Installation, Startup and Operation Manual

MFC Series Boilers

Multi-Fuel Condensing Boiler Models:

3000
4000
5000
6000
8000
10000

Other documents for this product include:

OMM-0108 GF-148-IN MFC-Series Installation Manual

TAG-0077 GF-148-E MFC-Series Electrical Power Guide
TAG-0078 GF-148-G MFC-Series Gas and #2 Oil Supply Guide
TAG-0080 GF-146-V MFC Series Vent-Combust Air Application Guide
TAG-0081 GF-148-B MFC-Series Boiler Application Guide

Heat | Hot Water Solutions

OMM-0104_D • GF-146-V • 1/30/2019

AERCO International, Inc. • 100 Oritani Drive • Blauvelt, NY 10913
USA: T: (845) 580-8000 • Toll Free: (800) 526-0288 • AERCO.com
Technical Support • (800) 526-0288 • Mon-Fri, 8 am - 5 pm EST

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Foreword

The AERCO MFC Series boilers are modulating and condensing units. The MFC Series represents a true industry advancement that meets the needs of today's energy and environmental concerns. Designed for application in any closed loop hydronic system, the MFC Series modulating capability relates energy input directly to fluctuating system loads. The maximum turn down ratio for these units is 5:1. The MFC Series provides extremely high efficiency and makes it ideally suited for modern low temperature, as well as, conventional heating systems and higher temperature systems (up to 230°F).

The MFC Series operates within the following input and output ranges:

MFC Series INPUT and OUTPUT RANGES (Btu/Hr.)

MODEL	INPUT RANGE (BTU/HR.)		OUTPUT RANGE (BTU/HR.) at High Fire Rate*	
	Min.	Max.	Min.	Max.
MFC 3000	600,000	3,000,000	2,565,000	2,826,000
MFC 4000	800,000	4,000,000	3,420,000	3,768,000
MFC 5000	1,000,000	5,000,000	4,275,000	4,710,000
MFC 6000	1,200,000	6,000,000	5,130,000	5,652,000
MFC 8000	1,600,000	8,000,000	6,840,000	7,536,000
MFC 10000	2,000,000	10,000,000	8,550,000	9,420,000

***** Output based on a supply temperature of 100°F.

Whether used in singular or modular arrangements, the MFC Series offers the maximum venting flexibility with minimum installation space requirements. These Boilers are Category II and IV, positive pressure appliances. Single and/or multiple breeched units are capable of operation in the following vent configurations:

- **Room Combustion Air:**
  - Vertical Discharge
  - Horizontal Discharge
- **Ducted Combustion Air:**
  - Vertical Discharge
  - Horizontal Discharge

These boilers are capable of being vented utilizing AL29-4C vent systems only.

The available burner's advanced electronics are available with several selectable modes of operation offering the most efficient operating methods and energy management system integration.

IMPORTANT:

Unless otherwise specified, all descriptions and procedures provided in this Installation, Operation & Maintenance Manual apply to the MFC Series boilers.

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SECTION 1: SAFETY PRECAUTIONS

1.1 Warnings & Cautions

Installers and operating personnel MUST, at all times, observe all safety regulations. The following warnings and cautions are general and must be given the same attention as specific precautions included in these instructions. In addition to all the requirements included in this AERCO Instruction Manual, the installation of units MUST conform with local building codes, or, in the absence of local codes, ANSI Z223.1 (National Fuel Gas Code Publication No. NFPA-54) for gas-fired boilers and ANSI/NFPASB for LP gas-fired boilers, as well as NFPA 31 "Standard for the Installation of Oil-Burning Equipment", and NFPA 54 for gas piping compliance requirements. Where applicable, the equipment shall be installed in accordance with the current Installation Code for Gas Burning Appliances and Equipment, CSA B149.1, and applicable Provincial regulations for the class; which should be carefully followed in all cases. Authorities having jurisdiction should be consulted before installations are made.

If installing within the Commonwealth of Massachusetts, see Section 1.4 for important information regarding installation of units.

IMPORTANT:

This Instruction Manual is an integral part of the product and must be maintained in legible condition. It must be given to the user by the installer and kept in a safe place for future reference.

WARNING!

- Do not use matches, candles, flames, or other sources of ignition to check for gas leaks.
- Fluids under pressure may cause injury to personnel or damage to equipment when released. Be sure to shut off all incoming and outgoing water shutoff valves. Carefully decrease all trapped pressures to zero before performing maintenance.
- Before attempting to perform any maintenance on the unit, shut off all gas and electrical inputs to the unit.
- The exhaust vent pipe of the unit may operate under a positive pressure and therefore must be completely sealed to prevent leakage of combustion products into living spaces.
- Electrical voltages up to 575 VAC may be used in this equipment. Therefore the burner cover and all other junction boxes must be installed at all times, except during maintenance and servicing.
- A three-pole switch must be installed on the electrical supply line of the unit. The switch must be installed in an easily accessible position to quickly and safely disconnect electrical service. Do not affix switch to unit or burner enclosures.

CAUTION!

- Many soaps used for gas pipe leak testing are corrosive to metals. The piping must be rinsed thoroughly with clean water after leak checks have been completed.
- DO NOT use this boiler if any part has been under water. Call a qualified service technician to inspect and replace any part that has been under water.

1.2 Emergency Shutdown

If overheating occurs or the gas supply fails to shut off, close the manual gas shutoff valve (Figure 1-1) located external to the unit.

NOTE:

The Installer must identify and indicate the location of the emergency shutdown manual gas valve to operating personnel.

Figure 1-1: Manual Gas Shutoff Valve

1.3 Prolonged Shutdown

If the boiler is to be taken out of service for an extended period of time (one year or more), perform the following procedure.

Shutting Boiler Down for Extended Period

1. Set **ON/OFF** switch on the front panel to the **OFF** position to shut down the boiler's operating controls.
2. Disconnect AC power from the unit.
3. Close the water supply and return valves to isolate boiler.
4. Close external gas supply valve.
5. Open relief valve to vent water pressure.

To bring the boiler back into service after a prolonged shutdown (one year or more), the following procedures must be followed:

Placing Boiler in Service After Long Shutdown

1. Review installation requirements included in Chapter 3.
2. Inspect all piping and connections to the unit.
3. Inspect exhaust vent and air inlet duct work (if applicable).
4. Perform initial startup per Chapter 5.
5. Perform scheduled maintenance procedures per Chapters 5 of this manual.

1.4 Moving the MFC Boiler

When the units is received from the carrier, it should be completely inspected for evidence of shipping damage and shipment completeness *before* the bill of lading is signed.

Carefully unpack the unit, taking care not to damage the unit enclose when cutting away the packaging materials.

For packaged boilers, the Riello gas train is shipped loose or stowed inside the boiler and must be installed and wired in the field. The condensate trap and the the boiler drain valves are also stowed inside the boiler for field installation.

Boiler Weight – in pounds (kg)						
	MFC 3000	MFC 4000	MFC 5000	MFC 6000	MFC 8000	MFC 10000
Boiler & Riello Burner	7,300 (3,311)	10,160 (4,608)	11,063 (5,018)	13,137 (5,959)	16,645 (7,550)	18,520 (8,401)
Bare Boiler (burner supplied by other)	7,067 (3,206)	9,910 (4,495)	10,813 (4,905)	12,887 (5,845)	16,149 (7,325)	18,024 (8,176)

The unit must be moved with the proper rigging equipment for safety and to avoid equipment damage (see Figure 1-2 for lifting points). A properly size forklift or other necessary equipment will be required in order to safely move the MFC boilers and avoid equipment damage.

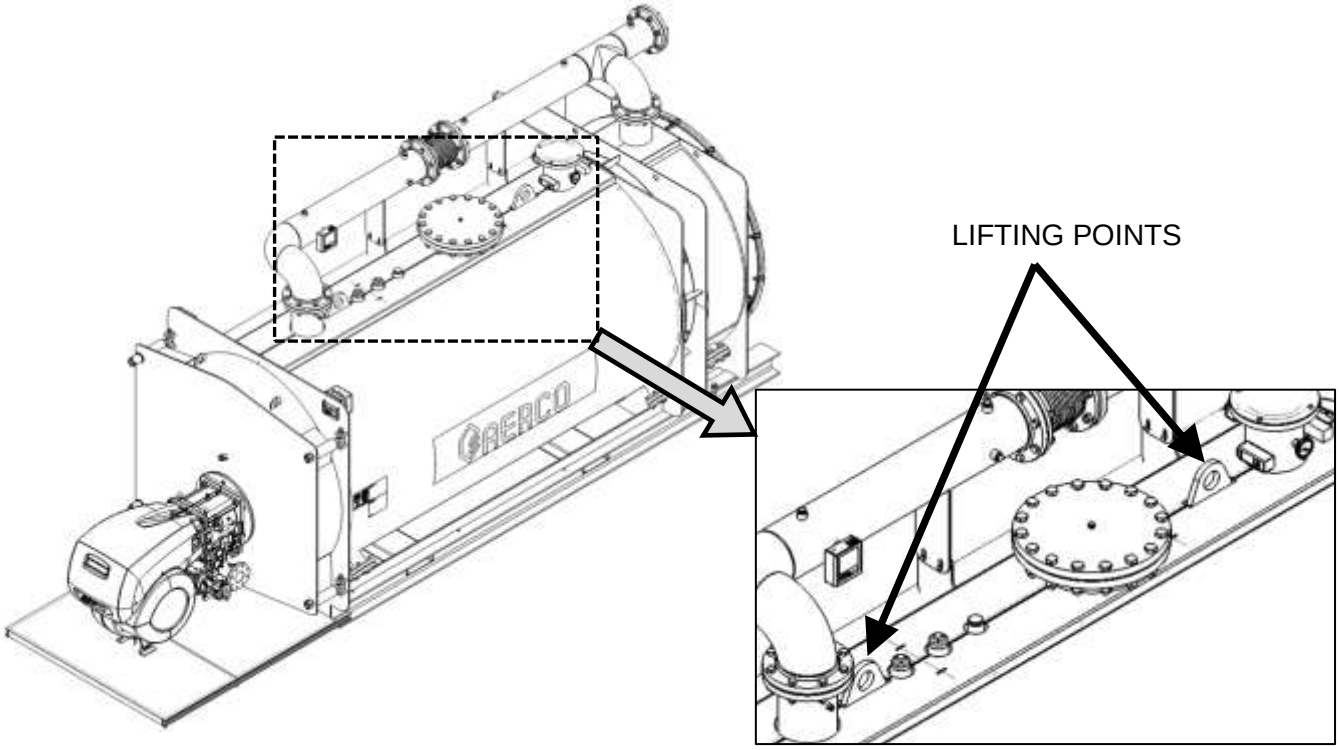

Figure 1-2: MFC Boiler Lifting Points

IMPORTANT:

Parts and accessories are stowed inside the boiler. The boiler door MUST first be opened to access the parts and accessories for field installation.

1.5 Massachusetts Installations

Boiler installations within the Commonwealth of Massachusetts must conform to the following requirements:

- Boiler must be installed by a plumber or a gas fitter who is licensed within the Commonwealth of Massachusetts.
- Prior to unit operation, the complete gas train and all connections must be leak tested using a non-corrosive soap.
- The vent termination must be located a minimum of 4 feet above grade level. If side-wall venting is used, the installation must conform to the following requirements **extracted from 248 CMR 5.08 (2):**

(a) For all side wall horizontally vented gas fueled equipment installed in every dwelling, building or structure used in whole or in part for residential purposes, including those owned or operated by the Commonwealth and where the side wall exhaust vent termination is less than seven (7) feet above finished grade in the area of the venting, including but not limited to decks and porches, the following requirements shall be satisfied:

- INSTALLATION OF CARBON MONOXIDE DETECTORS. At the time of installation of the side wall horizontal vented gas fueled equipment, the installing plumber or gasfitter shall observe that a hard wired carbon monoxide detector with an alarm and battery back-up is installed on the floor level where the gas equipment is to be installed. In addition, the installing plumber or gasfitter shall observe that a battery operated or hard wired carbon monoxide detector with an alarm is installed on each additional level of the dwelling, building or structure served by the side wall horizontal vented gas fueled equipment. It shall be the responsibility of the property owner to secure the services of qualified licensed professionals for the installation of hard wired carbon monoxide detectors.

  a. In the event that the side wall horizontally vented gas fueled equipment is installed in a crawl space or an attic, the hard wired carbon monoxide detector with alarm and battery back-up may be installed on the next adjacent floor level.

  b. In the event that the requirements of this subdivision can not be met at the time of completion of installation, the owner shall have a period of thirty (30) days to comply with the above requirements; provided, however, that during said thirty (30) day period, a battery operated carbon monoxide detector with an alarm shall be installed.

