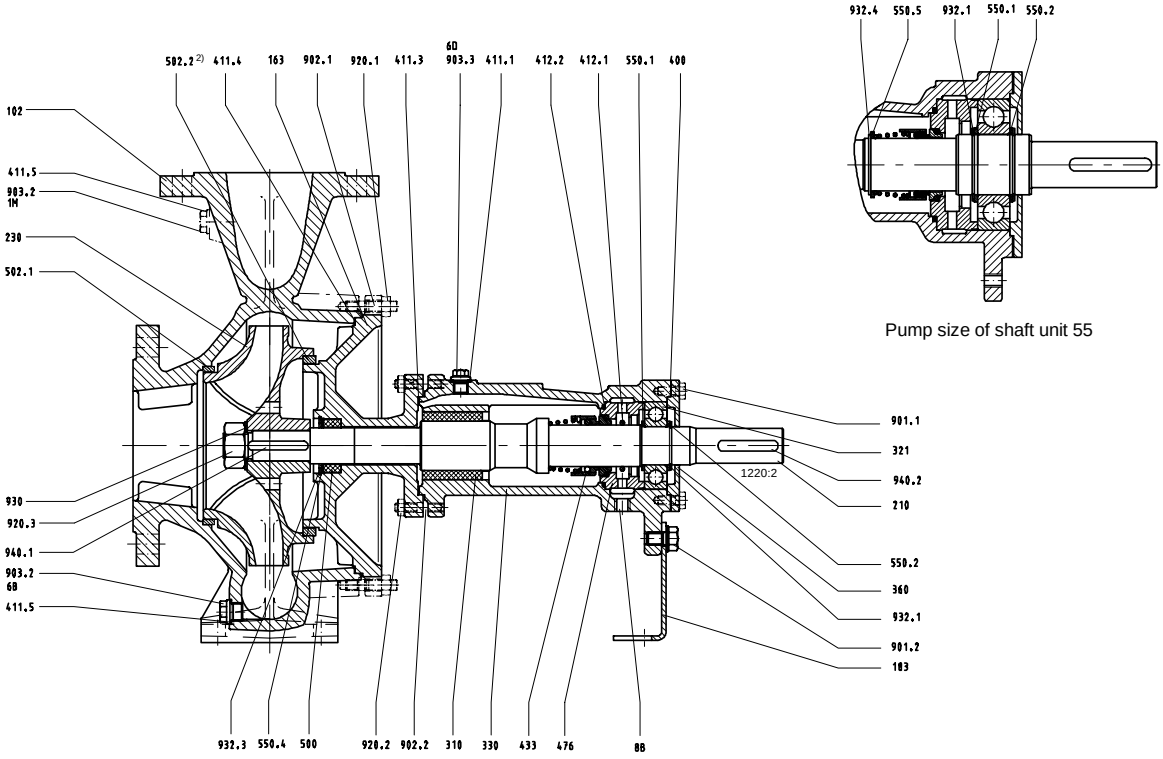
9.2 Exploded View and List of Components of Etanorm SYA, SU 25 [1)]



1) For shaft unit / pump size combinations refer to section 7.6.1.

Part No.	Description	Part No.	Description	Part No.	Description
102	Volute casing	411.1/.3/.4/.5	Joint ring	903.1/.2/.3	Screwed plug
163	Discharge cover	412.1/.2	O-ring	916	Plug
183	Support foot	433	Mechanical seal	920.1-/.3	Hex. nut
210	Shaft	476	Seat ring holder	930	Spring washer
230	Impeller	500	Ring	932.1-/.3	Circlip
310	Plain bearing	502.1/.2	Casing wear ring	940.1/.2	Key
321	Deep-groove ball bearing	550.1-/.4	Disc	99-20	Repair kit
330	Bearing bracket	901.1/.2	Hex. head bolt		
360	Bearing cover	902.1/.2	Stud with reduced shank		

9.3 General Drawing and List of Components, Etanorm SYA, SU 35, 55 [1]

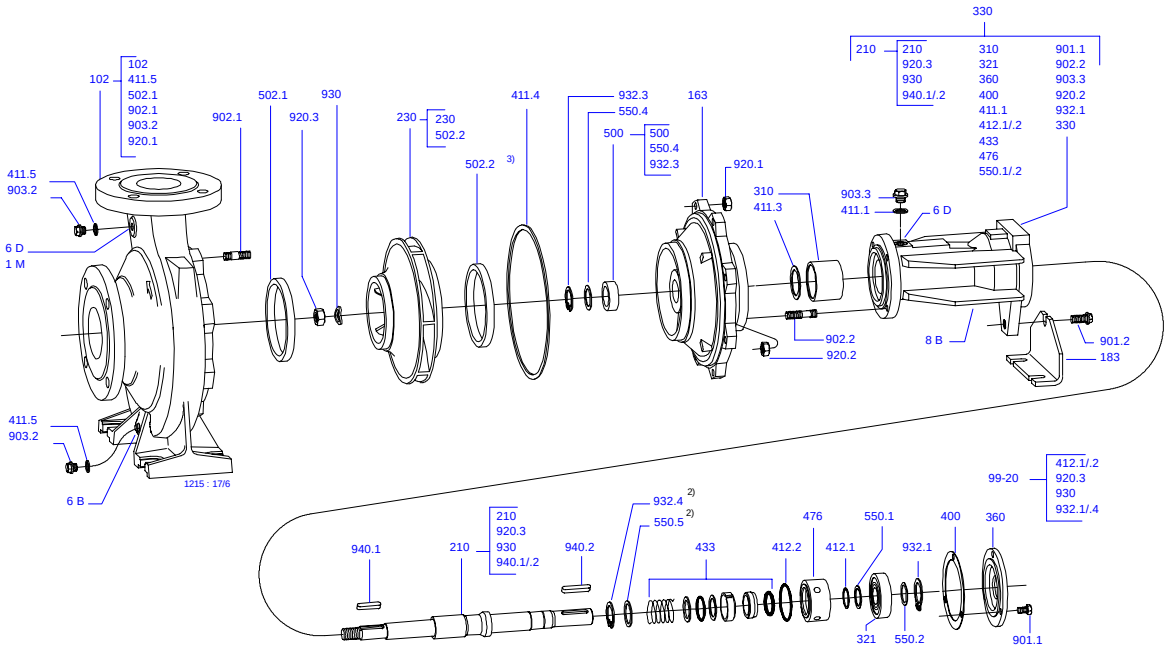


Pump size of shaft unit 55

1) For shaft unit / pump size combinations refer to section 7.6.1
2) Not fitted on pump size 150-400.1

Part No.	Description	Part No.	Description	Part No.	Description
102	Volute casing	400	Gasket	902.1/.2	Stud with reduced shank
163	Discharge cover	411.1/.3/.4/.5	Joint ring	903.1/.2/.3	Screwed plug
183	Support foot	412.1/.2	O-ring	920.1-/.3	Hex. nut
210	Shaft	433	Mechanical seal	930	Spring washer
230	Impeller	476	Seat ring holder	932.1/.3/.4	Circlip
310	Plain bearing	500	Ring	940.1/.2	Key
321	Deep-groove ball bearing	502.1/.2 [2]	Casing wear ring	99-20	Repair kit
330	Bearing bracket	550.1/.2/.4/.5	Disc	1 M	Pressure gauge connection
360	Bearing cover	901.1/.2	Hex. head bolt	6 B	Medium drain
				6 D	Medium venting
				8 B	Leakage drain

9.4 Exploded View and List of Components of Etanorm SYA, SU 35, 55 [1]



1) For shaft unit / pump size combinations refer to section 7.6.1
2) Only on Etanorm SYA, shaft unit 55
3) Not fitted on pump size 150-400.1

Part No.	Description	Part No.	Description	Part No.	Description
102	Volute casing	400	Gasket	902.1/.2	Stud with reduced shank
163	Discharge cover	411.1/.3/.4/.5	Joint ring	903.1/.2/.3	Screwed plug
183	Support foot	412.1/.2	O-ring	920.1-/.3	Hex. nut
210	Shaft	433	Mechanical seal	930	Spring washer
230	Impeller	476	Seat ring holder	932.1/.3/.4	Circlip
310	Plain bearing	500	Ring	940.1/.2	Key
321	Deep-groove ball bearing	502.1/.2	Casing wear ring	99-20	Repair kit
330	Bearing bracket	550.1/.2/.4/.5	Disc		
360	Bearing cover	901.1/.2	Hex. head bolt		

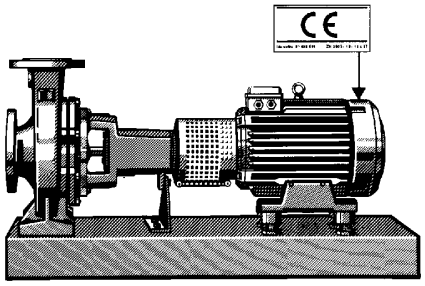
Please select the applicable declaration on the basis of the explanations below, depending on the criteria indicated and the actual delivery situation.

Declaration of Conformity

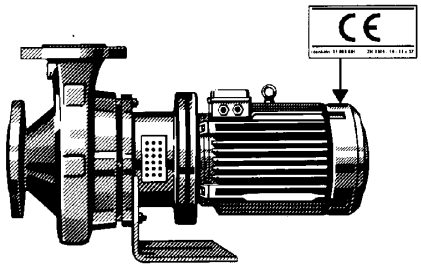
as per EC directive "Machinery" 98/37/EC

Please note: The declaration of conformity, in combination with the CE symbol, is only valid for machinery which is operative by itself (i.e. **w i t h** drive)!

E x a m p l e



Long-coupled pump



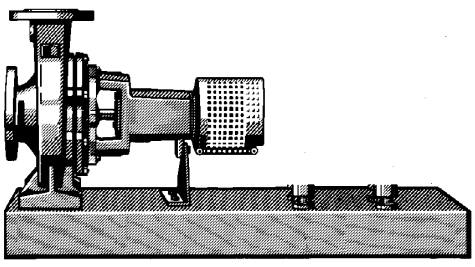
Close-coupled version

Manufacturer's Declaration

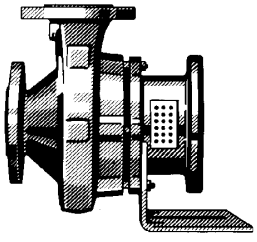
as per EC directive "Machinery" 98/37/EC

Please note: The manufacturer's declaration is only valid for pumps **w i t h o u t** drive. Commissioning is prohibited until evidence has been submitted that the drive the pump is to be assembled with complies with the provisions of EC directive 91/368/EEC. Commissioning is always subject to a declaration of conformity, in combination with the CE symbol, which has to be issued by the party assembling the pump with another machine.

E x a m p l e



Long-coupled pump



Close-coupled version

Konformitätserklärung
EC declaration of conformity
Déclaration »CE« de conformité
Declaración de conformidad
Declaração CE de conformidade
Dichiarazione CE di conformità
EG-verklaring van overeenstemming
EU-overensstemmelseserklæring
Samsvarserklæring
EG-försäkran om överensstämmelse
Vaatimustenmukaisuusvakuutus
Δήλωση συμφωνίας με τους κανονισμούς της Ευρωπαϊκής Κοινότητας

Hiermit erklären wir, daß das Pumpenaggregat
Herewith we declare that the pump unit
Par la présente, nous déclarons que le type de groupe moto-pompe
Por la presente declaramos que el grupo
Com a presente, declaramos que o grupo moto-bomba
Si dichiara che il modello del gruppo di pompaggio
Hiermee verklaren wij, dat het pompaggregaat
Hermed erklæres, at pumpetype
Herved erklærer vi at pumpeaggregatet
Härmed försäkrar vi att pumpaggregatet
Vakuutamme, että pumppukoneikko
Με την παρούσα δήλούμε ότι το Αντλητικό Συγκρότημα

Etanorm SYA

folgenden einschlägigen Bestimmungen in der jeweils gültigen Fassung entspricht:
complies with the following relevant provisions as applicable in their current version:
correspond aux dispositions pertinentes suivantes dans la version respective en vigueur:
es conforme a las disposiciones siguientes en su redacción vigente:
está em conformidade com as disposições pertinentes, a sabe na sua versão corrente:
è conforme alle seguenti disposizioni pertinenti nella versione valida al momento:
voldoet aan de huidige versie van de volgende bepalingen:
er i overensstemmelse med følgende bestemmelser til en hver tid gyldig udgave:
er i henhold til den til enhver tid gjeldende utgave av følgende EU-direktiv:
är tillverkad i överensstämmelse med
vastaa seuraavia määräyksiä kulloinkin voimassa olevassa muodossa:
ανταποκρί νεται στους σχετιχά ισχύοντες κανονισμούς:

EU-Richtlinie 98/37/EG ”Maschinen”, Anhang II A,
EU-Richtlinie 89/336/EWG ”Elektromagnetische Verträglichkeit”, Anhang I
und EU-Richtlinie 73/23/EWG ”Niederspannungsrichtlinie”, Anhang III B

Machinery directive 98/37/EC, Annex II A,
electromagnetic compatibility directive 89/336/EEC, Annex I
and EC directive on low-voltage equipment 73/23/EEC, Annex III B

La directive »CE« relative aux machines 98/37/CE, Annexe II A,
directive »CE« relative à la compatibilité électromagnétique 89/336/CEE, Annexe I et
directive »CE« relative à la basse tension 73/23/CEE, Annexe III B

Las directrices de la CE 98/37/CE ”Maquinaria”, anexo II A,
89/336/CEE ”Compatibilidad electromagnética”, anexo I
y 73/23/CEE ”Directriz de bajo voltaje”, anexo III B

Directiva CE máquinas 98/37/CE, Anexo II A,
directiva CE compatibilidade electromagnética 89/336/CEE, Anexo I
e la directiva sobre equipamento de baixa voltagem 73/23/CEE, Anexo III B
Direttiva CE 98/37/CE relativa a macchinari, Appendice II A,
direttiva CE 89/336/CEE relativa a compatibilità elettomagnetica, Appendice I
e la Direttiva 73/23/CEE relativa a bassa tensione, Appendice III B

Machine-richtlijn 98/37/EG, Bijlage II A,
de richtlijn 89/336/EEG i.v.m. elektromagnetische compatibiliteit, Bijlage I
en de laagspanningsrichtlijn 73/23/EEG, Bijlage III B

EU-lovgivning om maskiner 98/37/E F, Bilag II A,
elektromagnetisk kompatibilitet 89/336/E F, Bilag I
og EU-lovgivningen om elektrisk materiel for visse spændingsgrænser 73/23/E F, Bilag III B

EU-direktiv 98/37/EG "maskiner", vedlegg II A,
89/336/EWG "elektromagnetisk kompatibilitet", vedlegg I
og EU-direktiv 73/23/EWG "lavspenningsdirektivet", vedlegg III B

EG:s maskindirektiv 98/37/EC, Annex II A,
Elektromanetisk kompatibilitet (EMC) 89/336/EEC, Annex I
Lågspänningsdirektiv 73/23/EEC, Annex III B

EU-direktiivin 98/37/ETY, liite II A,
Ευρωπαϊκής Κοινότητας υπ αριθμόν 98/37/Ε.Κ. παράρτημα II Α περί Μηχανών
89/336/Ε.Κ. παράρτημα I περί Ηλεκτρομαγνητικών επιρροών
73/23/Ε.Κ. παράρτημα III Β περί Χαμηλής τάσης

EU-direktiivin 89/336/ETY "Sähkömagneettinen yhteensopivuus" liite I
ja EU-direktiivin 73/23ETY "Matalajännitedirektiivi", liite III B mukaan

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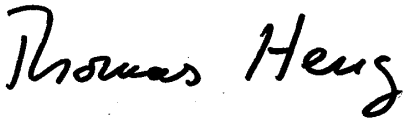
Angewendete harmonisierte Normen, insbesondere
Applied harmonized standards, in particular
Normes harmonisées utilisées, notamment
Normas concordantes aplicadas; en especial
Normas harmonizadas utilizadas, em particula
Norme armonizzate applicate, in particolare
Gebruikte geharmoniseerde normen, in het bijzonder:
De harmoniserde standarder, der er blevet anvendt, er i særdeleshed
Anvendte harmoniserte normer, spesielt
Tillämpade harmoniserade standarder, speciellt
Sovelletut, harmonisoidut normit, erityisesti
Εφαρμοσθεντες εναρμονισμένοι κανονισμοί, ιδιαίτερα