1. APPROVED CARBON MONOXIDE DETECTORS. *Each carbon monoxide detector as required in* accordance with the above provisions shall comply with NFPA 720 and be ANSI/UL 2034 listed and IAS certified.
2. SIGNAGE. A metal or plastic identification plate shall be permanently mounted to the exterior of the building at a minimum height of eight (8) feet above grade directly in line with the exhaust vent terminal for the horizontally vented gas fueled heating appliance or equipment. The sign shall read, in print size no less than one-half (1/2) inch in size, **"GAS VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS".**
3. INSPECTION. The state or local gas inspector of the side wall horizontally vented gas fueled equipment shall not approve the installation unless, upon inspection, the inspector observes carbon monoxide detectors and signage installed in accordance with the provisions of 248 CMR 5.08(2)(a)1 through 4.

(b) EXEMPTIONS: The following equipment is exempt from 248 CMR 5.08(2)(a)1 through 4:

1. The equipment listed in Chapter 10 entitled "Equipment Not Required To Be Vented" in the most current edition of NFPA 54 as adopted by the Board; and

2. Product Approved side wall horizontally vented gas fueled equipment installed in a room or structure separate from the dwelling, building or structure used in whole or in part for residential purposes.

(c) MANUFACTURER REQUIREMENTS - GAS EQUIPMENT VENTING SYSTEM PROVIDED. When the manufacturer of Product Approved side wall horizontally vented gas equipment provides a venting system design or venting system components with the equipment, the instructions provided by the manufacturer for installation of the equipment and the venting system shall include:

1. Detailed instructions for the installation of the venting system design or the venting system components; and

2. A complete parts list for the venting system design or venting system.

(d) MANUFACTURER REQUIREMENTS - GAS EQUIPMENT VENTING SYSTEM NOT PROVIDED. When the manufacturer of a Product Approved side wall horizontally vented gas fueled equipment does not provide the parts for venting the flue gases, but identifies "special venting systems", the following requirements shall be satisfied by the manufacturer:

1. The referenced "special venting system" instructions shall be included with the appliance or equipment installation instructions; and

2. The "special venting systems" shall be Product Approved by the Board, and the instructions for that system shall include a parts list and detailed installation instructions.

(e) A copy of all installation instructions for all Product Approved side wall horizontally vented gas fueled equipment, all venting instructions, all parts lists for venting instructions, and/or all venting design instructions shall remain with the appliance or equipment at the completion of the installation.

[End of Extracted Information From 248 CMR 5.08 (2)]

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SECTION 2: INTRODUCTION

2.1 General Features

The AERCO Multi-Fuel Condensing (MFC) Fire Tube Water Boiler is designed for condensing application in any closed loop hydronic system. It features a proven 4-pass fire tube heat exchanger design for maximum heat transfer and efficiency. The heat exchanger's combination of high quality carbon steel/316Ti stainless steel construction ensures the highest degree of durability. The 316Ti SS construction in the heat exchanger's 4th pass offers superior corrosion resistance against acidic flue gas condensation. Likewise, it can be fired with multiple fuels including natural gas, propane or #2 fuel oil (as backup), offering dual fuel flexibility. Moreover, the MFC series features dual return connections standard for optimal application flexibility and seasonal efficiency gains of up to 10%. The heat exchanger's maximum working temperature of 240°F allows for greater operating temperature range and meet the requirements of higher temperature applications when necessary, but allows for the building to reset water temperature for condensing in the shoulder months.

2.2 Certification References and Compliance

Each boiler and Stainless Steel 4th Pass is provided with a **manufacture plate** that can be found in the envelope with the boiler documents. The plate lists:

Manufacturer Plate Information	
BOILER	**STAINLESS STEEL 4TH PASS**
Serial Number	Serial Number
Minimum Relief Valve Capacity	Maximum Water Temperature
Heating Surface Area	Maximum Operating Pressure
Maximum Water Temperature	
Maximum Operating Pressure	

The installation must be performed in compliance with the regulations in force by **professionally qualified personnel**. The term "professionally qualified personnel" means persons with specific technical skills in the sector of heating system components. Incorrect installation may cause damage to persons, animals or objects for which the manufacturer cannot be held responsible.

At the first start up, all regulation and control devices positioned on the control panel should be checked for proper operation.

The **warranty** shall be valid only upon compliance with the instruction given in this manual.

The AERCO MFC Series boilers have been built and tested in observance of ASME requirements and UL when ordered with a factory supplied burner.

2.3 General Technical Specifications

MFC Series General Technical Specifications, for MFC Models:						
	3000	4000	5000	6000	8000	10000
Boiler Category	ASME Section IV					
Max. Allowed Working Pressure	80 PSIG					
Max. Working Temperature	240°F					
Gas Connections (NPT)	2”	2”	2’’	2’’	3’’ (Flange)	3’’ (Flange)
Oil Connections	0.375”	0.375”	0.5”	0.5”	0.5”	0.5”
Max. Gas Pressure	1 psi			2 psi		
Min. Gas Pressure 1	14”			1 psi		
Max #2 Fuel Oil Consumption Flow rate (GPH)	21.4	28.6	35.7	42.9	57.1	71.4
#2 Fuel Oil Supply Flow Rate	85	150	150	150	218	218
Electrical Req. 208V/3PH/60Hz 2, 3	11.4 FLA	16.8 FLA	16.8 FLA	16.8 FLA	25.8 FLA	25.8 FLA
Electrical Req. 460V/3PH/60Hz 2, 3	5.8 FLA	7.6 FLA	7.6 FLA	7.6 FLA	11.7 FLA	11.7 FLA
Electrical Req. 575V/3PH/60Hz 2,3	4.5 FLA	6.2 FLA	6.2 FLA	6.2 FLA	10.2 FLA	10.2 FLA
Control Circuit 120V/1PH/60Hz 2, 3	6.8 FLA					
Water Connections (Flanged)	4’’	6”	6”	6”	8”	8”
Dual Return Water Connection	Yes					
Min. Water Flow (GPM) [4]	0 / 19	0 / 25	0 / 31	0 / 38	0 / 50	0 / 62
Max. Water Flow (GPM)	350	520	610	700	890	1100
Water Volume Gallons	407	464	518	724	898	1043
Water Pressure Drop	2.4 PSIG @300 GPM	1 PSIG @400 GPM	1.3 PSIG @500 GPM	1.9 PSIG @600 GPM	1.1 PSIG @800 GPM	1.7 PSIG @1000 GPM
Turndown (Natural Gas/Propane)	Up to 5:1 (20%)					
Turndown (#2 Fuel Oil)	Progressive 2-Stage					
Vent/Air Intake Connections	10 Inch	12 Inch	12 Inch	14 Inch	16 Inch	16 Inch
Vent Materials	AL29-4C					
Type of Fuel	Natural Gas, Propane, #2 Fuel Oil (backup)					
NOx Emission on Nat. Gas	30 ppm	30 ppm	30 ppm	30 ppm	40 ppm	40 ppm
Temperature Control Range	125ºF to 230ºF					
Ambient Temperature Range	32ºFto140ºF (Preliminary)					
Standard Listings & Approvals	UL, CUL, CSD-1, ASME, AHRI(pending)					
Gas Train Operations	FM Compliant					
Weight (dry) Lbs.	7,300	10,160	11,063	13,137	16,645	18,520
Weight (wet) Lbs.	10,694	14,030	15,383	19,175	24,134	27,219
Shipping Weight Lbs.	7,300	10,160	11,063	13,137	16,645	18,520

NOTES:

[1] Values are for Natural Gas FM Compliant 2” gas trains available with Riello Dual Fuel (light oil/gas) burners. Additional gas train sizes added gas pressure ranges are available. Consult factory or see MFC Series Gas/Oil Components & Supply Design Guide GF-148-G for additional model gas train minimum gas pressure requirements.

[2] See the MFC Electrical Power Guide, GF-148-E, for Service Disconnect Switch amperage requirements.

[3] Values are for Riello Dual Fuel (light oil/gas) RLS 120-300 models. Consult MFC Electrical Power Guide, GF-148-E, for additional model and power requirements.

[4] Zero flow allowed during warm-up period of 5 minutes **maximum.** The second number is the minimum flow after the warm-up period and represents the boiler firing at the minimum input with a 60 degree delta T across the heat exchanger.

MFC Series Dimensions

Model	A (Width)	B (Length)	C (Height)	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S (REF)	T
MFC 3000	54.3"	171.5"	84.0"	63.0	126.0"	6.6"	72.9	0.6	12.6	35.2	73.0	48.9	7.1	2.6"	18.1	6.5	27.6	6.9	27.2	2.1
MFC 4000	58.7"	174.1"	88.3"	66.1	130.9"	7.3"	75.4	4.5	16.2	36.2	76.2	48.9	5.5	2.6"	17.3	6.4	27.4	6.9	29.3	2.1
MFC 5000	58.7"	186.3"	88.3"	66.1	143.0"	7.3"	75.4	4.5	16.2	36.2	76.2	49.3	5.5	2.6"	17.3	6.4	35.6	6.9	29.3	2.1
MFC 6000	70.9"	192.9"	101.1"	76.8	145.7	8.5"	87.1	3.1	22.8	40.9	86.8	50.8	6.5	**	21.1	6.6	53.2	6.7	35.4	2.1
MFC 8000	70.9"	220.4"	102.3"	76.8	165.4"	8.5"	87.1	7.8	22.8	40.9	86.8	53.8	5.0	3.1	18.1	7.2	55.9	7.1	35.4	2.1
MFC 10000	70.9"	240.0"	102.3"	76.8	185.0"	8.5"	87.1	7.8	22.8	40.9	86.8	52.7	5.0	3.1	18.0	7.2	70.9	7.9	35.4	2.1

*Dimensions and information for #2 fuel oil connections can be found in the Riello manual.
**MFC 6000 includes an 8" x 6" reducer. The reducer goes past the frame 4.0".

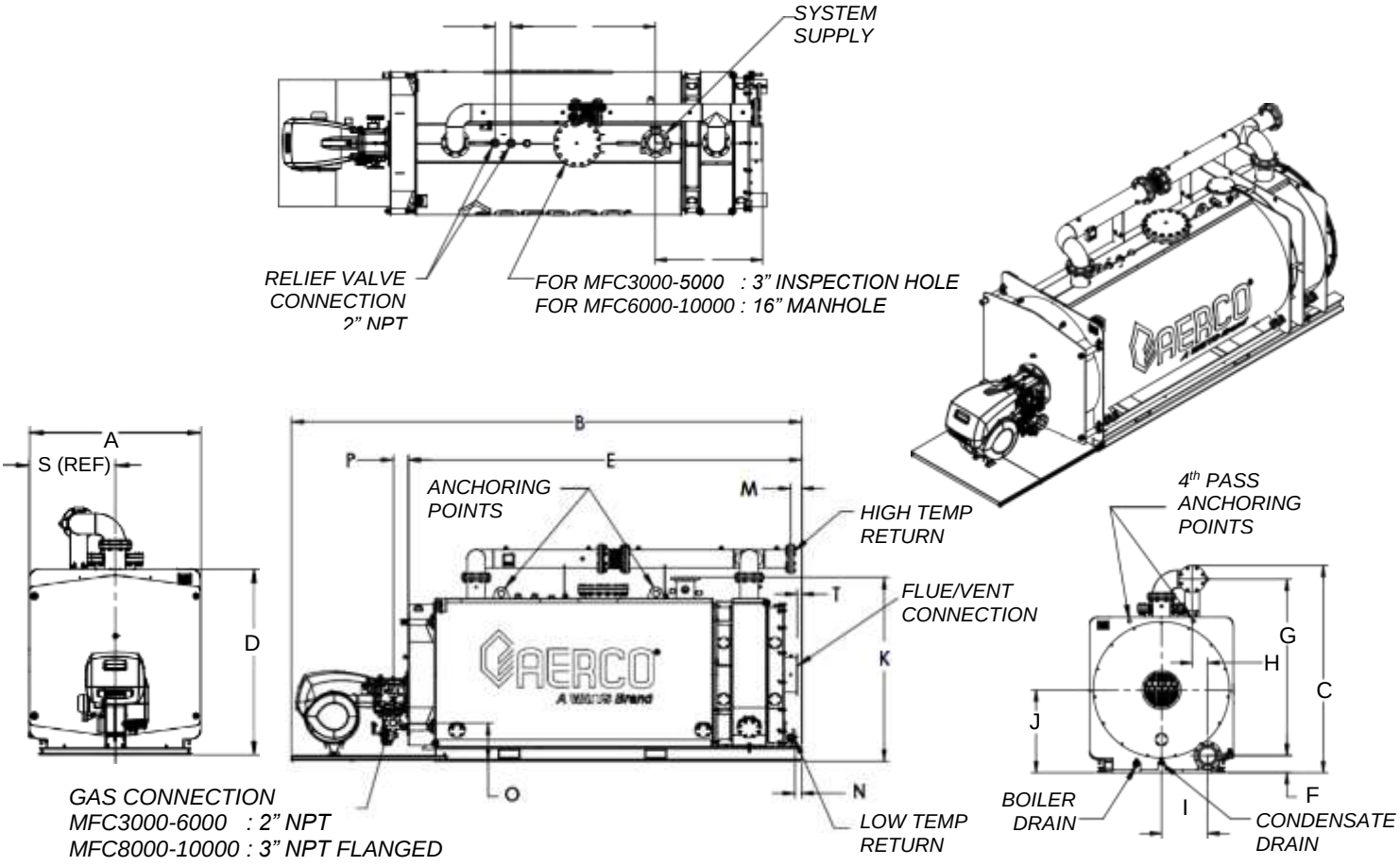

Figure 2-1: MFC Series Dimensional Drawing

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SECTION 3: INSTALLATION

3.1 Site Preparation

3.1.1 Electrical Requirements

(Refer to MFC Electrical Guide; GF-148-E / TAG-0077)

MFC Series boilers require 3Ø for the burner and include a step-down transformer as standard to provide 120VAC power to the control portion of the burner. Voltage requirements for each model are shown in the tables below:

Multi-Fuel (Gas-Oil) Power Requirements (Amperage)				
MFC	**Burner**	**208/3Ø/60**	**460/3Ø/60**	**575/3Ø/60**
3000	RLS120	20.0	15.0	15.0
4000	RLS160	30.0	15.0	15.0
5000	RLS160	30.0	15.0	15.0
6000	RLS160	30.0	15.0	15.0
8000	RLS300	40.0	20.0	15.0
10000	RLS300	40.0	20.0	15.0

Gas Burner Power Requirements (Amperage)				
MFC	**Burner**	**208/3Ø/60**	**460/3Ø/60**	**575/3Ø/60**
3000	RS68	15.0	15.0	15.0
4000	RS120	15.0	15.0	15.0
5000	RS160	15.0	15.0	15.0
6000	RS160	20.0	15.0	15.0
8000	RS300	30.0	15.0	15.0
10000	RS300	30.0	15.0	15.0

3.1.2 Natural Gas Requirements

(Refer to MFC Fuel Guide; GF-148-G / TAG-0078)

MFC boilers must have access to a Natural Gas line with the following ***minimum*** pressures with the unit at **FULL FIRE:**

- **MFC 3000 – 5000** = 14" W.C.
- **MFC 6000 – 10000** = 1 psi.

3.1.3 Installation Clearances

The MFC series boiler dimensions and minimum acceptable clearances are shown in Figures 3-1 and 3-2. The minimum clearance dimensions, required by AERCO, are listed below. However, if Local Building Codes require additional clearances, these codes shall supersede AERCO's requirements. Minimum acceptable clearances required are as follows:

- **FRONT:** = 24 inches (610 mm) (From front of blower).

NOTE: 24" is a minimum requirement per NFPA. If a tube must be replaced, the following minimum front door clearances are required:

MODEL	DISTANCE
MFC 3000	70" (1778 mm)
MFC 4000	70" (1778 mm)
MFC 5000	80" (2032 mm)
MFC 6000	85" (2159 mm)
MFC 8000	105" (2667 mm)
MFC 10000	122" (3099 mm)

- **SIDES:** = 24 inches (610 mm)
- **REAR:** = 24 inches (610 mm)
- **TOP:** = 12 inches (457 mm) from top of secondary inlet (high temp.) pipe connection.

NOTE:

MFC Series boilers may be installed side by side with a minimum 6" side clearance, as long as there is access to the rear of the units. Note the necessary burner door orientation per Figure 3-2. The perimeter clearances still apply. The door hinge will need to be reversed on one of the paired units. Refer to Section 3.8 for instructions on how to reverse the opening direction of the door.

All gas piping, water piping and electrical conduit or cable must be arranged so that they do not interfere with the removal of any panels, or inhibit service or maintenance of the unit.

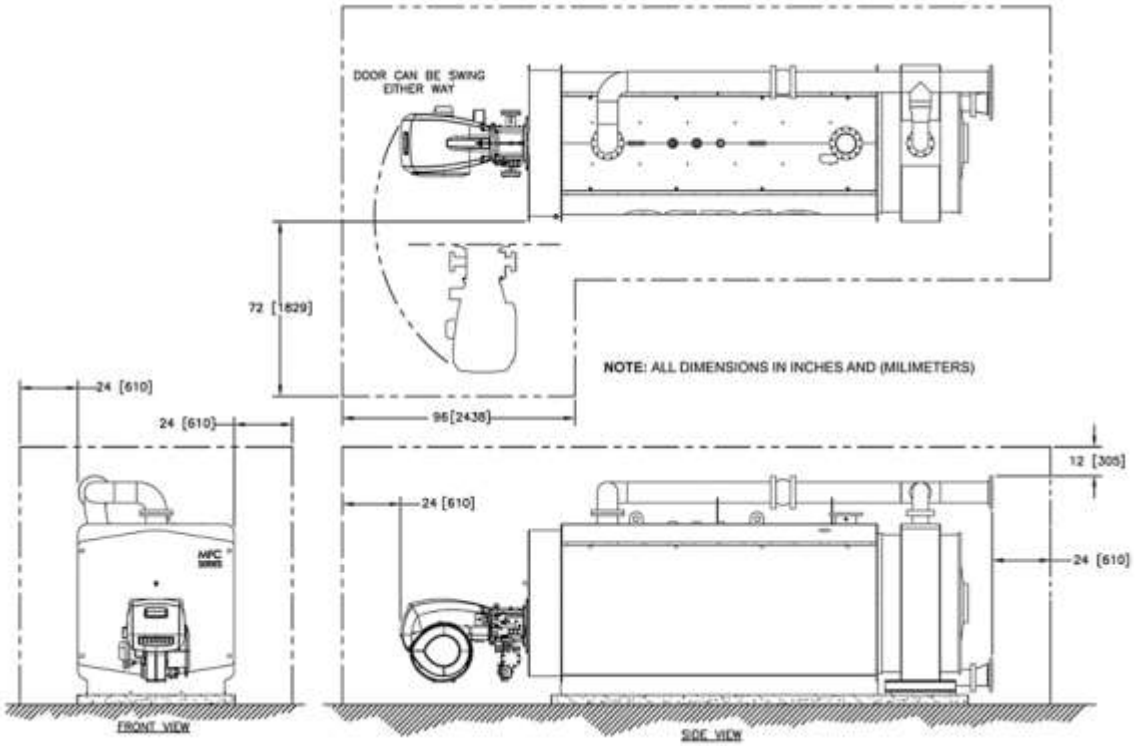


Figure 3-1: MFC Series – Single Unit Installation Clearances

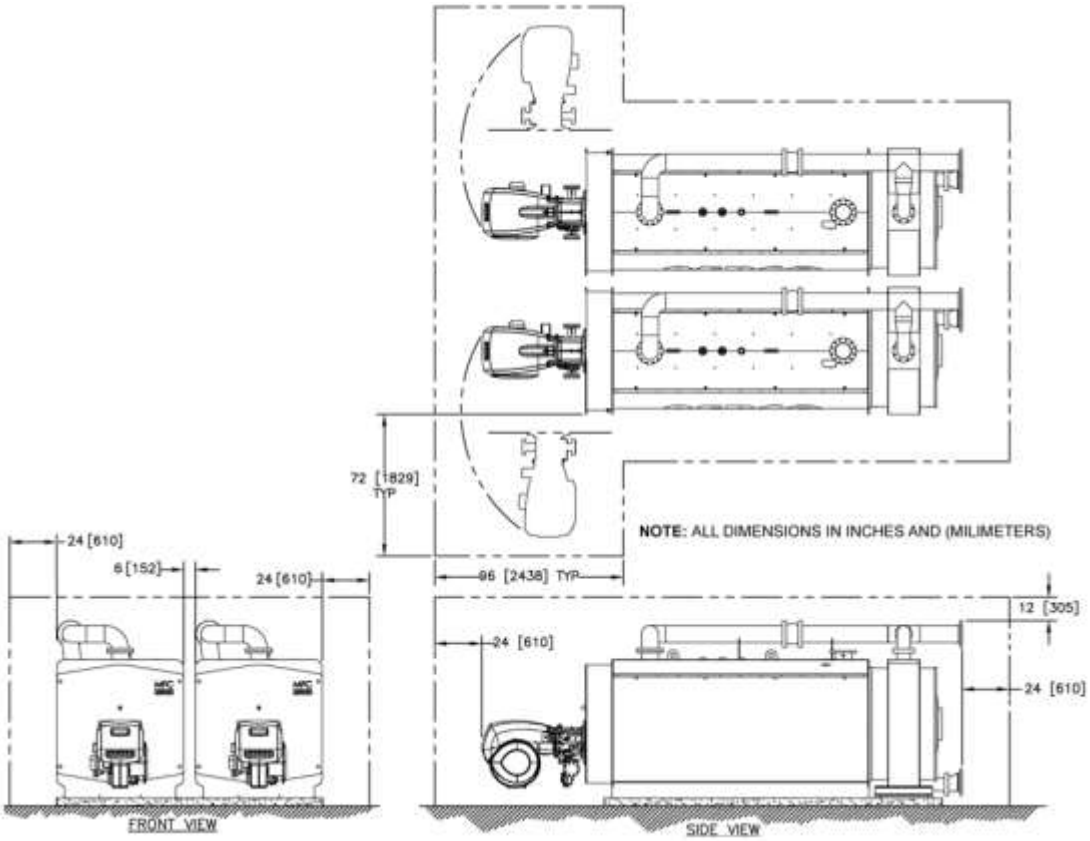


Figure 3-2: MFC Series – Multiple Unit Installation Clearances

WARNING:

Keep the unit area clear and free from all combustible materials and flammable vapors or liquids.

FOR MASSACHUSETTS ONLY:

For Massachusetts installations, the unit must be installed by a plumber or gas-fitter that is licensed within the Commonwealth of Massachusetts. In addition, the installation must comply with all requirements specified in Chapter 1 – Safety Precautions.

3.2 Installation - Site

MFC Boilers must be installed on a 4" pad, minimum, to enable the condensate to drain.

Before **connecting** the boiler, perform the following operations:

- Thoroughly clean all the **system pipes** in order to remove any foreign matter that could affect correct operation of the boiler.
- Check that the flue has no narrowing of passages and that it is free from debris; also check that other appliances do not discharge into the flue. See the regulations in force.

3.3 Boiler Room

Current regulations must always be observed. Premises in which boilers will be installed should be sufficiently ventilated and permit access for maintenance operations.

3.4 Flue

The exhaust flue must be dimensioned as to applicable regulations. See the MFC Series Venting Guide, GF-148-V for venting installation instructions and guidelines.

3.5 Water Connections

NOTE:

Refer to the MFC Series Boiler Application Guide, OMM-0081 (GF-148-B) for specific guidelines regarding installation of a variety of different water piping configurations and applications. The following are general guidelines only.

Refer to Figure 3-3 for component identification in a sealed hot water heating system with an expansion tank. This figure also shows an example of MFC Series water connections. Ensure that the hydraulic pressure measured after the reduction valve on the supply pipe does not exceed the operating pressure specified on the rating plate of the boiler.

- As the water contained in the heating system increases in pressure during operation, ensure that its maximum value does not exceed the maximum hydraulic pressure specified on the component rating plate.
- Ensure that the safety valve outlets of the boiler and hot water tank, if any, are piped to within 12 inches (30.5 cm) of the floor to prevent injury in the event of a discharge.
- Ensure that the pipes of the water and heating system are not used as an earth connection for the electrical system as this can seriously and very rapidly damage the pipes, boiler, heater and radiators.
- Once the heating system has been filled, you are advised to close the supply cock and keep it closed so that any leaks from the system will be identified by a drop in hydraulic pressure indicated on the system pressure gauge.