EN 809, EN 292-1, EN 292-2

EN 50081-1, EN 50081-2, EN 50082-1, EN 50082-2

Angewendete nationale technische Normen und Spezifikationen, insbesondere
Applied national technical standards and specifications, in particular
Normes et spécifications techniques nationales qui ont été utilisées, notamment
Normas y especificaciones técnicas nacionales aplicadas; en especial
Normas e especificações nacionais utilizadas, em particular
Norme e specifiche tecniche nazionali applicate, in particolare
Gebruikte nationale technische normen en specificaties, in het bijzonder:
De nationale normer og tekniske specifikationer, der er blevet benyttet, er
Anvendte nasjonale tekniske normer og spesifikasjoner, spesielt
Tillämpade nationella tekniska standarder och specifikationer, speciellt
Sovelletut kansalliset tekniset normit, erityisesti
Εφαρμοσθεντες εθνικοί τεχνικοί κανονισμοί και προδιαγραφές, ιδιαίτερα



KSB Aktiengesellschaft
Leiter Produktentwicklung
- Einstufige Pumpen Industrietechnik -
Unternehmensbereich Pumpen
Industrie– und Verfahrenstechnik
KSB Aktiengesellschaft, Bahnhofsplatz 1, D–91257 Pegnitz

Erklärung des Herstellers im Sinne der EU-Maschinenrichtlinie 98/37/EG, Anhang II B
Declaration by the manufacturer as defined by machinery directive 98/37/EC Annex II B
Déclaration du fabricant conformément à la directive »CE« relative aux machines 98/37/CE, Annexe II B
Declaración del fabricante conforme con la Directiva CE sobre máquinas 98/37/CE, Anexo II B
Declaração do Fabricante segundo directiva CE 98/37/CE, Anexo II B
Dichiarazione del fabbricante ai sensi della direttiva CE 98/37/CE relativa a macchinari, Appendice II B
Verklaring van de fabrikant inzake richtlijn 98/37/EG, voor machines, bijlage II B
Fabrikantens erklæring i henhold til EU-lovgivning om maskiner 98/37/EU, bilag II B
Erklæring fra produsent ifølge EU's-maskindirektiv 98/37/EC, vedlegg II B
Tillverkardeklaration enligt EU:s Maskindirektiv 98/37/EC, Annex II B
Valmistajanvakuutus EU-konedirektiivin 98/37/ETY mukaan, Liite II B

Hiermit erklären wir, daß die Pumpe
Herewith we declare that the pump
Par la présente, nous déclarons que la pompe
Por la presente, declaramos que la bomba
Com a presente, declaramos que a bomba
Si dichiara che la pompa
Hiermee verklaren wij, dat de pomp
Hermed erklæres, at pumpetype
Hermed erklærer vi, at pumpen
Härmed försäkrar vi att pumpen
Vakuutamme, että pumppu
Με την παρούσα δήλωση βεβαιούμε, ότι η αντλία

Etanorm SYA

zum Einbau in eine Maschine [1] / Zusammenbau mit anderen Maschinen zu einer Maschine [1] bestimmt ist. Ihre Inbetriebnahme ist solange untersagt, bis festgestellt wurde, daß die Maschine, in die diese Pumpe eingebaut werden soll, bzw. mit der diese Pumpe zusammengebaut werden soll, den Bestimmungen der EU-Richtlinie in der jeweils gültigen Fassung entspricht.

is intended to be incorporated into machinery [1] or assembled with other machinery to constitute machinery [1] covered by this directive and must not be put into service until the machinery into which it is be incorporated or with which it is to be assembled has been declared in conformity with the provisions of the directive in its current version.

est destinée à être incorporée dans une machine [1] / à être assemblée avec d'autres machines afin de constituer une machine [1] et que sa mise en service est interdite avant que la machine dans laquelle elle sera incorporée / avec laquelle elle sera assemblée n'ait été déclarée conforme aux dispositions de la directive, dans la version respective en vigueur.

está destinada a ser incorporada en una máquina [1] /a ser ensamblada con otras máquinas para conformar una máquina [1] y que su puesta en servicio está prohibida antes de que la máquina en la que vaya a ser incorporada o con la que vaya a ser ensamblada haya sido declarada conforme con las disposiciones de la Directiva en su redacción vigente.

se destina a ser instalada numa máquina [1] / ser montada com outras máquinas de modo a formar uma máquina [1] coberta por esta directiva e que é proibida a colocação em serviço da mesma antes de a máquina em que essa bomba vier a ser incorporada/montada ser declarada em conformidade com o disposto na directiva CE na sua versão corrente.

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ertoe bestemd is, ingebouwd te worden in een machine [1] / samengebouwd wordt met andere machines tot één machine [1] en dat het in gebruik stellen verboden is, voordat vastgesteld is, dat de machine, waarin deze pomp wordt ingebouwd, in overeenstemming met de bepalingen van de richtlijn is.

er bestemt til indbygning i en maskine [1] / samling med andre maskiner med henblik på at udgøre en maskine [1] og at igangsætningen forbydes indtil det er konstateret, at maskinen, som vor pumpe skal monteres i, svarer til EU-bestemmelserne af EU-lovgivningen til en hver tid gyldig udgave.

Erklärung des Herstellers im Sinne der EU-Maschinenrichtlinie 98/37/EG, Anhang II B
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6.5 Riello Burner Manual

Installation, use and maintenance instructions

Gas Burners

RS 28/M - 38/M - 50/M

Low-High-Low or Modulating Operation

CONTENTS

N.B.
Figures mentioned in the text are identified as follows:
1)(A) = part 1 of figure A, same page as text;
1)(A)p.4 = part 1 of figure A, page number 4.

WARNING

If you smell gas:

- Do not touch any electrical items.
- Open all windows.
- Close all gas supply valves.
- Contact your local gas authority immediately.

Do not store flammable or hazardous materials in the vicinity of fuel burning appliances.

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or death. Refer to this manual for instructional or additional information. Consult a certified installer, service representative or the gas supplier for further assistance.

Burner shall be installed in accordance with manufacturers requirements as outlined in this manual, local codes and authorities having jurisdiction.

TECHNICAL DATA

Model			RS 28/M	RS 38/M	RS 38/M	RS 50/M
Output (1)	MAX.	MBtu/hr kW	617 - 1232 181 - 361	880 - 1665 258 - 488	880 - 1665 258 - 488	1099 - 2201 322 - 645
	MIN.	MBtu/hr kW	198 58	266 78	266 78	321 94
Fuel			Natural or propane gas			
- Max delivery		SCFH	1232	1665	1665	2201
- Pressure at maximum delivery (2) natural gas		" WC	2.95	2.6	2.6	2.83
Operation			Low - high-low or modulating			
Standard application			Boilers: water, steam, thermal oil			
Ambient temperature		°F	32 - 104 (0 - 40 °C)			
Combustion air temperature		°F max	140 (60 °C)			
Main power supply (+/-10%)		V/Ph/Hz	120/1/60		208-230/460/575/3/60	
Fan motor		rpm W - HP V A	3400 370 - 0.5 120 5.2		3400 550 - 0.75 208-230/460/575 3.2 - 1.6 - 1.3	
Motor capacitor		µV	45			
Ignition transformer		V1 - V2 I1 - I2	120 V - 1 x 7 kV 1.6 A - 23 mA			
Electrical power consumption		W max	600		750	
Electrical protection			NEMA 1			
Noise levels (3)		dBA	68	70	70	72

(1) Reference conditions: Ambient temperature 68 °F (20 °C) - Barometric pressure 394" WC - Altitude 329 ft.
(2) Pressure at test point 8)(A)p.4, with zero pressure in the combustion chamber, with open gas ring 2)(B)p.8 at maximum burner output
(3) Sound pressure measured in manufacturer's combustion laboratory, with burner operating on test boiler and at maximum rated output.

Burner models designation:

Model	Code	Voltage	Flame safeguard
RS 28/M	**C9521300** (3781070)	120/1/60	Burner mounted
	C9621300 (3781072)	120/1/60	Remote panel
RS 38/M	**C9522300** (3781270)	120/1/60	Burner mounted
	C9622300 (3781272)	120/1/60	Remote panel
	C9522350 (3781470)	208-230/460/3/60	Burner mounted
	C9522351 (3781470)	575/3/60	Burner mounted
	C9622350 (3781472)	208-230/460/3/60	Remote panel
	C9622351 (3781472)	575/3/60	Remote panel
RS 50/M	**C9523300** (3781670)	208-230/460/3/60	Burner mounted
	C9523301 (3781670)	575/3/60	Burner mounted
	C9623300 (3781672)	208-230/460/3/60	Remote panel
	C9623301 (3781672)	575/3/60	Remote panel

ACCESSORIES (optional):

- **Kit for LPG operation:** The kit allows the RS 28-38-50/M burners to operate on LPG.

Burner		RS 28/M		RS 38/M		RS 50/M	
Output	MBtu/hr	358 - 1232		437 - 1665		549 - 1986	
Blast tube length	inch	$8^{1}/_{2}$"	$13^{13}/_{16}$"	$8^{1}/_{2}$"	$13^{13}/_{16}$"	$8^{1}/_{2}$"	$13^{13}/_{16}$"
Code		3010270		3010271		3010272	

- **Modulating control kit:** Under modulating operation, the burner automatically adapts to one of an infinite number of firing rates between the low and high flame output position, thus ensuring stable operating conditions in terms of temperature or pressure. Two components should be ordered: • Modulating control to install to the burner; • probe to install to the boiler.

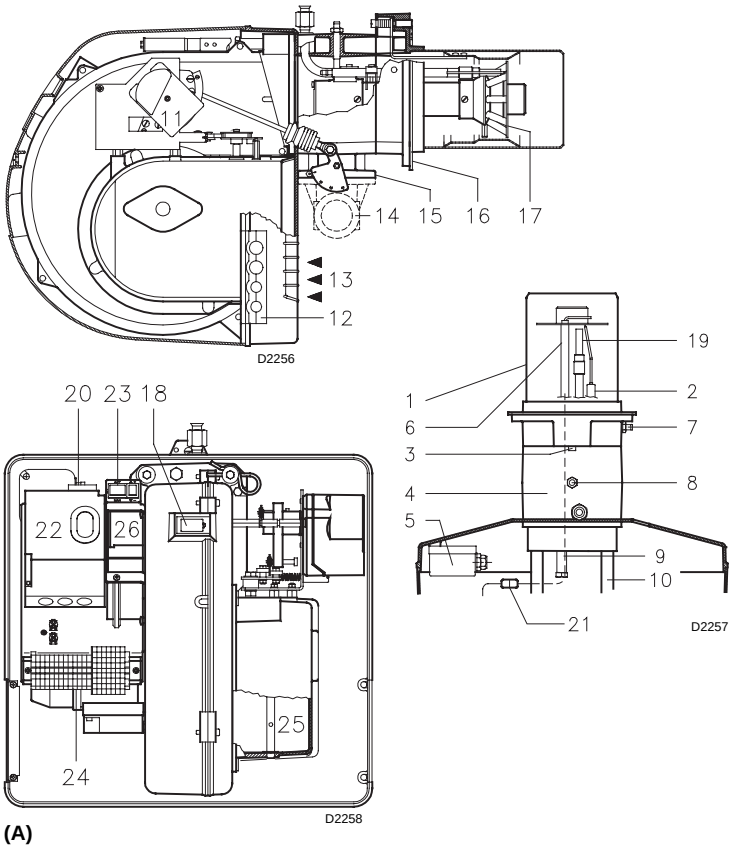
Parameter to be checked		Probe		Modulating control	
	Range	Type	Code	Type	Code
Temperature	- 212...+ 932 °F (- 100...+ 500 °C)	PT 100	3010110	RWF40	3010212
Pressure	0...36.3 PSI (0...2.5 bar) 0...232 PSI (0...16 bar)	Output probe 4...20 mA	3010213 3010214		

- **Gas train according to UL Standards:** see page 9.

Important:
The installer is responsible for the supply and installation of any required safety device(s) not indicated in this manual.

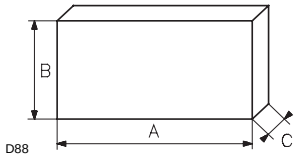
• Kit for lengthening the combustion head
L = Standard length
L1 = Length obtainable with the kit

COD. 3010256	L = $8^{1}/_{2}$"	L1 = $13^{13}/_{16}$"	• RS 28/M
COD. 3010257	L = $8^{1}/_{2}$"	L1 = 13 $^{13}/_{16}$"	• RS 38/M
COD. 3010258	L = $8^{1}/_{2}$"	L1 = 13 $^{13}/_{16}$"	• RS 50/M

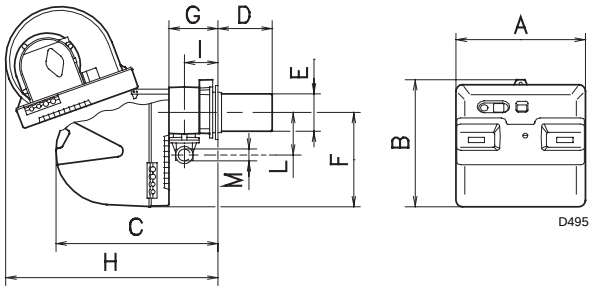


(A)

inch	A	B	C	lbs
RS 28/M	$39^{31}/_{32}$“	$24^{13}/_{16}$“	$19^{11}/_{16}$“	84
RS 38/M	$39^{31}/_{32}$“	$24^{13}/_{16}$“	$19^{11}/_{16}$“	88
RS 50/M	$39^{31}/_{32}$“	$24^{13}/_{16}$“	$19^{11}/_{16}$“	91



(B)



RS	A	B	C	D (1)	E	F	G	H	I	L	M
28	$18^{23}/_{32}$“	$18^{21}/_{32}$“	$22^{13}/_{16}$“	$8^{1}/_{2}$-$13^{13}/_{16}$“	$5^{1}/_{2}$“	$13^{27}/_{32}$“	$6^{7}/_{16}$“	$31^{7}/_{8}$“	$4^{1}/_{4}$“	$6^{5}/_{8}$“	$1^{1}/_{2}$”
38	$18^{23}/_{32}$“	$18^{21}/_{32}$“	$22^{13}/_{16}$“	$8^{1}/_{2}$“-$13^{13}/_{16}$“	$5^{1}/_{2}$“	$13^{27}/_{32}$“	$6^{7}/_{16}$“	$31^{7}/_{8}$“	$4^{1}/_{4}$“	$6^{5}/_{8}$“	$1^{1}/_{2}$”
50	$18^{23}/_{32}$“	$18^{21}/_{32}$“	$22^{13}/_{16}$“	$8^{1}/_{2}$“-$13^{13}/_{16}$“	$5^{31}/_{32}$“	$13^{27}/_{32}$“	$6^{7}/_{16}$“	$31^{7}/_{8}$“	$4^{1}/_{4}$“	$6^{5}/_{8}$“	$1^{1}/_{2}$”

(1) Blast tube: short - long (with kit)

(C)

BURNER DESCRIPTION (A)

1 Combustion head
2 Ignition electrode
3 Screw for combustion head adjustment
4 Sleeve
5 Low air pressure switch (differential operating type)
6 Flame sensor probe (flame rod)
7 Air pressure test point
8 Gas pressure test point and head fixing screw
9 Screws securing fan to sleeve
10 Slide bars for opening the burner and inspecting the combustion head
11 Servomotor controlling the gas butterfly valve and air damper (by means of a variable profile cam mechanism).
When the burner is not operating the air damper is fully closed in order to reduce heat loss.
12 Plate with four hole knock-outs for electrical cable routing
13 Air inlet to fan
14 Gas input connection
15 Gas butterfly valve
16 Boiler mounting flange
17 Flame stability disk
18 Flame inspection window
19 Ignition pilot
20 Motor contactor and thermal overload reset button (RS 38 - 50 three-phase)
21 Plug-socket on flame rod probe cable
22 Flame safeguard
23 Power switch for different operations:
automatic - manual - off
Switch for:
manual modulation of servomotor
24 Burner terminal strip
25 Air damper
26 Bracket for mounting the PID modulating controller RWF40 (optional)

Two types of burner failure may occur:

- **FLAME SAFEGUARD LOCK-OUT:** if the flame relay 22)(A) pushbutton lights up, it indicates that the burner is in lock-out.
To reset, press the pushbutton.
- **MOTOR TRIP** (RS 38 - 50 three-phase):
release by pressing the pushbutton on thermal overload 20)(A).