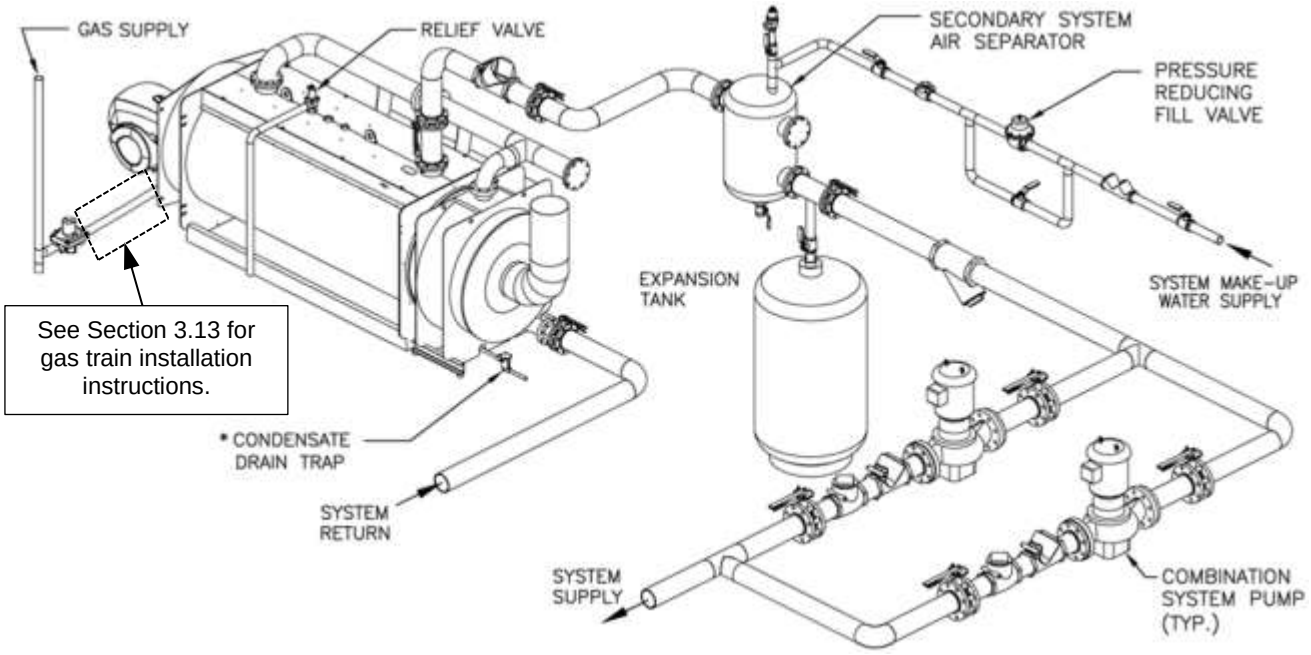


Figure 3-3: MFC Series – Water Connections and Components Example

3.6 Electrical Connections

Electrical systems of thermal plants designed only for heating purposes must comply with numerous legal regulations which apply in general as well as specifically to each application or fuel type.

Each unit must be connected to a dedicated electrical circuit. NO OTHER DEVICES SHOULD BE ON THE SAME ELECTRICAL CIRCUIT AS THE BOILER.

A three-pole switch must be installed on the electrical supply line in an easily accessible location to quickly and safely disconnect electrical service. DO NOT attach the switch to sheet metal enclosures of the unit.

After placing the unit in service, the ignition safety shutoff device must be tested. If an external electrical power source is used, the installed boiler must be electrically bonded to ground in accordance with the requirements of the authority having jurisdiction. In the absence of such requirements, the installation shall conform to National Electrical Code (NEC), ANSI/NFPA 70 and/or the Canadian Electrical Code (CEC) Part I, CSA C22.1 Electrical Code.

3.7 Burner Door Opening Orientation

The boiler door is installed at the factory with standard opening from the left and with functioning hinges on the right. Refer to Figure 3-4 and note the difference in door fixing hardware.

The opening-side features two large barrel nuts featuring a horizontal hole on the head for use with the door opening tool, as well as a washer under each. The hinge side features two large barrel nuts with keyed heads that are only removable using a wrench, and should never be removed unless the door opening is being reversed.

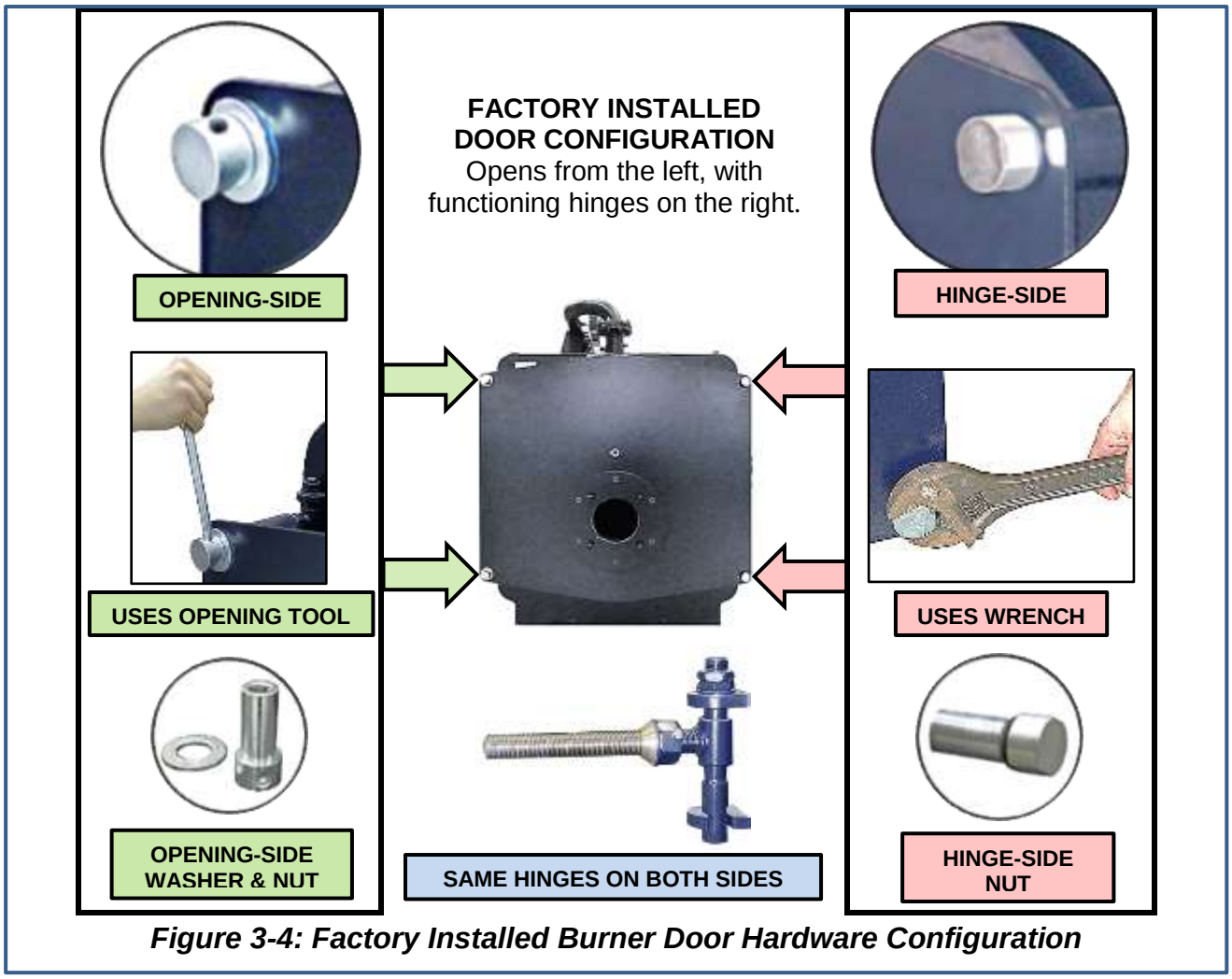


Figure 3-4: Factory Installed Burner Door Hardware Configuration

3.8 Reversing the Opening Direction of the Burner Door

Since there are already integral hinges on both sides of the door, the only procedures necessary to reverse the opening direction is to reverse the left and right side door fixing hardware, and then to ensure a tight seal and proper opening of the door, making adjustments if necessary. Instructions for reversing the door direction follow.

WARNING!

The boiler door is very heavy and it is dangerous to inappropriately remove door hardware and risk the door detaching from the boiler, which can cause serious harm to persons and damage to property. The boiler door should be kept closed at all times while switching hardware and the instruction steps followed in the exact order as written.

Reversing the Opening Direction of the Burner Door (Left to Right)

1. Ensure all barrel nuts and door hardware are tightened appropriately and the door swings freely and fits properly when closed and all hardware is secure.
2. Check the adjustment nuts on all four hinges to assure they are secure. These adjusting nuts are used to adjust and level the boiler door during the procedure if needed. See Section 3.10 for more information about adjustments if needed.

NOTE:

The main barrel nuts on the front should be switched in a "X" pattern, with one opening-side and one hinge-side nut always completely secured. Start by reversing the upper left (open-side) bolt with the lower right (hinge-side) nut, as shown in Figure 3-5.

WARNING!

NEVER REMOVE ALL FOUR BARREL NUTS AT THE SAME TIME!

Figure 3-5: Switching Upper Left and Lower Right Bolts

3. Use the door opening tool to loosen **upper left** nut & washer and remove.

Figure 3-6: Removing Upper Left Nut and Washer with Door Opening Tool

Reversing the Opening Direction of the Burner Door (Left to Right) – Cont.

4. Use a wrench to loosen and remove the **lower right** nut and remove it.

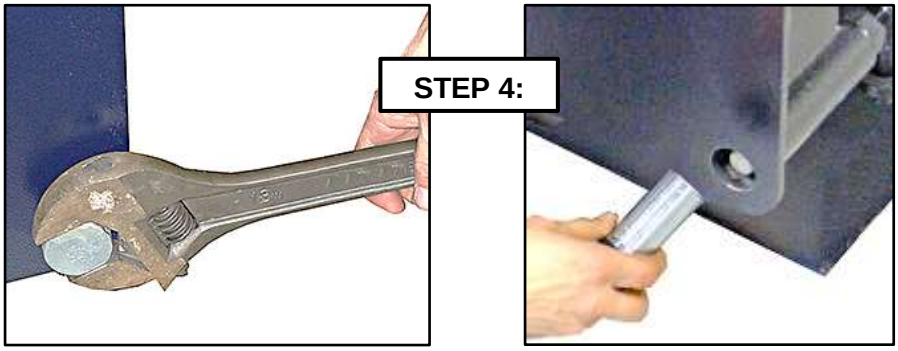


Figure 3-7: Removing lower Right Nut with Wrench

5. Insert the hinge-side nut just removed from the lower right position into the **upper left** hole as shown in Figure 3-8a. Tighten using the wrench, but do not tighten completely.
6. Insert the opening-side nut and washer just removed from the upper left position into the **lower right** hole as shown in Figure 3-8b. Tighten it with the door opening tool.
7. Now tighten the hinge-side nut in the **upper left** position completely with the wrench.

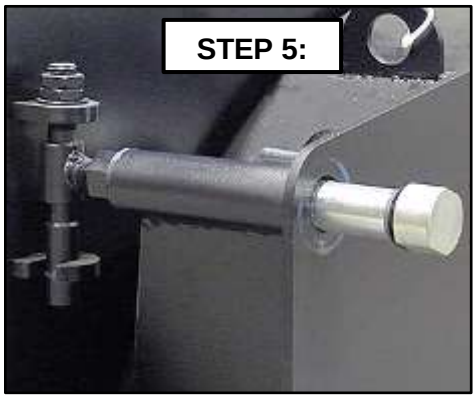


Figure 3-8a: Hinge Nut to Upper Left

Figure 3-8b: open-Side Nut to Lower Right

8. Perform the same procedure above, only by reversing the lower left opening-side nut with the upper right hinge-side nut, as illustrated in Figure 3-9.

CAUTION!

When cross-changing the barrel nuts, always make sure that the other two barrel nuts are fastened, so that they hold the door.

WARNING!

NEVER REMOVE ALL FOUR BARREL NUTS AT THE SAME TIME!

Reversing the Opening Direction of the Burner Door (Left to Right) – Cont.

Figure 3-9: Switching Upper Right and Lower Left Nuts

9. Check the correct adjustment of the hinges ensuring that, during door closure, the seal gasket of the boiler door is evenly pressed in the center on the whole circumference. If necessary, adjust as described in the next section.

3.9 Adjusting the Boiler Door – Vertical and Horizontal

Reversing door hardware may cause slight shifts in weight, that may in turn cause the door to not close uniformly, or even shift enough to prevent the nuts from being inserted into the holes onto the hinge bolts. The following instructions show how to adjust the boiler door if necessary.

WARNING!

Incorrect burner door adjustment may result in a dangerous situation for people and property.

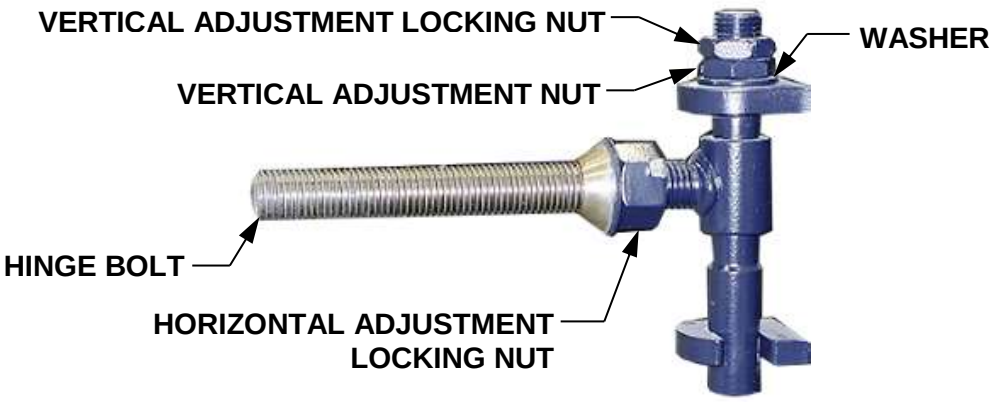


Figure 3-10: Hinge Mechanical Features

If the boiler door is not seating over the boiler opening properly, or if there are problems inserting the barrel nuts over the hinge bolts, perform the following.

Adjusting the Boiler Door – Vertical Adjustment

1. Determine which hinges need adjustment.
2. With the door ajar, loosen the vertical adjustment locking nuts of the hinge.
3. Adjust the vertical adjustment nut as required to raise or lower the hinge bolt.
4. When satisfied with the adjustment, retighten the locking nut.

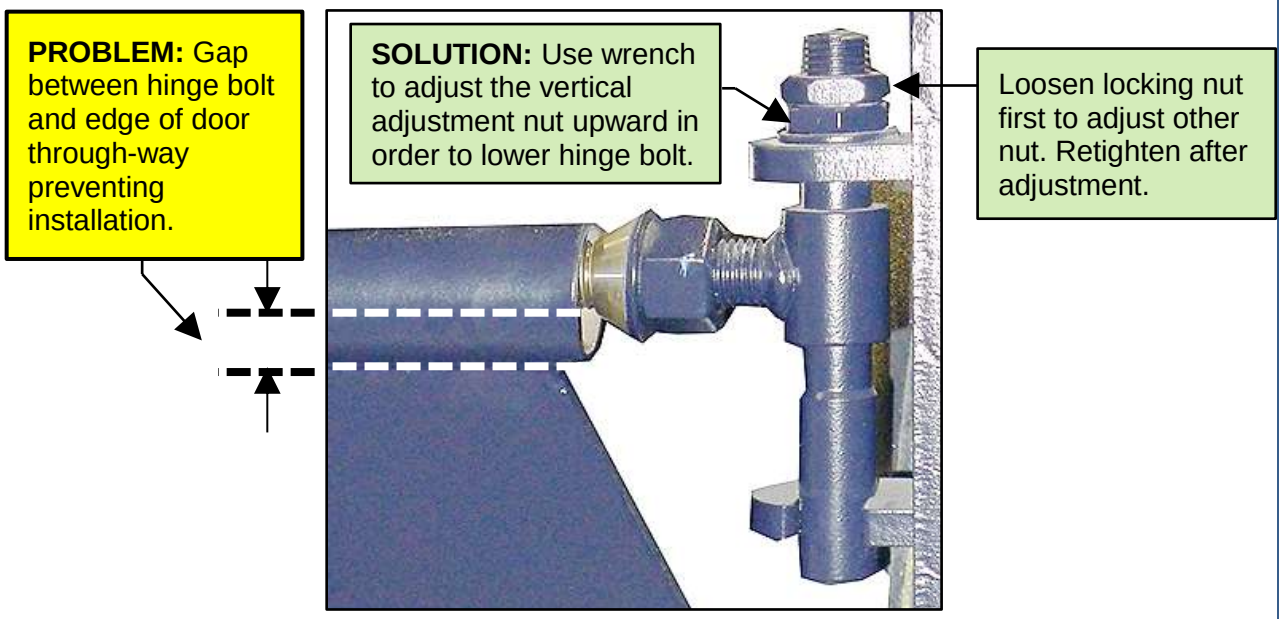


Figure 3-11: Example Problem for Adjusting Vertical Adjustment Nut on Hinge

Adjusting the Boiler Door – Horizontal Adjustment

1. Close the door and check that there is equal distance, on both sides, between the stop plate of the door and the band surrounding the door opening.
2. With the door ajar, adjust the vertical adjustment nut as required to increase or decrease the distance the hinge joint projects into the door opening.
3. When satisfied with the adjustment, retighten the locking nut.
4. Check the proper adjustment in depth ensuring that the door, manually pushed up to the stop plate naturally returns to the slightly ajar position. This is to ensure the hinge side door seal.

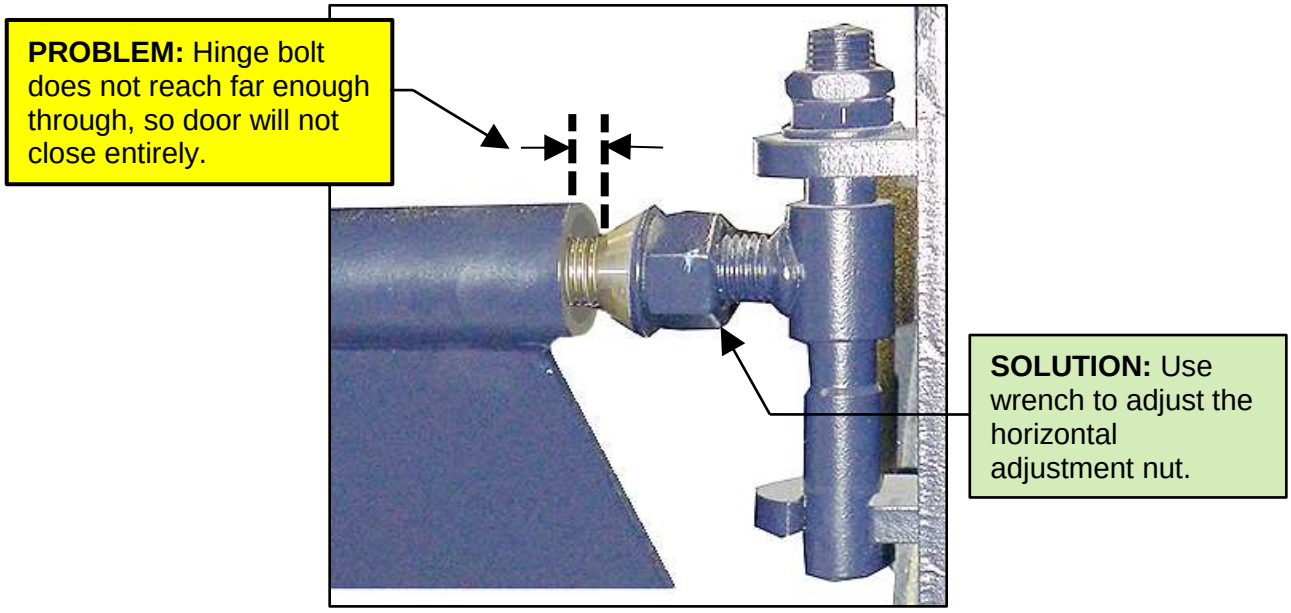


Figure 3-12: Adjusting Horizontal Adjustment Nut on Hinge

For any problems related to the reversal and adjustment of the door, we recommend contacting AERCO technical support team at **1-800-526-0288.**

3.10 Condensate Trap and Boiler Drain Valve Installation

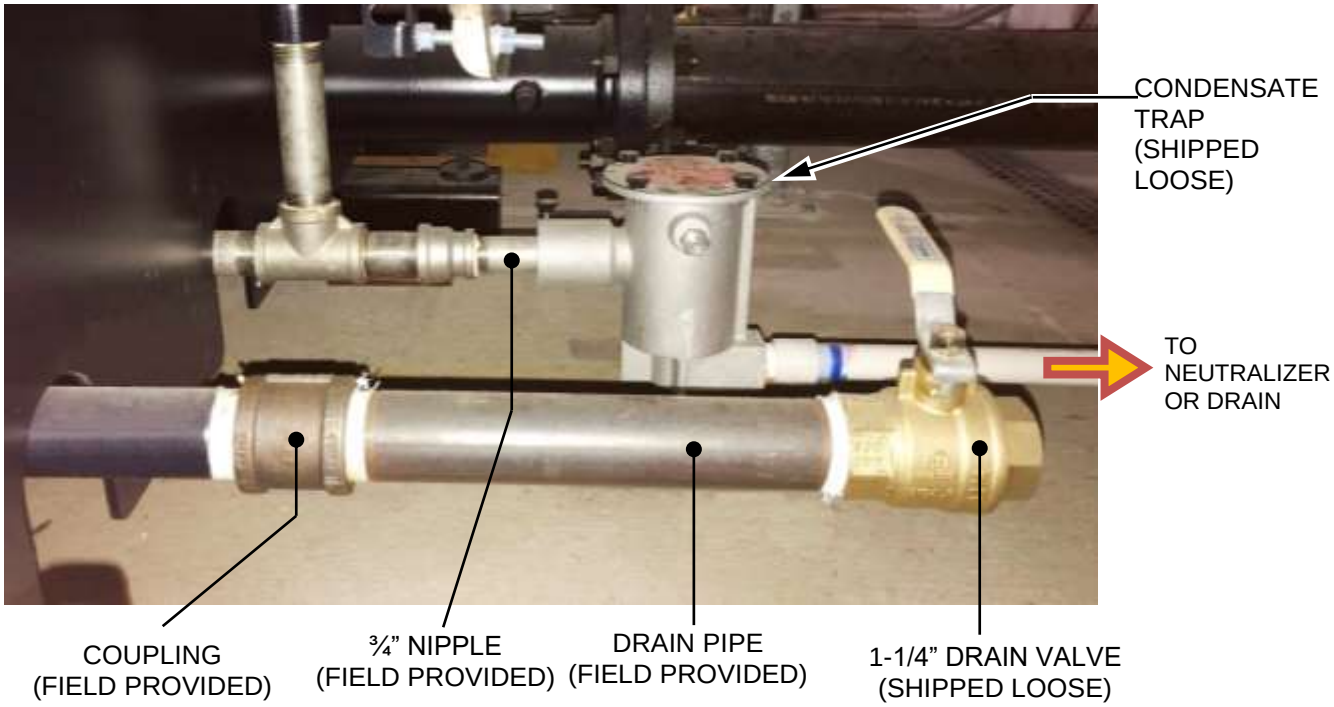


Figure 3-13: Example of Condensate Drain Piping Installed to Condensate Trap

For dual fuel applications, the condensate drain piping is recommended to be installed with diverting valve(s) (examples shown in Figure 3-14) for ease of maintenance of the 4th pass.

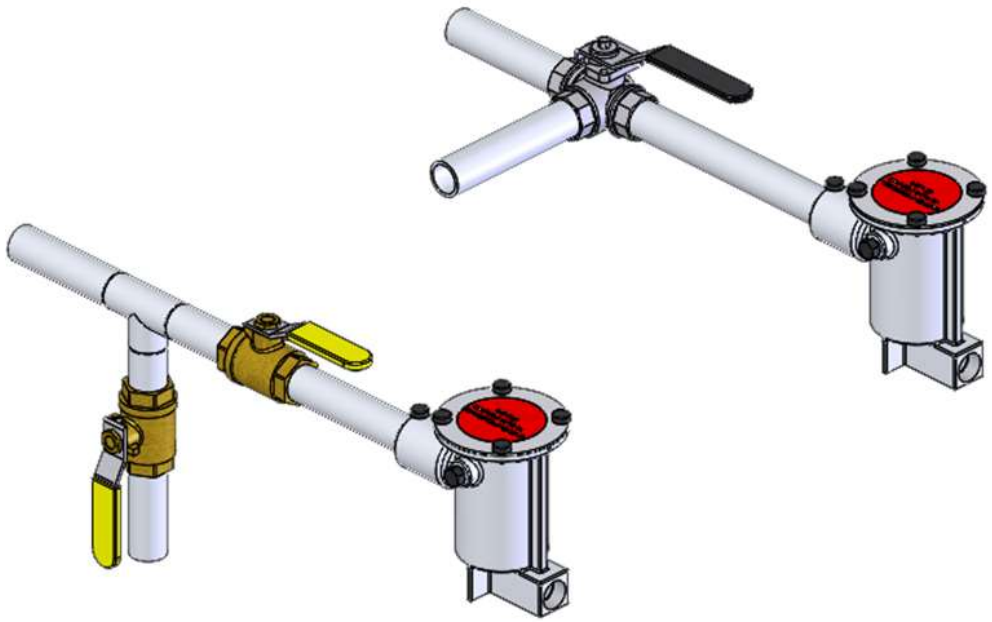


Figure 3-14: Condensate Drain Diverting Valves for Duel Fuel Applications (Provided By Others)

3.11 Control & Safety Devices

Certain control and safety devices are supplied with the boiler, although they may be installed somewhat differently or in conjunction with other devices not supplied according to special system configurations and/or local codes.