PACKAGING - WEIGHT (B) - Approximate measurements

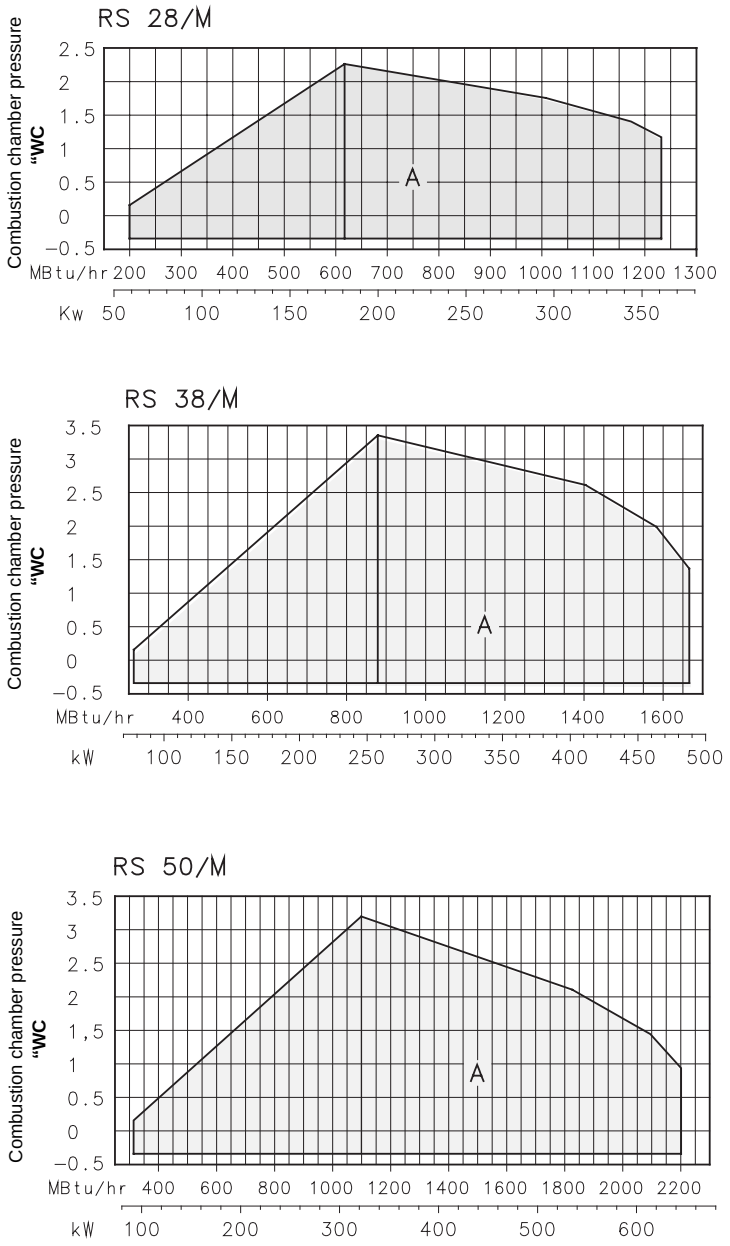
- The burners are shipped in cardboard boxes with the maximum dimensions shown in Table (B).
- The weight of the burner complete with packaging is indicated in table (B).

MAX. DIMENSIONS (C)

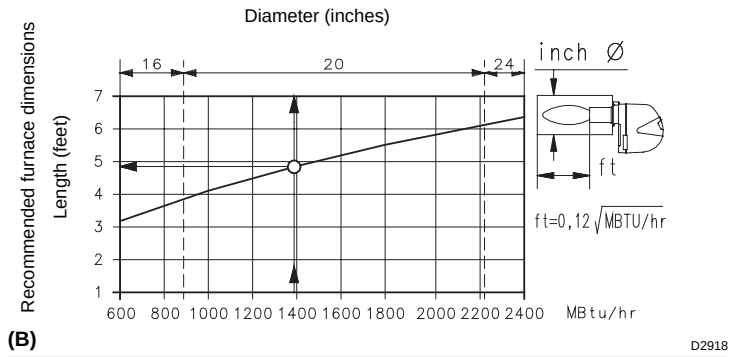
Approximate measurements
The maximum dimensions of the burners are given in (C).
Note that if you need to examine the combustion head, the burner must be pulled backward on the slide bars and turned upward.
The maximum dimension of the burner, without the cover, when open is give by measurement H.

STANDARD EQUIPMENT

1 - Gas train flange
1 - Flange gasket
4 - Flange fixing screws
1 - Burner head gasket
4 - Screws to secure the burner flange to the boiler: $^{3}/_{8}$ W x 1”
1 - Instruction booklet
1 - Spare parts list



(A) D2259



(B) D2918

FIRING RATES (A)

During operation, burner output varies between:

- **MAXIMUM OUTPUT**, selected within area A,
- **MINIMUM OUTPUT**, which must not be lower than the minimum limit in the diagram.

RS 28/M	= 198 MBtu/hr	58 kW
RS 38/M	= 266 MBtu/hr	78 kW
RS 50/M	= 321 MBtu/hr	94 kW

Important:
The FIRING RATE value range has been obtained considering an ambient temperature of 68 °F (20 °C), and an atmospheric pressure of 394" WC and with the combustion head adjusted as shown on page 8.

Note:
The FIRING RATE areas given in figure (A) have been reduced by 10% with respect to the maximum range that can be reached.

Consult Appendix on page 18 for operation at different surrounding temperatures and/or altitudes.

MINIMUM FURNACE DIMENSIONS (B)

The firing rates were set in relation to certified test boilers.
Figure (B) indicates the diameter and length of the test combustion chamber.

Example:
output 1388 MBtu/hr:
diameter 20 inch - length 4.9 ft.

RS 28/M

MBtu/hr	kW	Δp (" WC)		
		1		2
		A	B	
624	183	0.98	0.98	0.039
699	205	1.22	1.3	0.039
795	233	1.57	1.69	0.039
891	261	1.85	2.05	0.079
986	289	2.17	2.28	0.079
1078	316	2.48	2.68	0.12
1174	344	2.76	3.07	0.12
1232	361	2.95	3.58	0.12

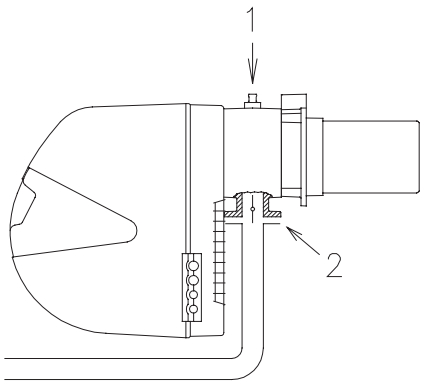
RS 38/M

MBtu/hr	kW	Δp (" WC)		
		1		2
		A	B	
870	255	1.02	1.02	0.079
979	287	1.22	1.38	0.079
1099	322	1.46	1.77	0.12
1211	355	1.69	2.28	0.12
1327	389	1.89	2.72	0.16
1440	422	2.13	3.11	0.16
1552	455	2.36	3.54	0.2
1665	488	2.6	4.21	0.23

RS 50/M

MBtu/hr	kW	Δp (" WC)		
		1		2
		A	B	
1099	322	0.87	0.87	0.12
1249	366	1.14	1.3	0.16
1402	411	1.42	1.61	0.2
1552	455	1.69	2.01	0.23
1706	500	1.97	2.36	0.28
1856	544	2.2	2.76	0.35
2006	588	2.48	3.15	0.39
2197	644	2.83	3.78	0.47

(A)



(B) D2786

GAS PRESSURE

The adjacent tables are used to calculate manifold pressure taking into account combustion chamber pressure.

Column 1

Pressure loss at combustion head.
Gas pressure measured at test point 1)(B), with:

- Combustion chamber at 0" WC
- Burner operating at maximum output
- **A** = Gas ring 2)(B)p.8 adjusted as indicated in diagram (C)p. 8.
- **B** = Gas ring 2)(B) adjusted to zero.

Column 2

Pressure loss at gas butterfly valve 2)(B) with maximum opening: 90°.

Calculate the approximate maximum output of the burner as follows:

- subtract the combustion chamber pressure from the gas pressure measured at test point 1)(B).
- Find the nearest pressure value to your result in column 1A or B of the table for the burner in question.
- Read off the corresponding output on the left.

Example - RS 28/M:

- Maximum output operation
- Natural gas
- Gas ring 2)(B)p.8 adjusted as indicated in diagram (C)p.8.
- Gas pressure at test point 1)(B) = 2.36" WC
- Pressure in combustion chamber = 0.79" WC

2.36 - 0.79 = 1.57" WC

A maximum output of 795 MBtu/hr shown in Table RS 28/M corresponds to 1.57" WC pressure, column 1A.
This value serves as a rough guide, the effective delivery must be measured at the gas meter.

To calculate the required gas manifold pressure at test point 1)(B), set the maximim output required from the burner operation:

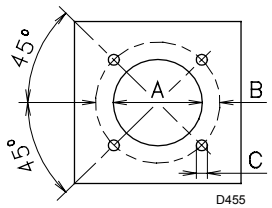
- find the nearest output value in the table for the burner in question.
- Read off the pressure at test point 1)(B) on the right in column 1A or B.
- Add this value to the estimated pressure in the combustion chamber.

Example - RS 28/M:

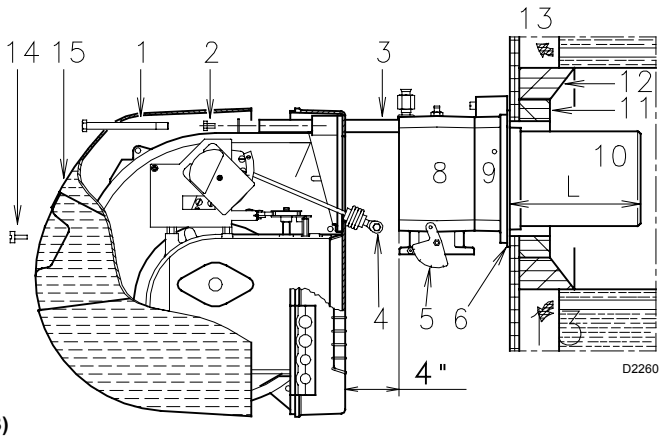
- Required burner maximum output operation: 795 MBtu/hr
- Natural gas
- Gas ring 2)(B)p.8 adjusted as diagram (C)p.8.
- Gas pressure at burner output of 795 MBtu/hr, taken from table RS 28, column 1A = 1.57" WC
- Pressure in combustion chamber = 0.79" WC

1.57 + 0.79 = 2.36" WC
pressure required at test point 1)(B).

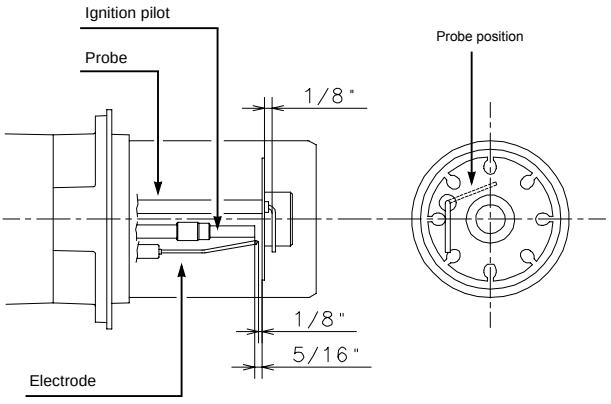
inch	A	B	C
RS 28/M	$6^{9}/_{32}$“	$8^{13}/_{16}$“	$^{3}/_{8}$ W
RS 38/M	$6^{9}/_{32}$“	$8^{13}/_{16}$“	$^{3}/_{8}$ W
RS 50/M	$6^{9}/_{32}$“	$8^{13}/_{16}$“	$^{3}/_{8}$ W



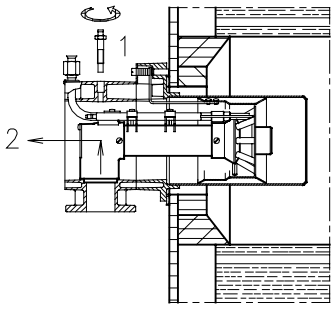
(A)



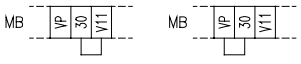
(B)



(C)



(D)



(E)

INSTALLATION

BURNER MOUNTING (A)

Drill the combustion chamber mounting plate as shown in (A).
The position of the threaded holes can be marked using the head gasket supplied with the burner.

BLAST TUBE LENGTH (B)

The length of the blast tube must be selected according to the indications provided by the manufacturer of the boiler, and it must be greater than the thickness of the boiler door complete with its insulation. The range of lengths available, L (inches), is as follows:

Blast tube 10):	RS 28/M	RS 38/M	RS 50/M
• short	8 $^{1}/_{2}$”	8 $^{1}/_{2}$”	8 $^{1}/_{2}$”
• long	13 $^{13}/_{16}$”	13 $^{13}/_{16}$”	13 $^{13}/_{16}$”

For boilers with front flue passes 13) or flame inversion chambers, protective insulation material 11) must be inserted between the boiler refractory 12) and the blast tube 10).
This protective insulation must not compromise the extraction of the blast tube.
For boilers having a water-cooled front, the insulation 11)-12)(B) is not required unless it is required by the boiler manufacturer.

SECURING THE BURNER TO THE BOILER (B)

Before securing the burner to the boiler, check through the blast tube opening to make sure that the flame sensor probe is correctly set in position, as shown in (C).

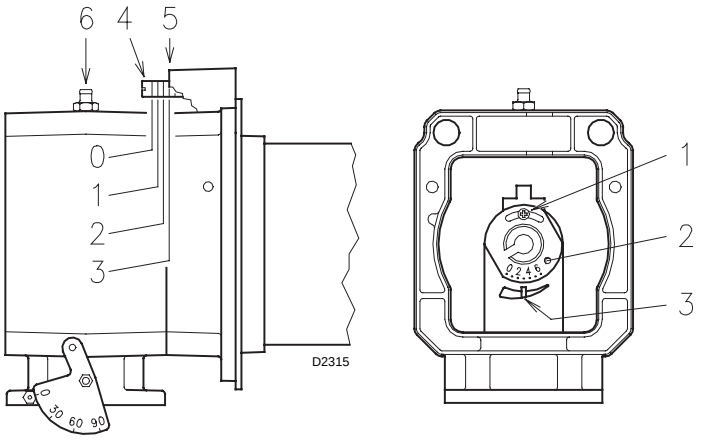
Now detach the combustion head from the burner, fig.(B):
- Remove screw 14) and withdraw the cover 15).
- Disengage the swivel coupling 4) from the graduated sector 5).
- Remove the screws 2) from the slide bars 3)
- Remove screw 1) and pull the burner back on slide bars 3) by about 4”.
  Disconnect the wires from the probe and the electrode and then pull the burner completely off the slide bars, after removing the split pin from the slide bar 3).

Secure the flange 9)(B) to the boiler plate, inserting the head gasket 6)(B). Use the 4 screws, also supplied with the unit, after first protecting the thread with an anti-seize product.
The seal between burner and boiler must be airtight.