The following parts are factory installed:

- Low Water Cutoff
- Secondary low water Cutoff (Optional)
- Manual Reset High Limit
- Operating High Limit
- Temperature Sensor for Modulating Control
- Tridicator
- Pressure Relief Valve(s)

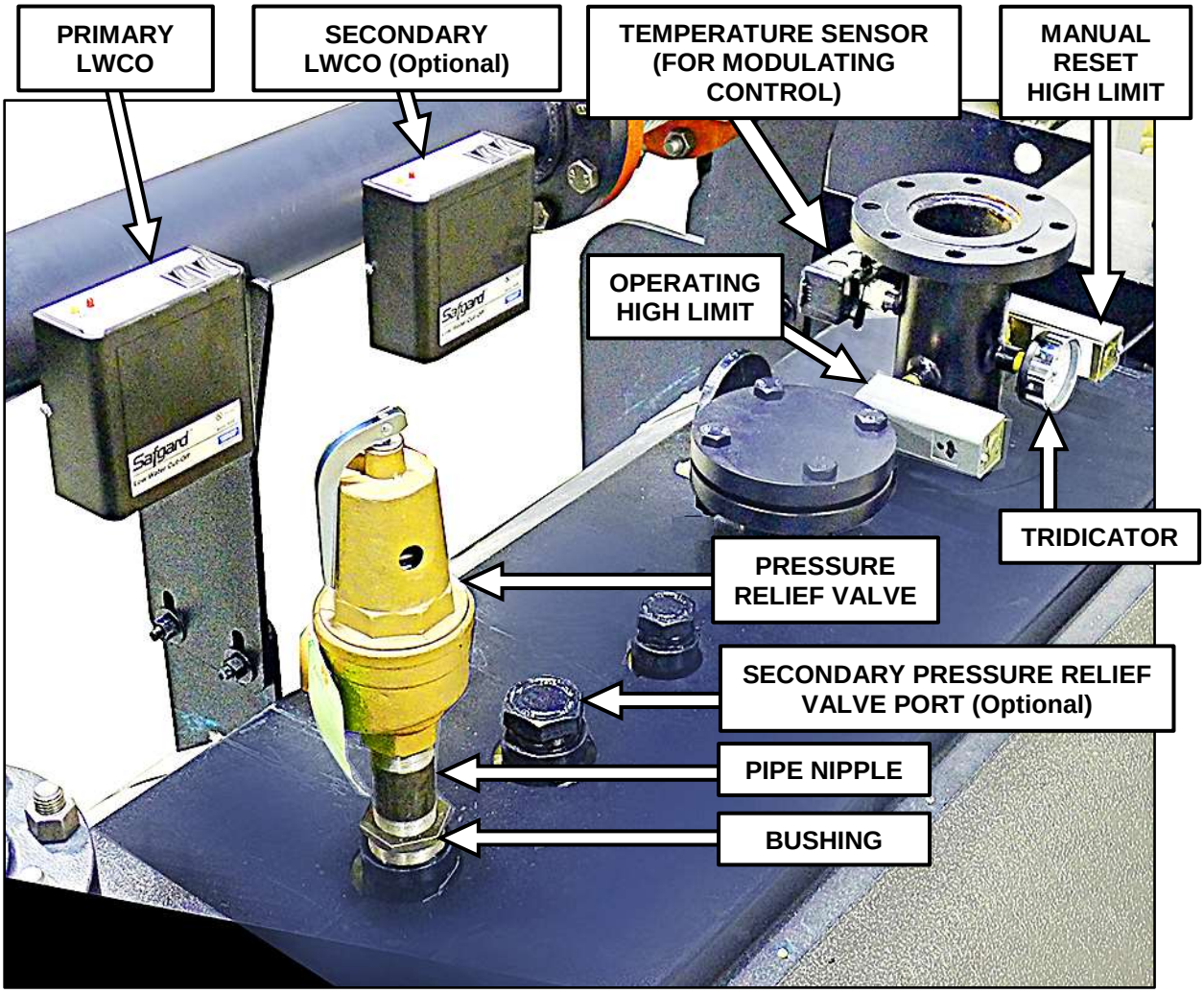


Figure 3-15: Location of Safety Relief Valve & Other Safety & Control Devices

3.12 Burner/Blower

Refer to the Figure 3-16 for location of blower/burner gas and oil connections for AERCO supplied Riello burners.

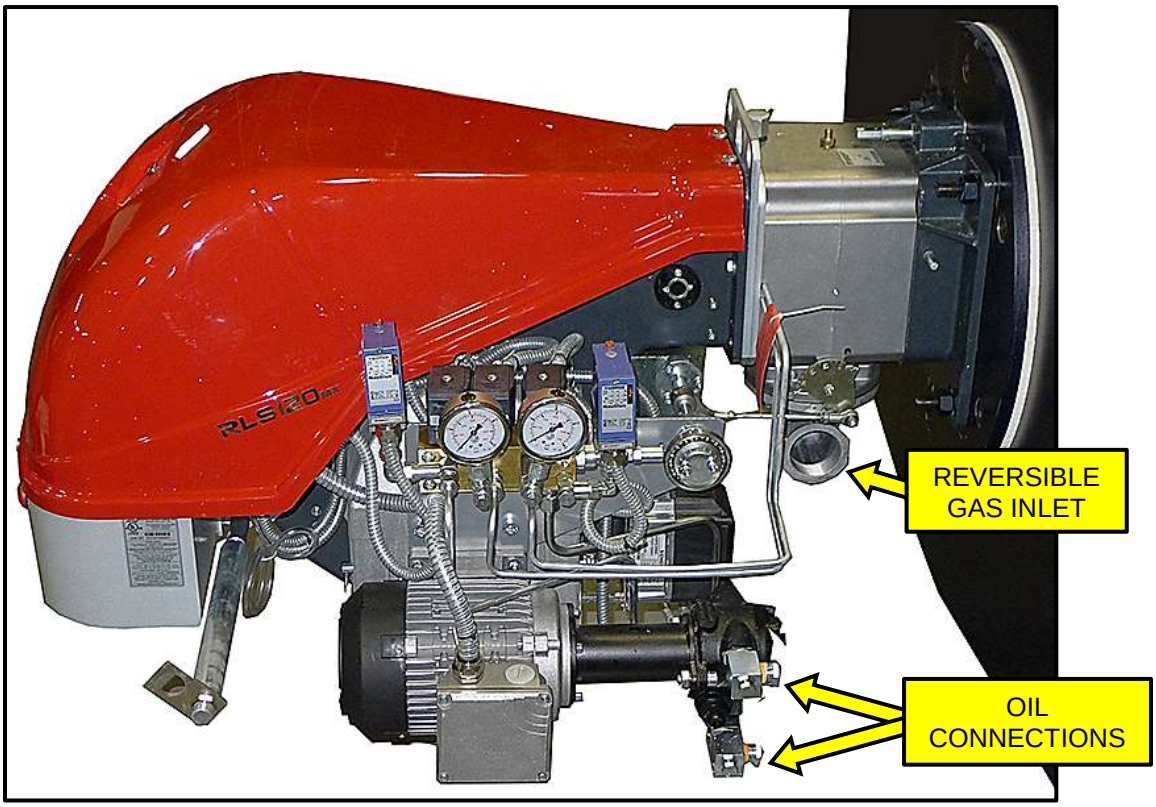


Figure 3-16: Blower/Burner Gas and Oil Connection Locations

3.12.1 Introduction

Before installation you are advised to clean thoroughly the inside of all the fuel supply system pipes to remove any foreign matter that could affect correct operation of the burner. The following actions should also be performed:

- Check that there are no leaks in the fuel supply system.
- Regulate the fuel flow according to the power required by the boiler.
- Check that the boiler is fired by the correct type of fuel.
- Check that the fuel supply pressure is within the values specified on the burner rating plate.
- Check that the fuel supply system is sized for the maximum flow rate necessary for the boiler and that it is provided with all control and safety devices provided for by the regulations referred to above.

In particular, when using natural gas:

- Check that the natural gas supply pipe complies with the regulations in force;
- Check that all the natural gas connections are sealed;

- Check that the boiler room vents are of sufficient size to ensure the air flow dictated by the regulations in NFPA 86;
- Check that the gas pipes are not used as earth connections for electrical appliances. If the boiler is not going to be used for some time, close the fuel supply cock or cocks.

3.12.2 Requirements

Note that instructions are only applicable to Riello burner models RLS 160/300 and RS 68/120/160/300, acquired through AERCO. For burners not acquired through AERCO:

- Consult the respective burner manufacturer for proper installation instructions.
- The burner mounting plate must be field fabricated.

3.12.3 Checking the Insulating Material

Open the door and check that the gap between the burner blast tube and the mounting plate are properly filled with thermo-insulating material. The boiler is supplied with insulating material for the combustion blast tube. Alternate material may be used as insulating material if necessary.

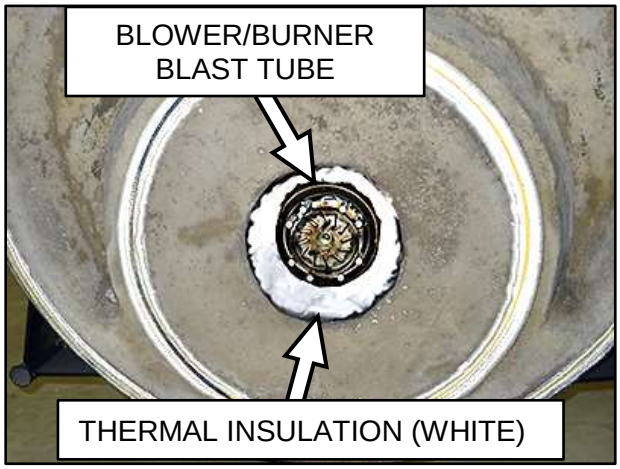


Figure 3-17: Thermal Insulation

3.13 Gas Train Installation

The gas train for Riello burners acquired from AERCO is shipped loose and must be assembled and installed at the site, as shown below.

Electrical connections for gas train components are shown in Appendix A.

Note that both the gas line and the pilot line require two unions near the front of the unit. All four unions (field provided) are required as shown in the Figure below to allow the unit's front door to swing open.

An external regulator must be installed at each MFC boiler, as shown in Figure 3-18, below. For installations that have greater than 14" W.C. supply pressure, and external lock-up type regulator must be installed.

The recommended distance between the gas pressure regulator and the nearest pipe fitting, elbow or valve is 5 to 10 pipe diameters.

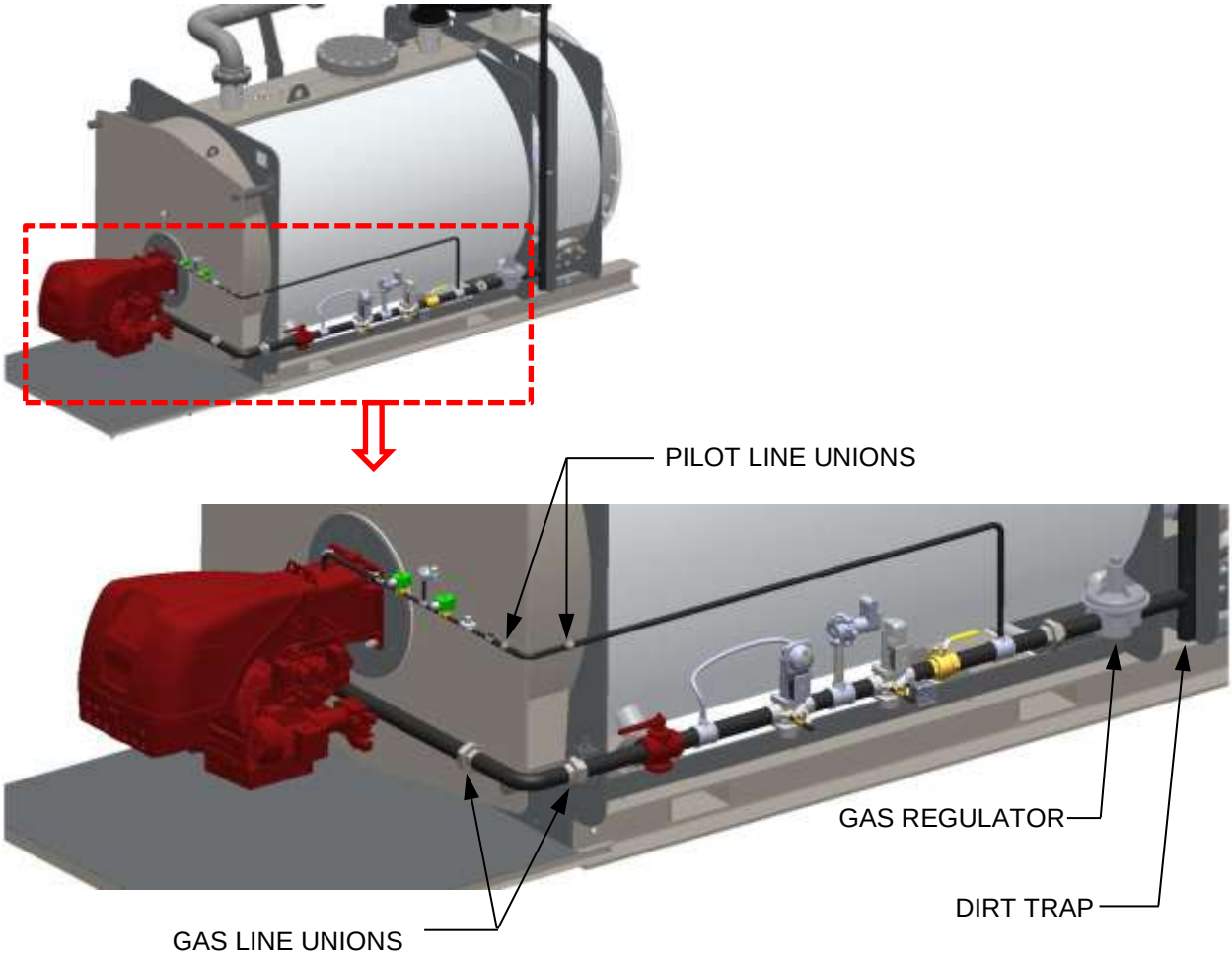


Figure 3-18: Gas Train Assembly – Installed

SECTION 4: STARTUP

4.1 Preliminary Checks

Before starting the boiler, check the following:

- The rating plate specifications and power supply network (electricity, water, gas or fuel oil) specifications correspond;
- The burner power range is compatible with the power of the boiler;
- There is a copy of the burner instructions in the boiler room;
- The flue gas exhaust pipe is correctly fitted;
- The air inlet supply is the correct size and free of any obstacles;
- The manhole, the exhaust flue and the burner plate are closed in order to provide a complete flue gas seal;
- The system is full of water and all air pockets have been eliminated;
- The anti-freeze protections are operative;
- The water circulation pumps are operating correctly;
- The expansion vessel and the safety valve(s) have been connected correctly and are properly operating.
- Check the electrical parts and thermostat operation.