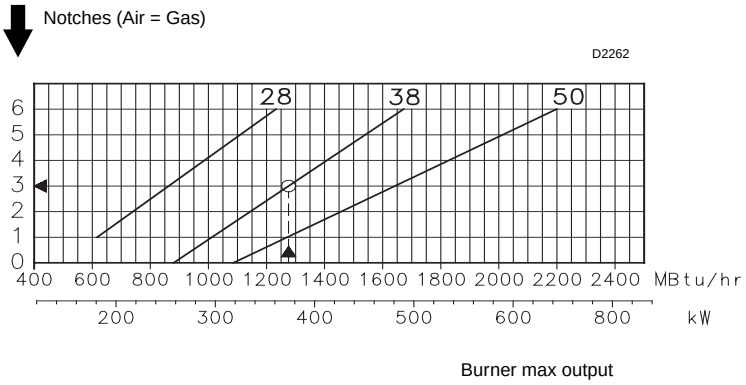
If you noticed any irregularities in the positions of the probe or ignition electrode during the check mentioned above, remove screw 1)(D), extract the internal part 2)(D) of the head and set up the two components correctly.

IGNITION PILOT ADJUSTMENT

Place the pilot and electrode as shown in fig. (C).
The pilot works correctly at pressures ranging from 5 - 12” WC.
Important
To set the pilot without main burner operation, proceed as follows:
- Move the jumper from terminals "**30-V11**" to terminals "**30-VP**", as given in fig. (E), this way the main valve is not energized.
- With the burner in the manual position, hold the air damper in the minimum position and make the setting.
- When the setting is correct, replace the jumper on “**30-V11**”.



(A) **(B)**

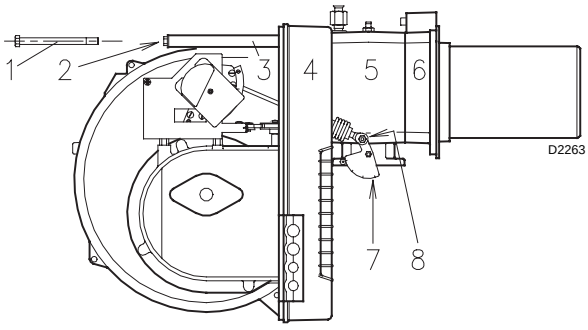


(C)

MODULATION MINIMUM OUTPUT: when the MIN output is within the value range given below, the gas ring 2)(B) is adjusted to zero.

RS 28/M	198 - 280 MBtu/hr	58 - 82 kW
RS 38/M	266 - 375 MBtu/hr	78 - 110 kW
RS 50/M	321 - 488 MBtu/hr	94 - 143 kW

(D)



(E)

COMBUSTION HEAD ADJUSTMENT

Installation operations are now at the stage where the blast tube and sleeve are secured to the boiler as shown in fig. (A).

There are two possible cases:

A - The MIN burner output is not in the values of table (D).

In diagram (C), depending on the MAX output, find the notch to use for adjusting the air and the gas, and then proceed as follows:

Air adjustment (A)

Turn screw 4)(A) until the notch identified is aligned with the front surface 5)(A) of the flange.

Gas adjustment (B)

Loosen screw 1)(B) and turn ring 2) until the notch identified is aligned with index 3).
Tighten the screw 1) fully down.

Example:

the burner RS 38/M varies its output between: MIN = 378.7 and MAX = 1288 MBtu/hr.
The MIN output of 378.7 MBtu/hr is not found in the values of table (D) and therefore diagram (C) is valid, from which it results that for a MAX output of 1288 MBtu/hr the gas and air adjustments are done on notch 3, as in fig. (A) and (B).
In this case the pressure load loss of the combustion head is given by column 1A page 6.

Note

Diagram (C) shows the ideal settings for the ring 2)(B). If the gas supply pressure is too low to reach the max output operation pressure indicated on page 6, and if the ring 2)(B) is not fully open, it can be opened wider by 1 or 2 notches.

Continuing with the previous example, page 6 indicates that for burner RS 38/M with output of 1288 MBtu/hr a pressure of approximately 1.81" WC is necessary at test point 6)(A). If this pressure cannot be reached, open the ring 2)(B) to notch 4 or 5.
Make sure that the combustion characteristics are satisfactory and free of pulsations.

B - The MIN burner output is found in the values of the table (D).

Air adjustment

The same as the previous case: follow diagramm (C).

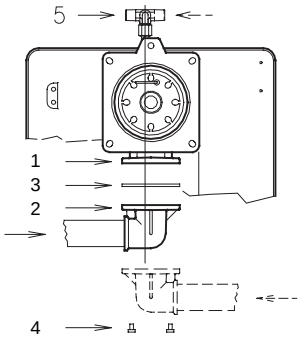
Gas adjustment

The gas ring 2)(B) is always adjusted to position 0, irrespective of the MAX burner.
In this case the pressure load loss of the combustion heads is given by column 1B page 6.

Once you have finished setting up the head, refit the burner 4)(E) to the slide bars 3) at approximately 4" from the sleeve 5) - burner positioned as shown in fig.(B)p.7 - insert the flame rod cable and the ignition electrode cable and then slide the burner up to the sleeve so that it is positioned as shown in fig.(E).
Refit screws 2) on slide bars 3).
Secure the burner to the sleeve by tightening screw 1) and then refit the split pin into one of two slide bars 3).
Reconnect the swivel connector 8) to the graduated sector 7).
Connect gas train and pilot train as shown in fig. (A) page 9.

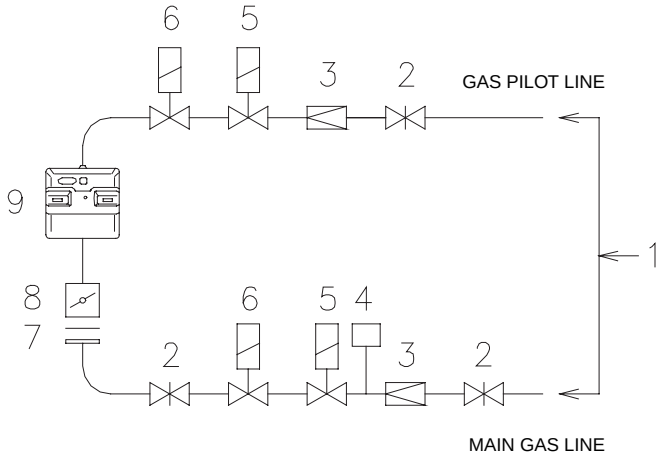
Important

When fitting the burner on the two slide bars, it is advisable to gently draw out the high tension cable and flame detection probe cable until they are slightly stretched.



(A)

TYPICAL UL SCHEMATIC GAS PIPING



(B)

GAS PIPING

- The main gas train must be connected to the gas attachment 1)(A), using flange 2), gasket 3) and screws 4) supplied with the burner.
- The main gas train can enter the burner from the right or left side, depending on which is the most convenient, see fig.(A).
- Gas safety shut-off valves 5)-6)(B) must be as close as possible to the burner to ensure gas reaches the combustion head within the safety time range.
- The pilot gas train must be connected to the gas attachment 5)(A) and can enter the burner from the right or left side.

GAS TRAIN (B)

It must be type-approved according to required local-standards and is supplied separately from the burner.

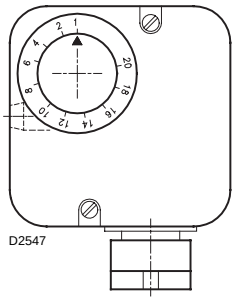
Note

See the accompanying instructions for the gas train layout.

KEY (B)

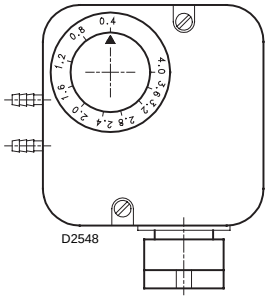
1 - Gas input pipe
2 - Manual valve
3 - Pressure regulator
4 - Low gas pressure switch
5 - 1st safety shut off valve
6 - 2nd safety shut off valve
7 - Standard issue burner gasket with flange
8 - Gas adjustment butterfly valve
9 - Burner

LOW GAS PRESSURE SWITCH

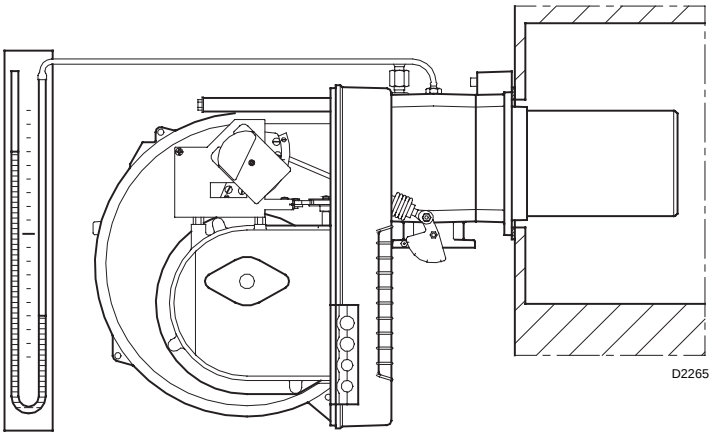


(A)

AIR PRESSURE SWITCH

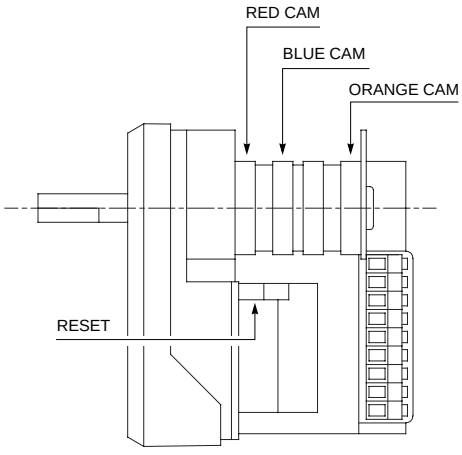


(B)

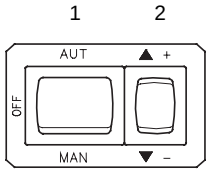


(C)

SERVOMOTOR



(D)



(E)

ADJUSTMENTS BEFORE FIRST FIRING

Adjustment of the combustion head, and air and gas deliveries has been illustrated on page 8.
In addition, the following adjustments must also be made:

- open manual valves on the gas train.
- Adjust the low gas pressure switch to the start of the scale (A).
- Adjust the air pressure switch to the zero position of the scale (B).
- Purge the air from the gas line.
- Fit a U-type manometer (C) to the gas pressure test point on the sleeve.
  The manometer readings are used to calculate MAX. burner power using the tables on page 6.

Before starting up the burner it is good practice to adjust the gas train so that ignition takes place in conditions of maximum safety, i.e. with gas delivery at the minimum.

SERVOMOTOR (D)

The servomotor provides simultaneous adjustment of the air damper, by means of the variable profile cam, and the gas butterfly valve.
The angle of rotation of the servomotor is equal to the angle on the graduated sector controlling the gas butterfly valve. The servomotor rotates through 90 degrees in 25 seconds.
Do not alter the factory setting for the cams; simply check that they are set as indicated below:

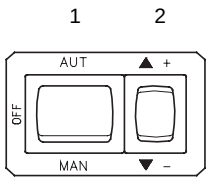
Red cam : 90°
Limits rotation toward maximum position.
When the burner is at max output the gas butterfly valve must be fully open: 90°.
Blue cam : 0°
Limits rotation toward the minimum position. When the burner is shut down the air damper and the gas butterfly valve must be closed: 0°.
Orange cam : 15°
Adjusts the ignition position and the MIN output.

BURNER STARTING

Close the control circuit and set switch 1)(E) to “MAN”.
As soon as the burner starts check the direction of rotation of the fan blade, looking through the flame inspection window 18)(A)p.4.

BURNER FIRING

Having completed the checks indicated in the previous heading, the pilot of the burner should fire. If the motor starts but the flame does not appear and the flame safeguard goes into lock-out, reset and wait for a new firing attempt.
Pilot adjustment has been illustrated on page. 7.
Having adjusted the pilot, reconnect the main valve and ignite the main flame; it might require several attempts to purge the air from the gas lines or to adjust the valve with little gas.
Once the burner has fired, now proceed with calibration operations.



(A)

BURNER CALIBRATION

The optimum calibration of the burner requires an analysis of the flue gases at the boiler outlet.

Adjust successively:
1 - First firing output
2 - Max. burner output
3 - Min. burner output
4 - Intermediate outputs between low and high fire
5 - Air pressure switch
6 - Minimum gas pressure switch

1 - FIRING OUTPUT

Pilot adjustment has been illustrated on page. 7.

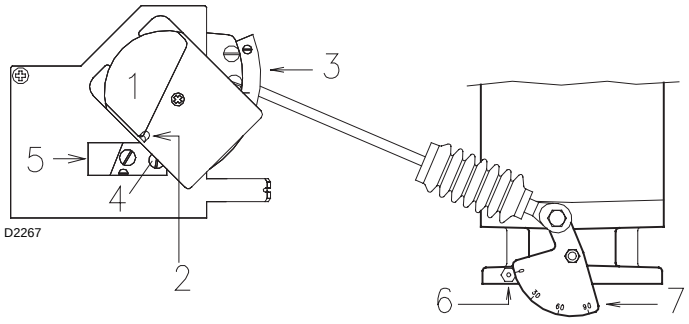
2 - MAXIMUM OUTPUT

Maximum output of the burner must be set within the firing rate range shown on page 5.
In the above instructions we left the burner running in MIN. output operation. Now press switch 2)(A) “increase output” and keep it pressed until the servomotor has opened the air damper and the gas butterfly valve to 90°.

Gas calibration

Measure the gas delivery at the meter.
A guideline indication can be calculated from the tables on page 6, simply read off the gas pressure on the U-type manometer, see fig.(C) on page 10, and follow the instructions on page 6.

- If delivery needs to be reduced, reduce outlet gas pressure and, if it is already very low, slightly close adjustment valve.
- If delivery needs to be increased, increase outlet gas pressure.



1 Servomotor
2 Lever, push to engage, push to release
3 Adjustable profile cam
4 Cam profile adjustment screws
5 Opening for access to screws 5
6 Index for graduated sector 8
7 Graduated sector for gas butterfly valve

(A)

Adjusting air delivery
Progressively adjust the end profile of cam 4)(A) by turning the cam adjustment screws as they appear through the access opening 6)(A).
- Turn the screws clockwise to increase air delivery.
- Turn the screws counter-clockwise to reduce air delivery.

3 - MINIMUM OUTPUT
Minimum output must be selected within the firing rate range shown on page 5.
Press switch 2)(A)p.11 “output reduction” until the servomotor has closed the air damper and the gas butterfly valve to 15° (factory set adjustment).

Adjusting gas delivery
Measure the delivery of gas from the gas meter.
- If this value is to be reduced, decrease the angle of orange cam (B) slightly by proceeding a little at a time until the angle is changed from 15° to 13° or 11°....
- If it has to be increased press the switch “output increase” 2)(A)p.11 (i.e. open the gas butterfly valve by 10-15°), increase the orange cam angle (B) with small successive movements, i.e. take it from angle 15° to 17° - 19°....
  Then press the switch “output decrease” until the servomotor is taken to the minimum opening position and measure the gas delivery.

Note
The servomotor follows the adjustment of cam only when the cam angle is reduced. If it is necessary to increase the cam angle, first increase the servomotor angle with the switch “output increase”, then increase the orange cam angle, and at the end bring the servomotor back to the MIN output position with the switch ”output decrease”.

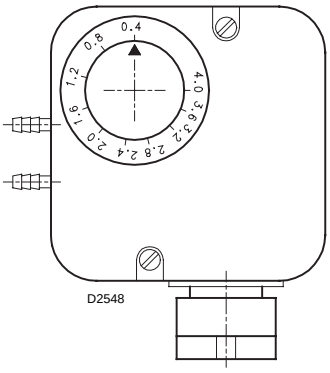
Adjustment of air delivery
Progressively adjust the starting profile of cam 4)(A) by turning the screws working throught the access hole 6)(A).