4.2 Water Treatment

The most common phenomena that occur in heating systems are described below.

4.2.1 Scaling

Scale reduces heat transfer between the combustion gases and the water, causing an abnormal increase in the temperature of the metal and therefore reducing the life of the boiler.

Scale is found mostly at the points where the wall temperature is highest and the best remedy, at construction level, is to eliminate areas that overheat.

Scale creates an insulating layer which reduces the thermal transfer of the boiler, affecting system efficiency. This means that the heat produced by burning the fuel is not fully exploited and is lost to the flue

4.2.2 Corrosion on the Water Side

Corrosion of the metal surfaces of the boiler on the water side is due to the passage of dissolved iron through its ions (Fe+). In this process the presence of dissolved gases and in particular of oxygen and carbon dioxide is very important. Corrosion often occurs with softened or demineralized water which has a more aggressive effect on iron (acid water with Ph <7): in these cases, although the system is protected from scaling, it is not protected against corrosion and the water must be treated with corrosion inhibitors.

For more information concerning water quality and requirements, see the MFC Boiler Application Guide, GF-148-B.

4.3 Filling the System

The water must enter the system as slowly as possible and in a quantity proportional to the air bleeding capacity of the components involved. Filling times vary depending on the capacity and characteristics of the system.

In the case of a sealed system with an **expansion vessel**, water is let in until the pressure gauge indicator reaches the static pressure value pre-set in the vessel.

Heat the water to maximum temperature. During this operation the air contained in the water is released through the automatic air separators. Once the air has been entirely released, reset the pressure to the pre-established value and close the manual and/or automatic filling valve.

4.4 Combustion Calibration Guidelines

Follow the combustion calibration guidelines below for both natural Gas and Oil.

4.4.1 Natural Gas

- Maintain Oxygen (O_2) level of **3% to 5%** for firing rates ***greater*** than 50%
- Maintain Oxygen (O_2) level of **4% to 6%** for firing rates ***less*** than 50%
- Maintain Carbon Di-Oxide (CO_2) level of **10.2%** maximum for firing rates ***greater*** than 50%
- Maintain Carbon Di-Oxide (CO_2) level of **4%** maximum for firing rates ***less*** than 50%

4.4.2 Oil

- Maintain Oxygen (O_2) level of **6% minimum** for all firing rates with a smoke level less than 1.
- Maintain Carbon Di-Oxide level of **11% maximum** for all firing rates with a smoke level less than 1.

SECTION 5: MFC SERIES MAINTENANCE

IMPORTANT:

Carry out thorough cleaning and periodic maintenance to ensure a correct and safe operation of the system. A perfectly clean tube bundle increases the thermal exchange between fumes and water contributing to energy saving and reducing air pollution.

5.1 Preparation for Inspection and Maintenance

CAUTION:

Before carrying out any kind of maintenance, in order to avoid risks, the operator must be equipped with all the personal protection provided by the standards in force.

WARNING:

Before performing any cleaning and maintenance operation, it is first necessary to disconnect the device from both the fuel and the mains supply. Proper lockout/tagout procedures should be utilized when needed.

Maintenance must be entrusted only to **technically qualified personnel** and can be either mechanical or electrical.

The preparation and status of the boiler may be different, depending on the operations to be performed:

- **With the boiler running,** to check the integrity of the boiler when hot (fume trace seal, water side gasket seal, flue draught, operation of adjustment and safety accessories),
- **With switch-off and complete cooling** of the boiler, when having to open the front door with inspection inside the furnace and fume chamber.
- **With cooling complete, the boiler emptied and the electrical locked out** when doing waterside inspections.

WARNING:

Particular precautions must be taken to avoid the risk of electric shock since the system on the boiler has accessories powered at 120V and 208, 460 or 575V.

CAUTION:

Before performing any maintenance on the boiler, ensure that the electrical connections and grounds have been made according to current standards.

5.2 Standard Maintenance

- Carry out burner maintenance (as to the specific burner manufacturer's instructions) and have the calibration checked by duly qualified personnel.
- Check the tightness of flange bolts and the state of the gaskets;
- Analyze the system water and make sure it is treated in such a way that scaling does not occur, as scaling reduces performance and can cause premature failure of the boiler. Ensure the refractory is not damaged and the gaskets between the boiler and door are not damaged. Replace or repair as necessary.
- Boiler Fireside inspection and Cleaning: Schedule a Fireside Inspection and Cleaning of the boiler according to the following firing conditions:

Firing Only Natural Gas or Propane	Every **24 months** and clean as necessary.
Firing #2 Fuel Oil	Every **12 months** and clean as necessary.

To perform a Fireside Inspection and Cleaning, perform the following procedures:

Boiler Fireside Inspection and Cleaning

1. Access the burner tubes, inspect, and determine if cleaning is necessary. (a in Fig. 13-1).
2. Remove the turbulator from each tube and clean of any fouling.

NOTE:
In general, gaseous fuels should not produce any carbon deposit. However, if liquid fuels are used, it is necessary to frequently clean to avoid substantial fouling.

3. Use a wire brush to internally clean each tube.
4. Reinsert the turbulators into the tubes and reassemble unit.
5. Vacuum any dust or particulate from cleaning in the rear of the tubes using the available access ports.

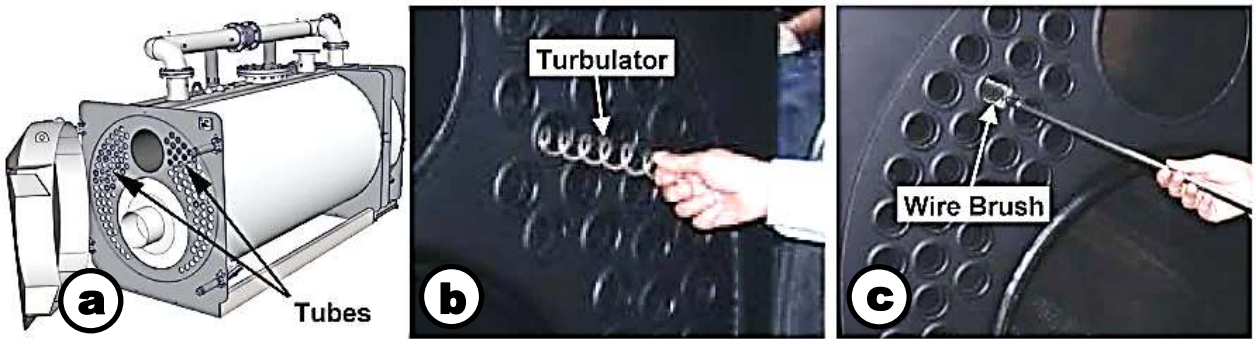


Figure 5-1: Burner Tube and Turbulator Maintenance

If a more thorough cleaning is necessary, the Stainless Steel 4th Pass has a total of eight (8) access ports to allow cleaning from the backside of the boiler. See next maintenance item for 4th Pass cleaning procedure.

5.2.1 4th Pass Inspection and Cleaning

The procedures to clean the 4th Pass are as follows.

NOTE:

When firing on oil, an inspection of the 4th pass should be conducted every 5 days or after 120 hours of operation, but only cleaned if necessary (if any particulate build-up is witnessed).

4th Pass Inspection and Cleaning

1. Utilize the first set of access ports on either side of the 4th pass for access per Figure 5-2.

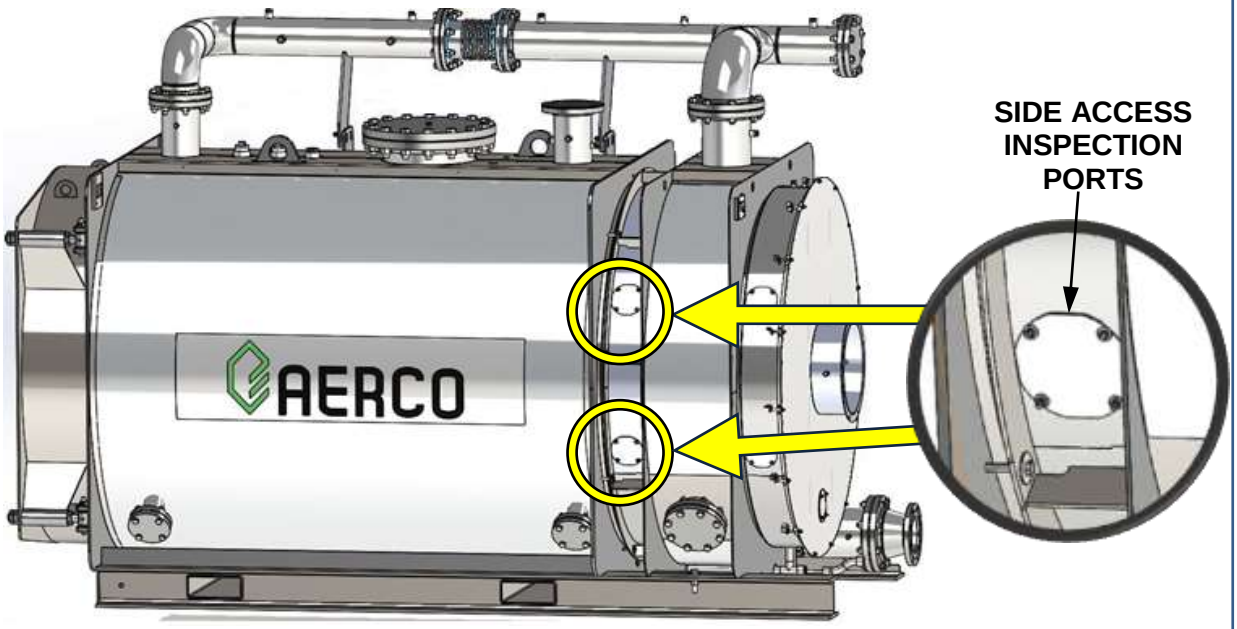


Figure 5-2: Location of Side Access Inspection Ports (Two Each Side)

2. Use a combination of compressed air/water or just pressurized water to clean.
3. An extension and a 90 degree head will be needed to facilitate cleaning (pressure wash) of the 4th pass. See Figure 5-3 for an example.

Figure 5-3 Example of 90 Degree Head Needed for Cleaning 4th Pass

4. Be sure any waste water from cleaning does not enter the condensate trap and neutralizer (a diverting valve(s) may be installed on the condensate line for ease of maintenance).
5. Once cleaning is complete, close all access ports, and resume operation of the unit.
   - Check the integrity of the electrical system on the boiler.
   - Perform a combustion testing and adjust as necessary.

5.3 Burner Maintenance

The periodic maintenance is essential for the good operation, safety, yield and duration of the burner. It allows you to reduce consumption and polluting emissions and to keep the product in a reliable state over time.

For burner maintenance instructions, consult the burner manual provided with the burner installed on your unit.

WARNING!