4 - INTERMEDIATE OUTPUTS
Adjustment of gas delivery
No adjustment of gas delivery is required.

Adjustment of air delivery
With the switch 1)(A) page 11 move in intermediate outputs and set the variable profile cam 4) by turning the screws 5).
- If the burner operation is low-high it is sufficient to set only minimum and maximum firing rates
- If the burner operation is modulating, all the points of modulation should be adjusted.

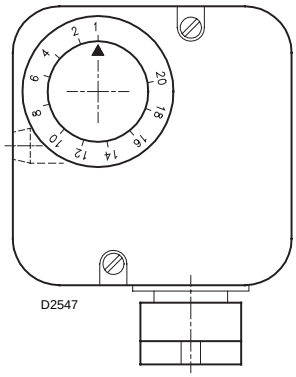
When the adjustment is complete, release the servomotor and manually check there is no binding of the cam.

AIR PRESSURE SWITCH

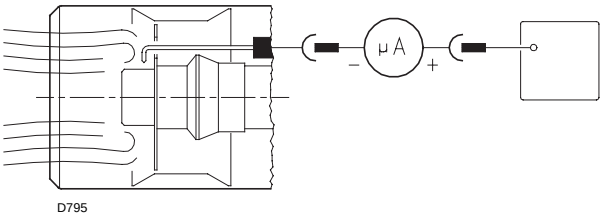


(A)

LOW GAS PRESSURE SWITCH



(B)



(C)

5 - AIR PRESSURE SWITCH (A) - CO CHECK

Adjust the air pressure switch after having performed all other burner adjustments with the air pressure switch set to the start of the scale (A).

With the burner operating at min. output, increase adjustment pressure by slowly turning the relative dial clockwise until the burner locks out.

Then turn the dial anti-clockwise by about 20% of the set point and repeat burner starting to ensure it is correct.

If the burner locks out again, turn the dial anti-clockwise a little bit more.

Attention:

As a rule, the air pressure switch must prevent the formation of CO.

To check this, insert a combustion analyser into the chimney, slowly close the fan suction inlet (for example with cardboard) and check that the burner locks out, before the CO in the fumes exceeds 400 ppm.

The air pressure switch may operate in "differential" operation in two pipe system. If a negative pressure in the combustion chamber during pre-purging prevents the air pressure switch from switching, switching may be obtained by fitting a second pipe between the air pressure switch and the suction inlet of the fan. In this way the air pressure switch operates as differential pressure switch.

6 - LOW GAS PRESSURE SWITCH (B)

Adjust the low gas pressure switch after having performed all the other burner adjustments with the pressure switch set at the start of the scale (B).

With the burner operating at MAX output, increase adjustment pressure by slowly turning the relative dial clockwise until the burner locks out.

Then turn the dial anti-clockwise by 0.8” WC and repeat burner starting to ensure it is uniform.

If the burner locks out again, turn the dial anti-clockwise again by 0.4” WC.

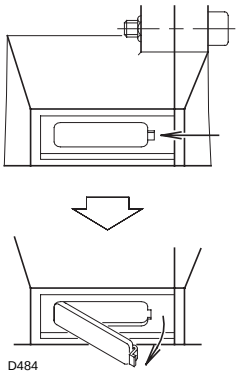
FLAME PRESENT CHECK (C)

The burner is fitted with an ionisation system (flame rod) which ensures that a flame is present. The minimum current for operation is 6 µA. (or see appropriate documentation of flame safeguard manufacturer)

The burner provides a much higher current, so that controls are not normally required. However, if it is necessary to measure the ionisation current, disconnect the plug-socket 21)(A)p.4 on the ionisation probe cable and insert a direct current microamperometer with a base scale of 100 µA.

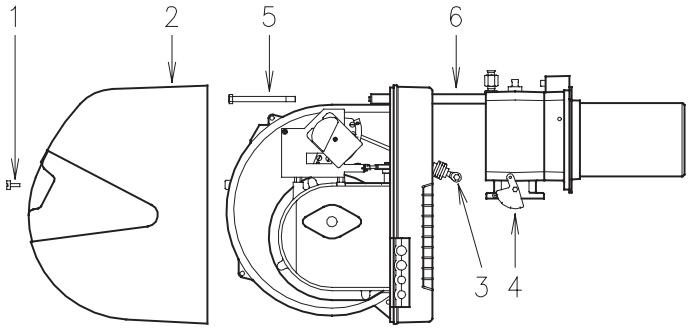
Carefully check polarities!

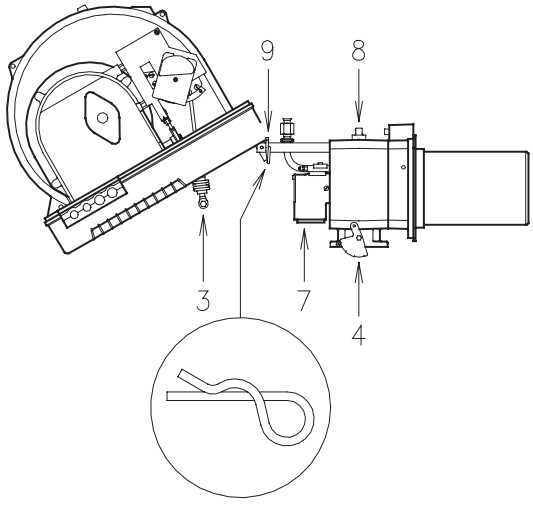
FLAME INSPECTION WINDOW



(A)

OPENING THE BURNER





(B)

MAINTENANCE

Combustion
The optimum calibration of the burner requires an analysis of the flue gases. Significant differences with respect to the previous measurements indicate the points where more care should be exercised during maintenance.

Gas leaks
Make sure that there are no gas leaks on the pipework between the gas meter and the burner.

Flame inspection window
Clean the flame inspection window (A).

Combustion head
Open the burner and make sure that all components of the combustion head are in good condition, not deformed by the high temperatures, free of impurities from the surroundings and correctly positioned. If in doubt, disassemble the elbow fitting 7)(B).

Servomotor
Disengage the cam from servomotor and turn it backward and forward by hand to make sure it is free moving. Now engage cam again.

Burner
Check for excess wear or loose screws in the mechanisms controlling the air damper and the gas butterfly valve. Also make sure that the screws securing the electrical leads in the burner connections are fully tightened. Clean the outside of the burner, taking special care with the linkages joints and cam.

Combustion
Adjust the burner if the combustion values found at the beginning of the operation do not comply with the regulations in force, or do not correspond to good combustion.

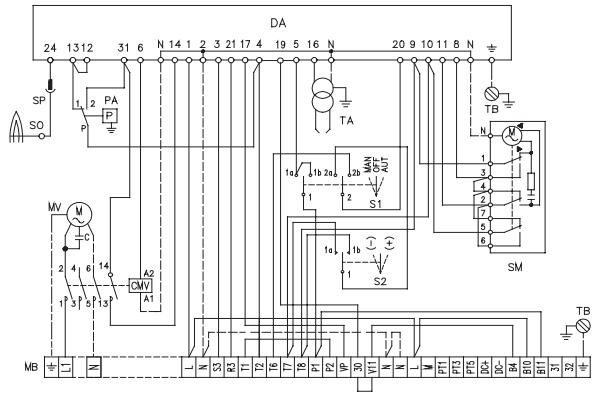
TO OPEN THE BURNER (B):
- Switch off the electrical power.
- Remove screw 1) and withdraw cover 2).
- Disengage the swivel coupling 3) from the graduated sector 4).
- Remove screw 5), the split pin 9) and pull the burner back by about 4” on the slide bars 6).
- Disconnect the probe and electrode leads and then pull the burner fully back.
- Turn the burner as shown in the figure and fit the split pin 9) into one of the slide bar holes so that the burner remains in position.

Now extract the gas distributor 7) after having removed the screw 8) and disconnecting the pilot gas line.

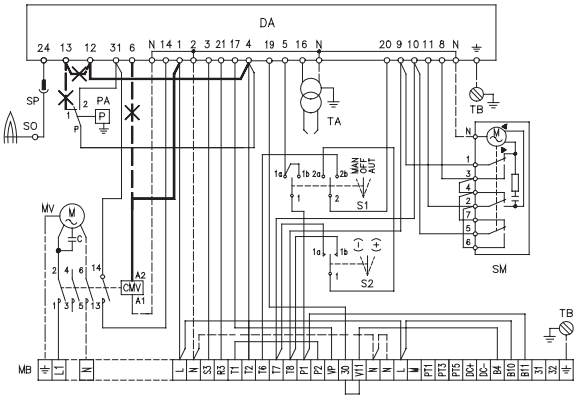
TO CLOSE THE BURNER (B):
- Remove the split pin 9) and push the burner until it is about 4” from the sleeve.
- Re-connect the leads and slide in the burner until it comes to a stop.
- Refit screw 5), the split pin 9) and pull the probe and electrode leads gently out until they are slightly stretched.
- Re-couple the swivel coupling 3) to the graduated sector 4).
- Connect the pilot gas line.

Factory Wiring Diagram
RS 28/M - RS 38/M single-phase
With Siemens LFL control

Continuous fan operation
Change the wire connection from terminal 6 to terminal 1, move the jumper from terminals 12-13 to terminals 4-12 and remove the wire from terminal 13 of control box as indicated below.



D2269

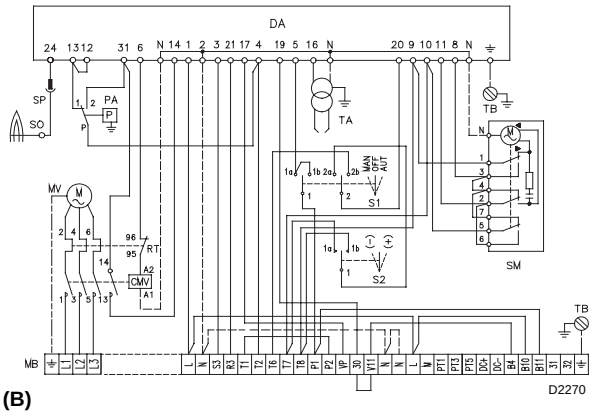


D2876

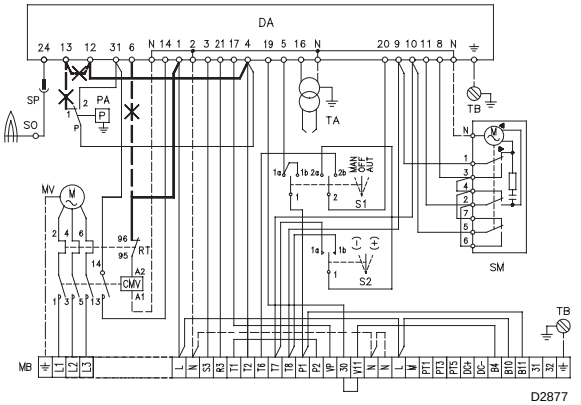
(A)

Factory Wiring Diagram
RS 38/M - RS 50/M three-phase
With Siemens LFL control

Continuous fan operation
Change the wire connection from terminal 6 to terminal 1, move the jumper from terminals 12-13 to terminals 4-12 and remove the wire from terminal 13 of control box as indicated below.



D2270



D2877

(B)

ELECTRICAL SYSTEM

ELECTRICAL SYSTEM as set up by the manufacturer

LAYOUT (A)
Burner RS 28/M - RS 38/M (single-phase)

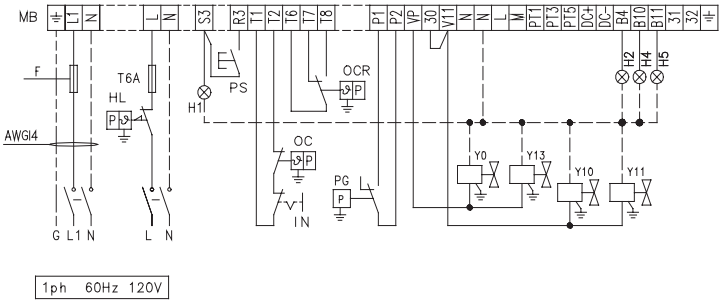
LAYOUT (B)
Burners RS 38/M - RS 50/M (three-phase)

- Models RS 38/M and RS 50/M leave the factory preset for **208-230 V** power supply.
- If **460 V** power supply is used, change the motor connection from delta to star and change the setting of the thermal cut-out as well.

Key to Layouts (A) - (B)

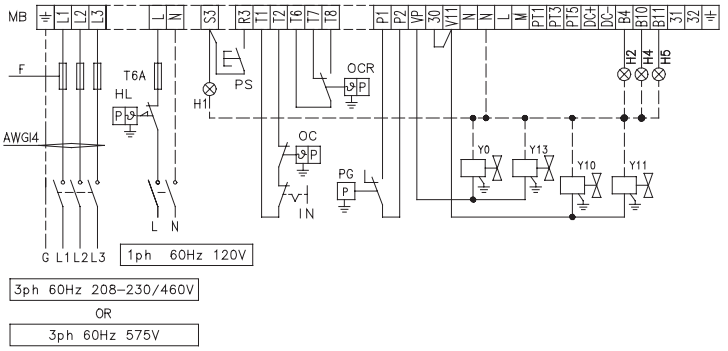
C	- Capacitor
CMV	- Motor contactor
DA	- Siemens LFL Control box
MB	- Burner terminal strip
MV	- Fan motor
PA	- Air pressure switch
RT	- Thermal overload
S1	- Switch for following operations: MAN = manual AUT = automatic OFF
S2	- Button for: - = power reduction + = power increase
SM	- Servomotor
SO	- Ionisation probe (flame rod)
SP	- Plug-socket
TA	- Ignition transformer
TB	- Burner ground

Field Wiring Diagram
RS 28/M - RS 38/M Single-phase
with burner mounted Siemens LFL control



(A) D2271

Field Wiring Diagram
RS 38/M - RS 50/M Three-phase
With Burner mounted Siemens LFL control

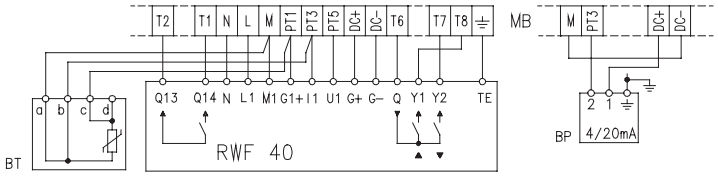


(B) D2272

		RS 28/M	RS 38/M Single-phase	RS 38/M Three-phase			RS 50/M		
		120 V	120 V	208 - 230 V	460 V	460 V	208 - 230 V	460 V	575 V
F	A	T10	T10	T6	T6	T4	T6	T6	T4

(C)

RWF40



(D) D2322

ELECTRICAL CONNECTIONS

Use flexible cables according to local Regulations.

LAYOUT (A) - The RS 28/M - RS 38/M models electrical connection single-phase power supply

LAYOUT (B) - The RS 38/M - 50/M models electrical connection three-phase power supply

Fuses layout (A) - (B), see table (C).
Wire size when not indicated: AWG18.

KEY TO LAYOUTS (A) - (B)

IN - Burner manual stop switch
MB - Burner terminal strip
PG - Min. gas pressure switch
PS - Remote lock-out reset
H1 - Remote lock-out signal
H2 - Burner on signal
H4 - Power on signal
H5 - Permission ok
OCR - High-low control.
OC - Operating control.
HL - High limit.
Y0 - Pilot valve
Y10 - Adjustment valve
Y11 - Safety valve
Y13 - Pilot valve (safety)

LAYOUT (D)
Connection of RWF40 and related probe to RS 28-38-50/M burners (modulating operation)

Note
The OCR and OC controls are not required when the PID control RWF40 is connected, as their function is performed by the RWF40 itself.

It can be connected to the terminals:
- **T1 -T2**, to replace the remote control TL

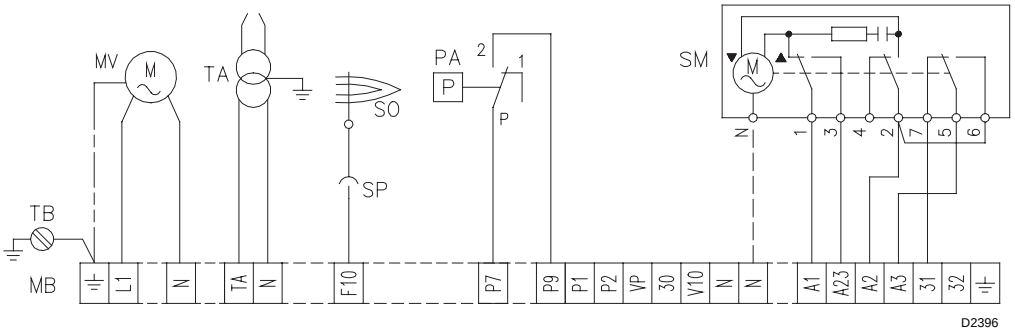
Key to layout (D)

BT - Temperature probe
BP - Pressure probe
MB - Burner terminal strip
a - Red
b - Red
c - White
d - White

NOTES

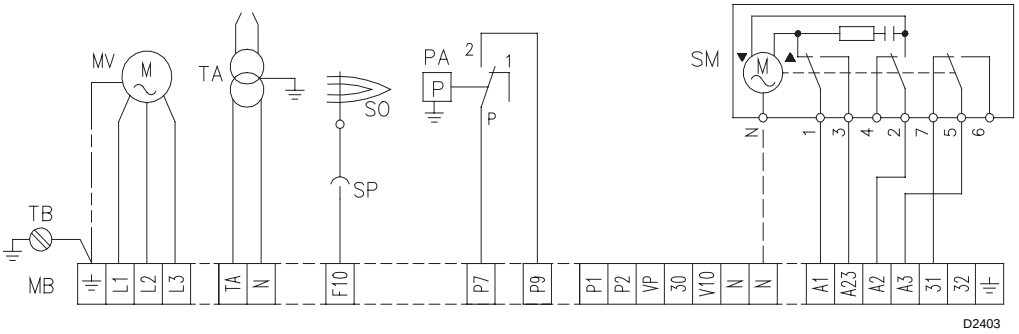
- The setting of the thermal overload must be according to the total burner amperage draw.
- Models RS 38-50/M leave the factory preset for 208 - 230 V power supply. If 460 V power supply is used, change the motor connection from delta to star and change the setting of the thermal cutout as well.
- Models RS 28-38-50/M have been type- approved for intermittent operation. This means they should compulsorily be stopped at least once every 24 hours to enable the control box to check its own efficiency at start-up. Burner halts are normally provided for automatically by the boiler load control system.
  If this is not the case, a time switch should be fitted in series to IN to provide for burner shut-down at least once every 24 hours.

Factor Wiring Diagram
RS 28/M - RS 38/M single-phase with Remote Panel



(A)

Factory Wiring Diagram
RS 38/M - RS 50/M three-phase with remote panel



(B)

ELECTRICAL SYSTEM

ELECTRICAL SYSTEM as set up by the manufacturer

LAYOUT (A)
Burner RS 28/M - RS 38/M (single-phase)
The flame safeguard is in remote panel.
See the internal electrical systems of the remote panel in order to have the complete wiring diagram.

LAYOUT (B)
Burners RS 38/M - RS 50/M (three-phase)
The flame safeguard is in remote panel.
See the internal electrical systems of the remote panel in order to have the complete wiring diagram.

Key to Layouts (A) - (B)

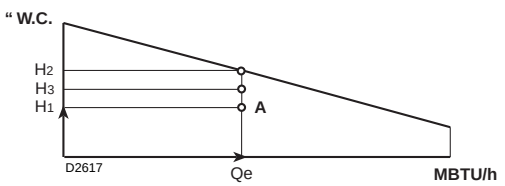
C	- Capacitor
CMV	- Motor contactor
DA	- Siemens LFL Control box
MB	- Burner terminal strip
MV	- Fan motor
PA	- Air pressure switch
RT	- Thermal overload
S1	- Switch for following operations: MAN = manual AUT = automatic OFF
S2	- Button for: - = power reduction + = power increase
SM	- Servomotor
SO	- Ionisation probe (flame rod)
SP	- Plug-socket
TA	- Ignition transformer
TB	- Burner ground

APPENDIX - Burner firing rates according to air density

above sea level		average barom. pressure		CORRECTION FACTOR **F**							
				Air temperature **°F (°C)**							
ft	m	" W.C.	mbar	0 (0°C)	41 (5°C)	50 (10°C)	59 (15°C)	68 (20°C)	77 (25°C)	86 (30°C)	104 (40°F)
0	0	399	1013	1,087	1,068	1,049	1,031	1,013	0,996	0,980	0,948
329	100	394	1000	1,073	1,054	1,035	1,017	1,000	0,983	0,967	0,936
658	200	389	989	1,061	1,042	1,024	1,006	0,989	0,972	0,956	0,926
987	300	385	978	1,050	1,031	1,013	0,995	0,978	0,962	0,946	0,916
1316	400	380	966	1,037	1,018	1,000	0,983	0,966	0,950	0,934	0,904
1645	500	376	955	1,025	1,007	0,989	0,972	0,955	0,939	0,923	0,894
1974	600	372	944	1,013	0,995	0,977	0,960	0,944	0,928	0,913	0,884
2303	700	367	932	1,000	0,982	0,965	0,948	0,932	0,916	0,901	0,872
2632	800	363	921	0,988	0,971	0,954	0,937	0,921	0,906	0,891	0,862
2961	900	358	910	0,977	0,959	0,942	0,926	0,910	0,895	0,880	0,852
3290	1000	354	898	0,964	0,946	0,930	0,914	0,898	0,883	0,868	0,841
3947	1200	346	878	0,942	0,925	0,909	0,893	0,878	0,863	0,849	0,822
4605	1400	337	856	0,919	0,902	0,886	0,871	0,856	0,842	0,828	0,801
5263	1600	329	836	0,897	0,881	0,866	0,851	0,836	0,822	0,808	0,783
5921	1800	321	815	0,875	0,859	0,844	0,829	0,815	0,801	0,788	0,763
6579	2000	313	794	0,852	0,837	0,822	0,808	0,794	0,781	0,768	0,743

(A)

The FIRING RATE area values have been obtained considering a surrounding temperature of 68°F (20°C), and an atmospheric pressure of 398" W.C. and with the combustion head adjusted as shown on page 8.
The burner may be required to operate with combustion air at a higher temperature and/or at higher altitudes.
Heating of air and increase in altitude produce the same effect: the expansion of the air volume, i.e. the reduction of air density.
The burner fan's delivery remains substantially the same, but the oxygen content per cubic meter and the fan's head are reduced.
It is therefore important to know if the maximum output required of the burner at a given combustion chamber pressure remains within the burner's firing rate range even at different temperature and altitude conditions. Proceed as follows to check the above:



(B)

1 - Find the correction factor F in the Table (A) for the plant's air temperature and altitude.
2 - Divide the burner's delivery Q by F in order to obtain the equivalent delivery Qe:

Qe = Q : F (MBtu/hr)

3 - In the firing rate range of the burner, Fig. (B), indicate the work point defined by:
Qe = equivalent delivery
H1 = combustion chamber pressure
The resulting point A must remain within the firing rate range.
4 - Plot a vertical line from Point A as shown in Figure (B) and find the maximum pressure H2 of the firing rate.
5 - Multiply H2 by F to obtain the maximum reduced pressure H3 of the firing rate.

H_3 = H_2 x F (" W.C.)

If H3 is greater than H1, as shown in Fig. (B), the burner delivers the output required.
If H3 is lower than H1, the burner's delivery must be reduced. A reduction in delivery is accompanied by a reduction of the pressure in the combustion chamber:
Qr = reduced delivery
H1r = reduced pressure

$$H1r = H1 \times \left(\frac{Qr}{Q}\right)^2$$

Example, a 5% delivery reduction:

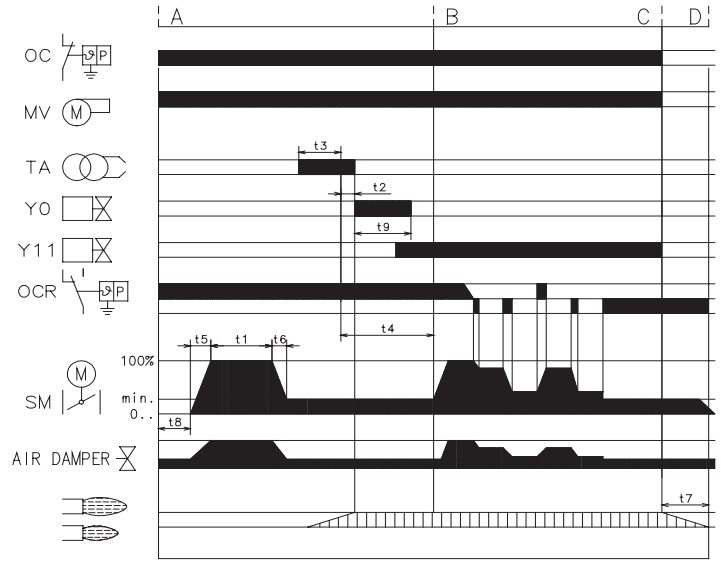
$Qr = Q \times 0.95$

$H1r = H1 \times (0.95)^2$

Steps 2 - 5 must now be repeated using the new Qr and H1r values.

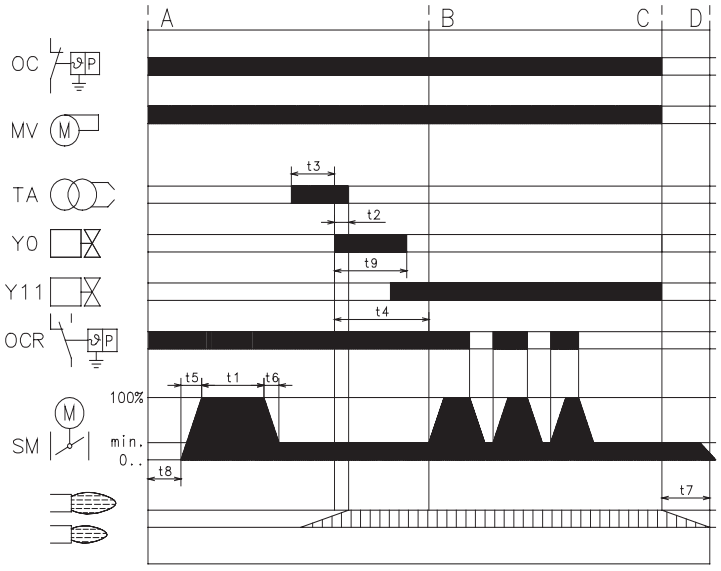
Important: the combustion head must be adjusted in respect to the equivalent delivery Qe.

Full Modulation



(A) D2273

Low - High



(B) D2274

BURNER OPERATION

BURNER STARTING

- Operating closes.
  Fan motor starts.
- Servomotor starts:
  90° rotation to right, until contact is made on red cam.
  The air damper is positioned to MAX. output.
- Pre-purge stage with air delivery at MAX. output.
- After pre-purge stage, servomotor rotates to left up to the angle set on blu cam for MIN. output.
- The air damper and the gas butterfly are positioned to MIN. output.
- Ignition electrode strikes a spark.
- Pilot valve opens. The pilot flame is ignited.
- After about 12 s the main flame ignites and starting cycle ends.

STEADY STATE OPERATION

Burner without modulating control RWF40

At the end of the starting cycle, the servomotor control then passes to the load control for boiler pressure or temperature.

(The flame safeguard continues, however, to check that the flame is present and that the air pressure switch is in the correct position.)

- If the temperature or pressure is low, the burner progressively increases its output to the MAX. value.
- If the temperature or pressure is high, the burner progressively decreases its output to the MIN. value.
  And so on.
- The burner locks out when demand for heat is less than the heat supplied by the burner at min. output.
  Load control opens. The servomotor returns to the 0° angle limited by contact with orange cam. The air damper closes completely to reduce thermal dispersion to a minimum.

Every time output is changed, the servomotor automatically modifies gas delivery (gas butterfly valve) and air delivery (fan damper).

Burner with modulating control RWF40

See the handbook enclosed with the modulating control.

Switching times are given in seconds, in the burner start-up sequence.

LFL 1.335 Series 01

t1	30	**t6**	optional
t2	2	**t7**	12
t3	4	**t8**	4
t4	20	**t9**	16
t5	optional		

Legend for the times

t1 Pre-purge time with air damper open
t2 Safety time
t3 Pre-ignition time, short (ignition transformer on terminal 16)
t4 Interval between start of t2 and release of valve at terminal 19
t5 Interval between end of t4 and release of load controller or valve at terminal 20
t5 Running time of air damper into OPEN position
t6 Running time of air damper into low-flame position (MIN)
t7 Permissible after-burn time
t8 Interval until OPEN command for the air damper is given
t9 Running time of pilot

FIRING FAILURE

If the burner does not fire, it locks out within 2.5 seconds from opening the pilot valve and then within 5 seconds from opening the main valves.

BURNER FLAME GOES OUT DURING OPERATION

If the flame should accidentally go out during operation, the burner will lock out within 1s.

BURNER FAULTS

Control program under fault conditions and lock-out indication

In case of any disturbance, the sequence mechanism stops and with it the lock-out indicator. The symbol above the reading mark of the indicator gives the type of disturbance:

◀ **No start**, e.g. because one contact is not closed. Lock-out during or after control program sequence due to extraneous light (e.g. non-extinguished flames, leaking fuel valves, defects in the flame supervision circuit, etc.)

▲ **Interruption of startup sequence**, because the OPEN signal has not been delivered to terminal 8 by limit switch “a”. Terminals 6, 7 and 14 remain under voltage until the fault has been corrected!

P **Lockout**, because there is no air pressure indication at the beginning of air pressure control. **Every air pressure failure after this moment in time leads to lock-out, too!**

■ **Lock-out** due to a fault in the flame supervision circuit.

▼ **Interruption of startup sequence**, because the position signal for the low-flame position has not been delivered to terminal 8 by auxiliary switch “m”. Terminals 6, 7 and 14 remain under voltage until the fault has been corrected!

1 **Lock-out**, because no flame signal is present after completion of the (1st) safety time.

2 **Lock-out**, because no flame signal has been received on completion of the 2nd safety time (flame signal of the main flame with interrupted pilot burners).

| **Lock-out**, because the flame signal has been lost during burner operation.

If lock-out occurs at any other moment in time between the start and the pre-ignition which is not marked by a symbol, this is usually caused by a premature, i.e. faulty flame signal, e.g. caused by a self-igniting UV tube.

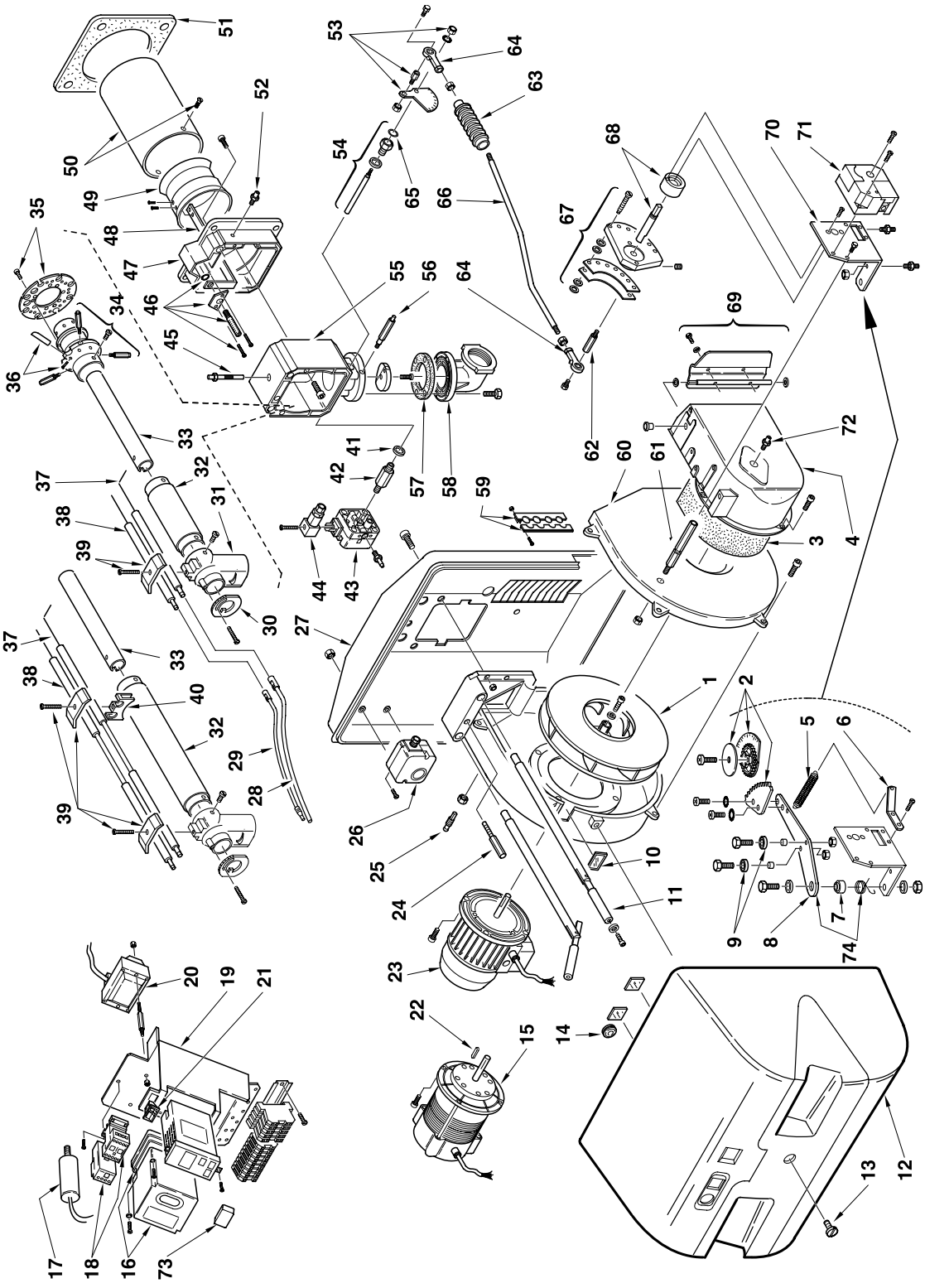
6.6 Riello Burner Parts Manual

Catalogo ricambi
Spare parts list
Catalogue pièces détachées
Ersatzteile Katalog
Catálogo recambios

Bruciatori di gas ad aria soffiata
Blown gas burners
Brûleurs gaz à air soufflé
Gebläse-Gasbrenner
Quemadores de gas

Funzionamento bistadio progressivo o modulante
Progressive two-stage or modulating operation
Fonctionnement à 2 allures progressives ou modulant
Gleitend-zweistufiger oder modulierender Betrieb
Funcionamiento a dos llamas progresivas o modulante

COD.	MOD.	TYP.
3781012	**RS 28/M**	**824 T1**
3781013	**RS 28/M**	**824 T1**
3781412	**RS 38/M**	**825 T1**
3781413	**RS 38/M**	**825 T1**
3781612	**RS 50/M**	**826 T1**
3781613	**RS 50/M**	**826 T1**


8173

N.	COD.	824 T1		825 T1		826 T1		DESCRIZIONE	DESCRIPTION	DESCRIPTION	BESCHREIBUNG	DENOMINACION	MATRICOLA BRUCIATORE BURNER SERIAL NUMBER MATRICULE BRULEUR BRENNER KENN-NUMMER MATRICULA QUEMADÓRES	RICAMBI CONSIGLIATI ADVISED PARTS RECHANGE CONSEIL EMPFOHLENE ERSATZTEILE RECAMBIOS ACONSEJADOS **
		3781012	3781013 *	3781412	3781413 *	3781612	3781613 *							
1	**3003760**	•	•					GIRANTE	FAN	TURBINE	GEBLÄSERAD	TURBINA		C
1	**3003761**			•	•			GIRANTE	FAN	TURBINE	GEBLÄSERAD	TURBINA		C
1	**3003762**					•	•	GIRANTE	FAN	TURBINE	GEBLÄSERAD	TURBINA		C
2	**3012063**	•	•	•	•	•	•	QUADRANTE	GRADUATE SECTOR	SECTEUR GRADUE	SKALENSEGMENT	MIRILLA		
3	**3003830**	•	•	•	•	•	•	FONOASSORBENTE	SOUND DAMPING	INSONORISANT	GERÄUSCHDÄMMUNG	AISLAMIENTO ACÙSTICO		
4	**3012077**	•	•	•	•	•	•	BOCCA D'ASPIRAZIONE	AIR INTAKE	BOITIER D'ASPIRATION	ANSAUGÖFFNUNG	BOCA ASPIRACION		
5	**3003879**	•	•	•	•	•	•	MOLLA	SPRING	RESSORT	FEDER	MUELLE	≤ 02484999999	A
6	**3012078**	•	•	•	•	•	•	SQUADRETTA	SQUARE	EQUERRE-SUPPORT	HALTER	ESCUADRA	≤ 02484999999	
7	**3003843**	•	•	•	•	•	•	PERNO	SCREW	VIS CREUSE	HOHLKERNSCHRAUBE	GUÍA		C
8	**3012064**	•	•	•	•	•	•	LEVA	LEVER	LEVIER	HEBELSCHRAUBE	PALANCA	≤ 02484999999	C
9	**3003841**	•	•	•	•	•	•	CUSCINETTO	BEARING	ROULEMENT	LAGER	COJINETE		
10	**3003763**	•	•	•	•	•	•	VISORE	INSPECTION WINDOW	VISEUR	SICHTFENSTER	VISOR		
11	**3003842**	•	•	•	•	•	•	PERNO	BAR	GLISSIERE	BOLZEN	GUÍA		C
12	**3003765**	•	•	•	•	•	•	COFANO	COVER	COFFRET	VERKLEIDUNG	ENVOLVENTE		
13	**3003766**	•	•	•	•	•	•	VITE	SCREW	VIS	SCHRAUBE	TORNILLO		
14	**3007627**	•	•	•	•	•	•	MEMBRANA	MEMBRAN	MEMBRANE	MEMBRANE	MEMBRANA		
15	**3003768**	•	•					MOTORE	MOTOR	MOTEUR	MOTOR	MOTOR		C
16	**3006090**	•	•	•	•	•	•	APPARECCHIATURA	CONTROL BOX	BOITE DE CONTROLE	STEUERGERÄT	CAJA CONTROL		B
17	**3005285**	•	•					CONDENSATORE	CONDENSER	CONDENSATEUR	KONDENSATOR	CONDENSADOR		B
18	**3003781**			•	•			AVVIATORE	STARTER	DEMARREUR	ANLASSER	ARRANCADOR		C
18	**3003782**					•	•	AVVIATORE	STARTER	DEMARREUR	ANLASSER	ARRANCADOR		C
19	**3012079**	•	•	•	•	•	•	SUPPORTO	SUPPORT	SUPPORT	HALTER	CORCHETE		
20	**3003847**	•	•	•	•	•	•	TRASFORMATORE	TRANSFORMER	TRANSFORMATEUR	ZÜNDTRANSFORMATOR	TRANSFORMADOR		B
21	**3012080**	•	•	•	•	•	•	INTERRUTTORE	SWITCH	INTERRUPTEUR	SCHALTER	INTERUCTOR		C
22	**3003816**	•	•					CHIAVETTA	KEY	CLAVETTE	PASSFEDER	CHAVETA		
23	**3003772**			•	•			MOTORE	MOTOR	MOTEUR	MOTOR	MOTOR		C
23	**3003773**					•	•	MOTORE	MOTOR	MOTEUR	MOTOR	MOTOR		C
24	**3003778**	•	•	•	•	•	•	ALBERINO	SHORT SHAFT	AXE	KLEINWELLE	ARBORILLO		
25	**3003891**	•	•	•	•	•	•	RACCORDO	CONNECTOR	MAMELON	NIPPEL	RACORD		C
26	**3007444**	•	•	•	•	•	•	PRESSOSTATO ARIA	AIR PRESSURE SWITCH	PRESSOSTAT AIR	LUFTDRUCKWÄCHTER			A
27	**3012089**	•	•	•	•	•	•	SCUDO ANTERIORE	FRONT SHIELD	BOUCLIER AVANT	VORDERES SCHILD	ESCUDO ANTERIOR		
28	**3003848**	•	•	•	•	•	•	COLLEG. PER SONDA	PROBE LEAD	CONNEXION POUR SONDE	VERBINDUNG FÜR SONDE	CABLE SONDA DE IONIZACIÓN		A
29	**3003794**	•	•	•	•	•	•	COLLEG.PER ELETTRODO	H.T. LEAD	CONNEXION POUR ELECTRODE	VERBINDUNG FÜR ELEKTRODE	CABLE ELECTRODO		A
30	**3003844**	•	•					GHIERA	FERRULE	DISQUE	STELLRING	VIROLA		
30	**3003845**			•	•			GHIERA	FERRULE	DISQUE	STELLRING	VIROLA		
30	**3003846**					•	•	GHIERA	FERRULE	DISQUE	STELLRING	VIROLA		
31	**3003854**	•	•	•	•	•	•	GOMITO	ELBOW	COUDE	SCHLITTEN	CODO		
32	**3003855**	•		•		•		TUBO ESTERNO	EXTERIOR TUBE	TUYAU EXTERIEUR	AUSSERER ROHR	TUBO EXTERNO		
32	**3003856**		•		•		•	TUBO ESTERNO	EXTERIOR TUBE	TUYAU EXTERIEUR	AUSSERER ROHR	TUBO EXTERNO		
33	**3003857**	•						TUBO INTERNO	INTERIOR TUBE	TUYAU INTERIEUR	INNERER ROHR	TUBO INTERNO		
33	**3003858**		•					TUBO INTERNO	INTERIOR TUBE	TUYAU INTERIEUR	INNERER ROHR	TUBO INTERNO		
33	**3003859**			•				TUBO INTERNO	INTERIOR TUBE	TUYAU INTERIEUR	INNERER ROHR	TUBO INTERNO		
33	**3003860**				•			TUBO INTERNO	INTERIOR TUBE	TUYAU INTERIEUR	INNERER ROHR	TUBO INTERNO		

* = Versione Testa Lunga - Long Combustion Head Version - Version Tête Longue - Langer Brennkopf Ausführung - Version alargado de tubo llama

N.	COD.	824 T1		825 T1		826 T1		DESCRIZIONE	DESCRIPTION	DESCRIPTION	BESCHREIBUNG	DENOMINACION	MATRICOLA BRUCIATORE BURNER SERIAL NUMBER MATRICULE BRULEUR BRENNER KENN-NUMMER MATRICULA QUEMADÓRES	RICAMBI CONSIGLIATI ADVISED PARTS RECHANGE CONSEIL EMPFOHLENE ERSATZTEILE RECAMBIOS ACONSEJADOS **
		3781012	3781013 *	3781412	3781413 *	3781612	3781613 *							
33	**3003861**					•		TUBO INTERNO	INTERIOR TUBE	TUYAU INTERIEUR	INNERER ROHR	TUBO INTERNO		
33	**3003862**						•	TUBO INTERNO	INTERIOR TUBE	TUYAU INTERIEUR	INNERER ROHR	TUBO INTERNO		
34	**3012081**	•	•					DISTRIBUTORE	GAS HEAD	DISTRIBUTEUR	GASVERTEILER	DISTRIBUIDOR		
34	**3012082**			•	•			DISTRIBUTORE	GAS HEAD	DISTRIBUTEUR	GASVERTEILER	DISTRIBUIDOR		
34	**3012083**					•	•	DISTRIBUTORE	GAS HEAD	DISTRIBUTEUR	GASVERTEILER	DISTRIBUIDOR		
35	**3003868**	•	•					DISCO	DISC	DISQUE	SCHEIBE	DISCO		A
35	**3003869**			•	•			DISCO	DISC	DISQUE	SCHEIBE	DISCO		A
35	**3003849**					•	•	DISCO	DISC	DISQUE	SCHEIBE	DISCO		A
36	**3003865**	•	•					TUBETTO	TUBE	TUYAU	RÖHRCHEN	TUBITO		
36	**3003866**			•	•			TUBETTO	TUBE	TUYAU	RÖHRCHEN	TUBITO		
36	**3003867**					•	•	TUBETTO	TUBE	TUYAU	RÖHRCHEN	TUBITO		
37	**3012174**	•		•		•		SONDA	PROBE	SONDE	FÜHLER	SONDA		A
37	**3012177**		•		•		•	SONDA	PROBE	SONDE	FÜHLER	SONDA		A
38	**3003850**	•		•				ELETTRODO	ELECTRODE	ELECTRODE PORCELAINE	ELEKTRODE	ELECTRODO		A
38	**3003851**		•		•			ELETTRODO	ELECTRODE	ELECTRODE PORCELAINE	ELEKTRODE	ELECTRODO		A
38	**3012129**					•		ELETTRODO	ELECTRODE	ELECTRODE PORCELAINE	ELEKTRODE	ELECTRODO		A
38	**3012130**						•	ELETTRODO	ELECTRODE	ELECTRODE PORCELAINE	ELEKTRODE	ELECTRODO		A
39	**3003409**	•	•	•	•	•	•	CAVALLOTTO	U BOLT	CAVALIER	BÜGELBOLZEN	FIJACION ELECTRODO		
40	**3012191**		•		•		•	SUPPORTO	SUPPORT	SUPPORT	HALTER	SOPORTE		
41	**3007166**	•	•	•	•	•	•	GUARNIZIONE	SEAL	RONDELLE	METALLDICHTUNG	JUNTA		
42	**3003864**	•	•	•	•	•	•	RACCORDO	CONNECTOR	MAMELON	NIPPEL	RACORD		
43	**3003660**	•	•	•	•	•	•	PRESSOSTATO GAS	GAS PRESSURE SWITCH	PRESSOSTAT GAZ	GASDRUCKWÄCHTER	PRESOSTATO DEL AIRE		
44	**3006953**	•	•	•	•	•	•	PRESA	SOCKET	PRISE	STECKERBUCHSE	CONECTOR		
45	**3003873**	•	•	•	•	•	•	GRUPPO MISURAZIONE	TEST POINT	PRISE DE PRESSION	MESSNIPPEL	GRUPO TOMA DE PRESiON		
46	**3003797**	•	•	•	•	•	•	GRUPPO REGOLAZIONE	CONTROL DEVICE	GROUPE OBTURATION	DRUCKREGULIERUNG	GRUPO REGULACION		
47	**3003798**	•	•	•	•	•	•	FRONTONE	FONT PIECE	FACADE	VORDERTEIL	SOPORTE QUEMADOR		
48	**3003799**	•						SQUADRETTA	SQUARE	EQUERRE-SUPPORT	HALTER	ESCUADRA		
48	**3003800**		•					SQUADRETTA	SQUARE	EQUERRE-SUPPORT	HALTER	ESCUADRA		
48	**3003801**			•				SQUADRETTA	SQUARE	EQUERRE-SUPPORT	HALTER	ESCUADRA		
48	**3003802**				•			SQUADRETTA	SQUARE	EQUERRE-SUPPORT	HALTER	ESCUADRA		
48	**3003803**					•		SQUADRETTA	SQUARE	EQUERRE-SUPPORT	HALTER	ESCUADRA		
48	**3003804**						•	SQUADRETTA	SQUARE	EQUERRE-SUPPORT	HALTER	ESCUADRA		
49	**3003805**	•	•	•	•			OTTURATORE	SHUTTER	OBTURATEUR	SCHIEBER	OBTURADOR		C
49	**3003806**					•	•	OTTURATORE	SHUTTER	OBTURATEUR	SCHIEBER	OBTURADOR		C
50	**3003807**	•						IMBUTO FIAMMA	END CONE	EMBOUT GUEULARD	FLAMMENROHR	TUBO EXTREMO		B
50	**3003808**		•					IMBUTO FIAMMA	END CONE	EMBOUT GUEULARD	FLAMMENROHR	TUBO EXTREMO		B
50	**3003809**			•				IMBUTO FIAMMA	END CONE	EMBOUT GUEULARD	FLAMMENROHR	TUBO EXTREMO		B
50	**3003810**				•			IMBUTO FIAMMA	END CONE	EMBOUT GUEULARD	FLAMMENROHR	TUBO EXTREMO		B
50	**3003811**					•		IMBUTO FIAMMA	END CONE	EMBOUT GUEULARD	FLAMMENROHR	TUBO EXTREMO		B
50	**3003812**						•	IMBUTO FIAMMA	END CONE	EMBOUT GUEULARD	FLAMMENROHR	TUBO EXTREMO		B
51	**3003817**	•	•	•	•	•	•	SCHERMO	FLANGE GASKET	ECRAN THERMIQUE	FLANSCHDICHTUNG	JUNTA AISLANTE		B
52	**3003893**	•	•	•	•	•	•	GRUPPO MISURAZIONE	TEST POINT	PRISE DE PRESSION	MESSNIPPEL	GRUPO TOMA DE PRESiON		A
53	**3003875**	•	•	•	•	•	•	QUADRANTE	GRADUATE SECTOR	SECTEUR GRADUE	SKALENSEGMENT	CUADRANTE		
54	**3003874**	•	•	•	•	•	•	ALBERO MANICOTTO	BUTTERFLY VALVE SHAFT	AXE DE LA VANNE PAPILLON	SPINDEL GASDROSSEL	ARBORILLO MANGUITO		
55	**3003876**	•	•	•	•	•	•	MANICOTTO	MANIFOLD	MANCHON	GASANSCHLUSS	MANGUITO		

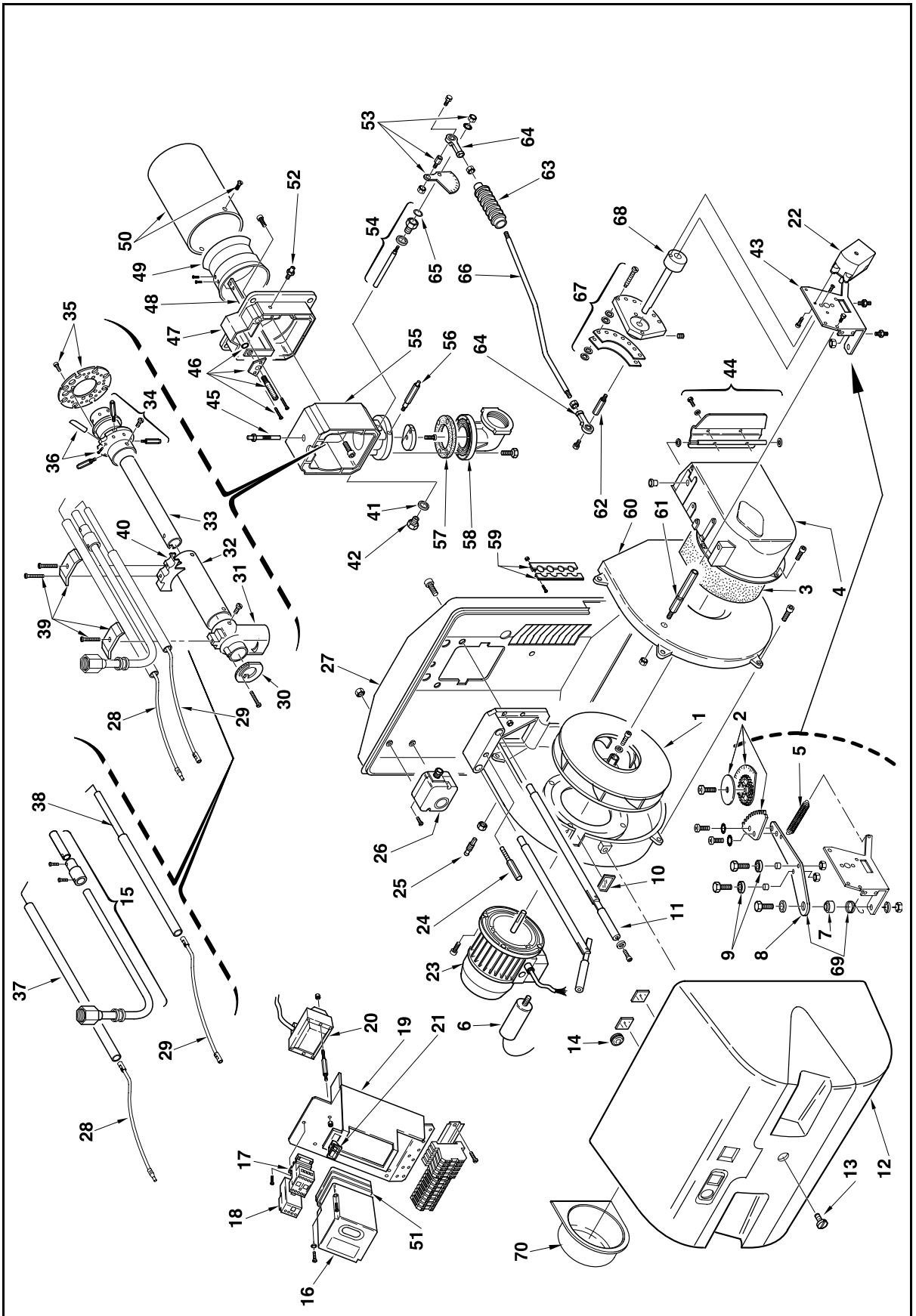
* = Versione Testa Lunga - Long Combustion Head Version - Version Tête Longue - Langer Brennkopf Ausführung - Version alargado de tubo llama

6.7 North American Riello Burner Parts Manual

Gas Burners
Bruciatori di gas

Progressive two-stage or modulating operation
Funzionamento bistadio progressivo o modulante

CODE	MODEL
C9521300 (3781070)	**RS 28/M**
C9522300 (3781270)	**RS 38/M**
C9522350 (3781470)	**RS 38/M**
C9522351 (3781475)	**RS 38/M**
C9523300 (3781670)	**RS 50/M**
C9523301 (3781675)	**RS 50/M**
(3781676)	**RS 50/M**


C6505066 - 2918310

N.	CODE	C9521300 (3781070)	C9522300 (3781270)	C9522350 (3781470)	C9522351 (3781475)	C9523300 (3781670)	C9523301 (3781675)	(3781676)	DESCRIPTION	DESCRIZIONE	BURNER SERIAL NUMBER MATRICOLA BRUCIATORE	ADVISED PARTS RICAMBI CONSIGLIATI **
1	3012985	•							FAN	GIRANTE		C
1	3012986		•	•	•				FAN	GIRANTE		C
1	3003760					•	•	•	FAN	GIRANTE		C
2	3012063	•	•	•	•	•	•	•	GRADUATE SECTOR	QUADRANTE		
3	3003830	•	•	•	•	•	•	•	SOUND DAMPING	FONOASSORBENTE		
4	3003890	•	•	•	•	•	•	•	AIR INTAKE	BOCCA D'ASPIRAZIONE		
5	3003879	•	•	•	•	•	•	•	SPRING	MOLLA	≤ 02484999999	A
6	3012988	•	•						CONDENSER	CONDENSATORE		
7	3003843	•	•	•	•	•	•	•	BAR	PERNO		C
8	3012064	•	•	•	•	•	•	•	LEVER	LEVA	≤ 02484999999	C
9	3003841	•	•	•	•	•	•	•	BEARING	CUSCINETTO		
10	3003763	•	•	•	•	•	•	•	INSPECTION WINDOW	VISORE		
11	3003842	•	•	•	•	•	•	•	BAR	PERNO		C
12	3012987	•	•	•	•	•	•		COVER	COFANO		
12	3013873							•	COVER	COFANO		
13	3003766	•	•	•	•	•	•	•	SCREW	VITE		
14	3007627	•	•	•	•	•	•	•	MEMBRAN	MEMBRANA		
15	3013009	•	•	•	•	•	•	•	PILOT TUBE	TUBO PILOTA		
16	C5830008 3012955	•	•	•	•	•	•	•	CONTROL BOX LFL 1.335	APPARECCHIATURA LFL 1.335		B
17	3012989	•	•						CONTACTOR	CONTATTORE		C
17	3012990			•	•	•	•		CONTACTOR	CONTATTORE		C
17	20006633							•	CONTACTOR	CONTATTORE		C
18	3012991			•		•			OVERLOAD 208-230/460V	RELE' TERMICO 208-230/460V		C
18	3013123				•		•		OVERLOAD 575V	RELE' TERMICO 575V		C
19	3012079	•	•	•	•	•	•		SUPPORT	SUPPORTO		
19	3013871							•	SUPPORT	SUPPORTO		
20	3012956	•	•	•	•	•	•	•	TRANSFORMER	TRASFORMATORE		B
21	3012080	•	•	•	•	•	•	•	SWITCH	INTERRUTTORE		C
22	3013008	•	•	•	•	•	•	•	SERVOMOTOR	SERVOMOTORE		B
23	3012993	•	•						MOTOR 120V	MOTORE 120V		C
23	3012994			•		•			MOTOR 208-230/460V	MOTORE 208-230/460V		C
23	3013057				•		•		MOTOR 575V	MOTORE 575V		C
23	3013869							•	MOTOR 120V	MOTORE 120V		C
24	3003778	•	•	•	•	•	•	•	SHORT SHAFT	ALBERINO		
25	3003891	•	•	•	•	•	•	•	CONNECTOR	RACCORDO		C
26	3012948	•	•	•	•	•	•	•	AIR PRESSURE SWITCH	PRESSOSTATO ARIA		B
27	3012089	•	•	•	•	•	•		FRONT SHIELD	SCUDO ANTERIORE		
27	3013872							•	FRONT SHIELD	SCUDO ANTERIORE		
28	3003848	•	•	•	•	•	•	•	PROBE LEAD	COLLEGAMENTO PER SONDA		A
29	3012995	•	•	•	•	•	•	•	H.T.LEAD	COLLEGAMENTO PER ELETTRODO		A
30	3003844	•							FERRULE	GHIERA		
30	3003845		•	•	•				FERRULE	GHIERA		
30	3003846					•	•	•	FERRULE	GHIERA		

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N.	CODE		C9521300 (3781070)	C9522300 (3781270)	C9522350 (3781470)	C9522351 (3781475)	C9523300 (3781670)	C9523301 (3781675)	(3781676)	DESCRIPTION	DESCRIZIONE	BURNER SERIAL NUMBER MATRICOLA BRUCIATORE	ADVISED PARTS RICAMBI CONSIGLIATI **
31		3003854	•	•	•	•	•	•	•	ELBOW	GOMITO		
32		3013129	•	•	•	•	•	•	•	EXTERIOR TUBE	TUBO ESTERNO		
33		3003857	•							INTERIOR TUBE	TUBO INTERNO		
33		3003859		•	•	•				INTERIOR TUBE	TUBO INTERNO		
33		3003861					•	•	•	INTERIOR TUBE	TUBO INTERNO		
34		3012081	•							GAS HEAD	DISTRIBUTORE		
34		3002082		•	•	•				GAS HEAD	DISTRIBUTORE		
34		3002083					•	•	•	GAS HEAD	DISTRIBUTORE		
35		3012997	•							DISC	DISCO		A
35		3012998		•	•	•				DISC	DISCO		A
35		3012999					•	•	•	DISC	DISCO		A
36		3003865	•							TUBE	TUBETTO		
36		3003866		•	•	•				TUBE	TUBETTO		
36		3003867					•	•	•	TUBE	TUBETTO		
37		3012174	•	•	•	•	•	•	•	PROBE	SONDA		A
38		3013136	•	•	•	•	•	•	•	ELECTRODE	ELETTRODO		A
39		3013001	•	•	•	•	•	•	•	U BOLT	CAVALLOTTO		
40		3013002	•	•	•	•	•	•	•	U BOLT	CAVALLOTTO		
41		3007166	•	•	•	•	•	•	•	SEAL	GUARNIZIONE		C
42		3003863	•	•	•	•	•	•	•	PLUG	TAPPO		
43		3013007	•	•	•	•	•	•	•	SUPPORT	SUPPORTO		
44		3012085	•	•	•	•	•	•	•	AIR DAMPER ASSEMBLY	GRUPPO SERRANDA		
45		3003873	•	•	•	•	•	•	•	TEST POINT	GRUPPO MISURAZIONE		
46		3003797	•	•	•	•	•	•	•	CONTROL DEVICE	GRUPPO REGOLAZIONE		
47		3003798	•	•	•	•	•	•	•	FRONT PIECE	FRONTONE		
48		3003799	•							SQUARE	SQUADRETTA		
48		3003801		•	•	•				SQUARE	SQUADRETTA		
48		3003803					•	•	•	SQUARE	SQUADRETTA		
49		3003805	•	•	•	•				SHUTTER	OTTURATORE		C
49		3003806					•	•	•	SHUTTER	OTTURATORE		C
50		3003807	•							END CONE	IMBUTO FIAMMA		B
50		3003809		•	•	•				END CONE	IMBUTO FIAMMA		B
50		3003811					•	•	•	CONTROL BOX BASE	ZOCCOLO		
51	C5360002	3013010	•	•	•	•	•	•	•	CONTROL BOX BASE	ZOCCOLO		
52		3003893	•	•	•	•	•	•	•	TEST POINT	GRUPPO MISURAZIONE		
53		3003875	•	•	•	•	•	•	•	GRADUATE SECTOR	QUADRANTE		
54		3003874	•	•	•	•	•	•	•	BUTTERFLY VALVE SHAFT	ALBERO MANICOTTO		
55		3013003	•	•	•	•	•	•	•	MANIFOLD	MANICOTTO		
56		3003878	•	•	•	•	•	•	•	INDEX	INDICE		
57		3005483	•	•	•	•	•	•	•	SEAL	GUARNIZIONE		C
58		3013004	•	•	•	•	•	•	•	FLANGE AND ELBOW	FLANGIA E GOMITO		
59		3003780	•	•	•	•	•	•	•	FAIRLEAD	PASSACAVO		
60		3003829	•	•	•	•	•	•	•	HALF-SHELL	GUSCIO		

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N.	CODE	C9521300 (3781070)	C9522300 (3781270)	C9522350 (3781470)	C9522351 (3781475)	C9523300 (3781670)	C9523301 (3781675)	(3781676)	DESCRIPTION	DESCRIZIONE	BURNER SERIAL NUMBER MATRICOLA BRUCIATORE	ADVISED PARTS RICAMBI CONSIGLIATI **
61	3013005	•	•	•	•	•	•	•	STUD	COLONNETTA		
62	3003888	•	•	•	•	•	•	•	SPACER	DISTANZIALE		
63	3003883	•	•	•	•	•	•	•	COWLING	CUFFIA		
64	3006098	•	•	•	•	•	•	•	PIN JOINT	SNODO SFERICO		
65	3003203	•	•	•	•	•	•	•	PISTON SEAL	ANELLO		
66	3003881	•	•	•	•	•	•	•	TIE ROD	TIRANTE		
67	3012062	•	•	•	•	•	•	•	CAM ASSEMBLY	CAMMA COMPLETA		
68	3013006	•	•	•	•	•	•	•	CAM-HOLDER SHAFT	ALBERO CAMMA		
69	3013478	•	•	•	•	•	•	•	SPRING - LEVER	MOLLA - LEVA	≥ 02494000000	A
70	3013874							•	PROTECTION	PROTEZIONE		A

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**
A = Spare parts for minimum fittings - Ricambi per dotazione minima
A+B = Spare parts for basic safety fittings - Ricambi per dotazione base di sicurezza
A+B+C = Spare parts for extended safety fittings - Ricambi per dotazione estesa di sicurezza