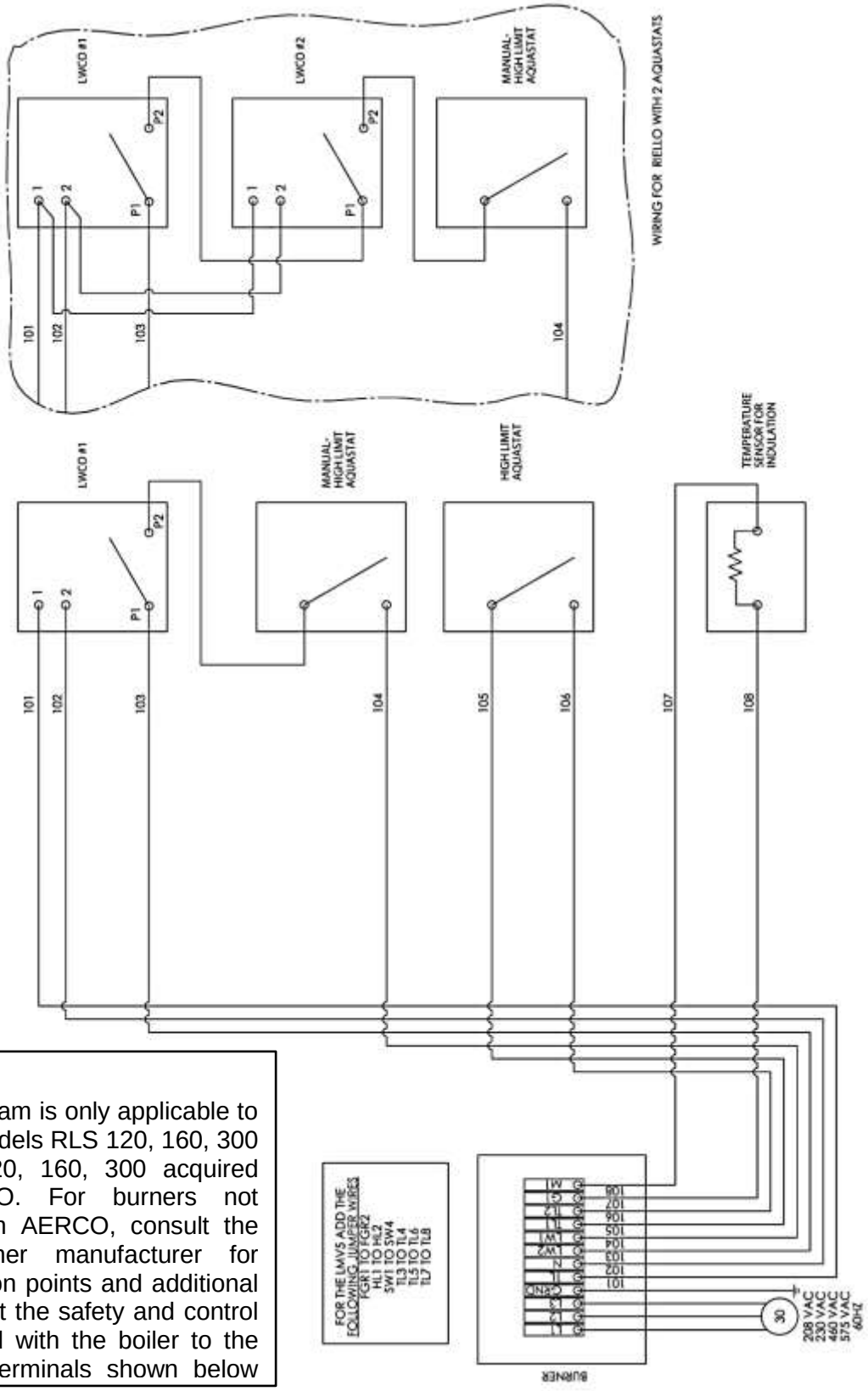
The maintenance interventions and the calibration of the burner must only be carried out by qualified, authorized personnel, in accordance with the contents of the burner manual and in compliance with the standards and regulations of current laws.

WARNING!

Before carrying out any maintenance, cleaning or checking operations:

- Disconnect the electricity supply from the burner by means of the main switch of the system.
- Close the fuel interception tap.

APPENDIX A – ELECTRICAL DIAGRAMS



NOTE:
This wiring diagram is only applicable to Riello burner models RLS 120, 160, 300 and RS 68, 120, 160, 300 acquired through AERCO. For burners not supplied through AERCO, consult the respective burner manufacturer for proper connection points and additional support. Connect the safety and control devices supplied with the boiler to the burner control terminals shown below

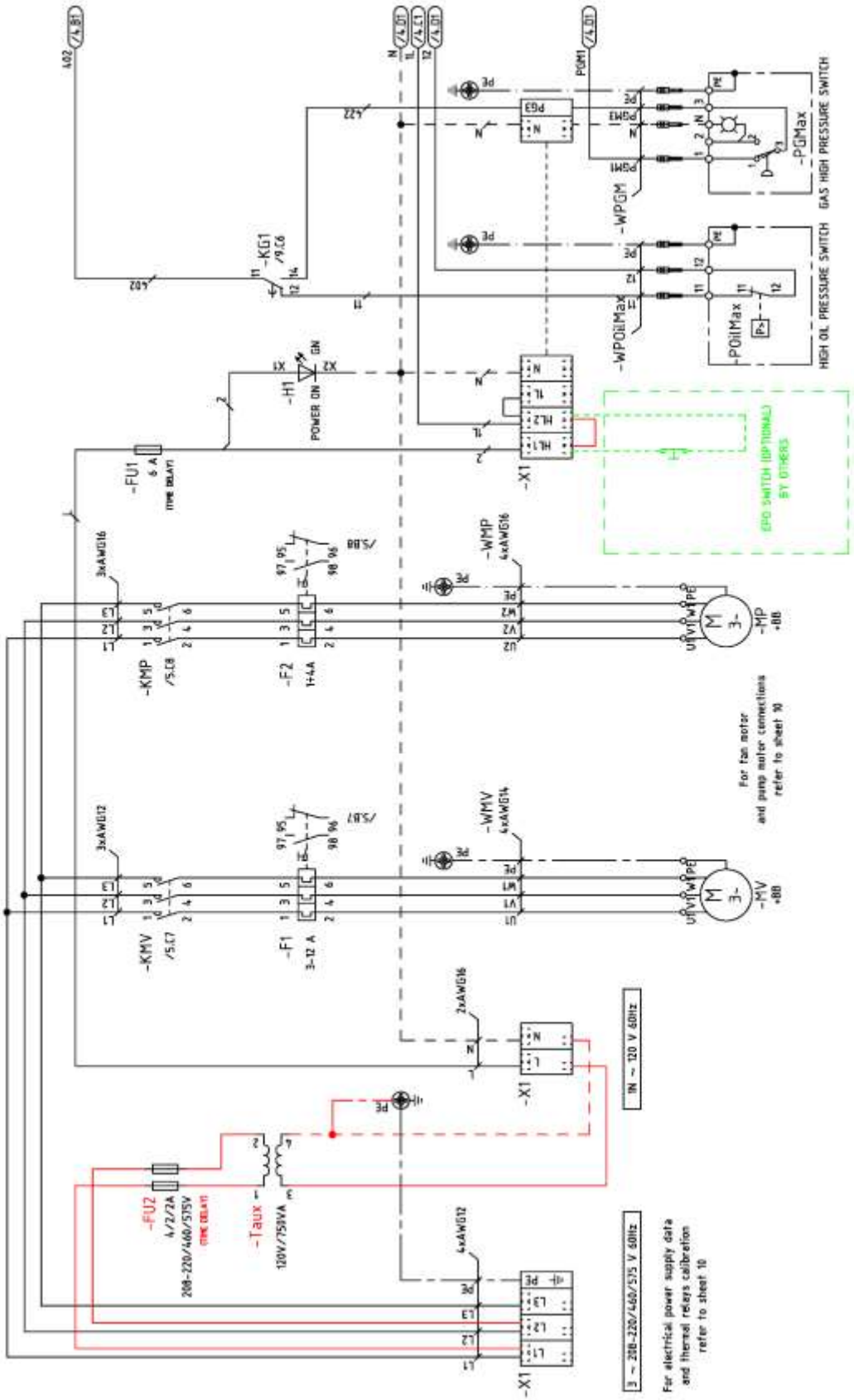
A1. MFC 3000 / 4000 / 5000 / 6000 Electrical Diagrams 1-8

DIAGRAM LEGEND

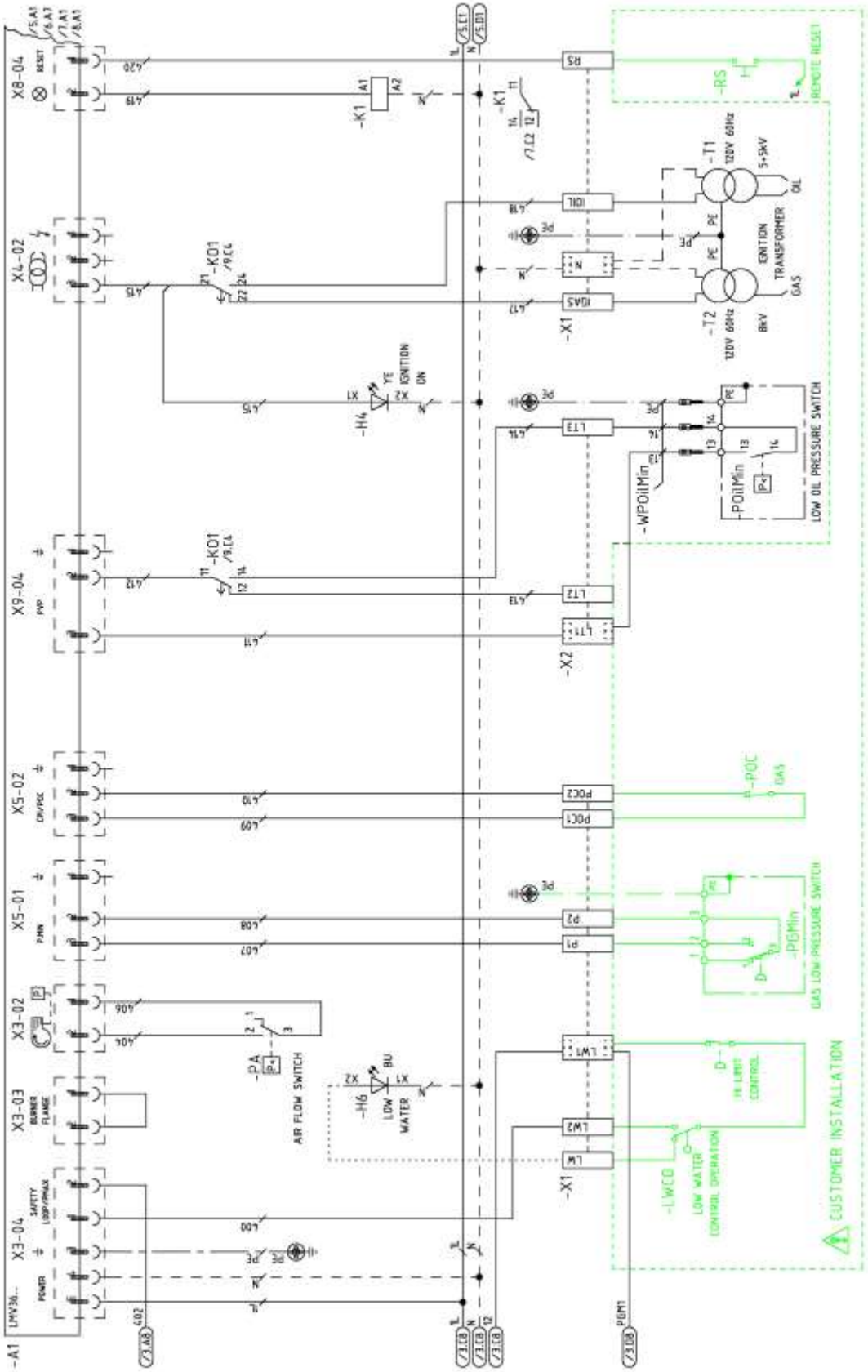
MFC 3000 / 4000 / 5000 / 6000 Electrical Diagrams 1 - 8 (page 2)

A2	AZL display and operating unit
AH	Alarm Horn
AS	Alarm Silence Switch
BMS	Building management system
FU1	Control circuit fuse
FU2	Transformer fuse - optional
FU3	Transformer fuse - optional
F1	Fan motor thermal overload
F2	Pump motor thermal overload
H1	Indicator Light power on (Green)
H2	Indicator Light call for heat (Green)
H3	Indicator Light alarm (Red)
H4	Indicator Light ignition on (Yellow)
H5	Indicator Light fuel on (Green)
H6	Indicator Light low water (Blue) - optional
K1	Burner on relay
K2	Local/Remote relay
K3	Alarm Silence relay
K4	Combustion air damper and gas booster relay
K5	Alarm relay
KG1	Gas relay
KG2	Gas relay
KMP	Pump motor contactor
KMV	Fan Motor contactor
KO1	Oil relay
MV	Fan Motor
MP	Pump Motor
PA	Air Pressure Switch
PE	Burner ground
PGMax	High gas pressure switch
PGMin	Low gas pressure switch
POC	Proof of closure switch
POilMin	Low oil pressure switch
POilMax	High oil pressure switch
RS	Remote reset
SM1	Air servomotor
SM2	Fuel servomotor
S1	On/Off switch
S2	Local/Remote switch
S5	Fuel transfer switch
TAux	Control circuit transformer - optional
T1	Ignition transformer - oil
T2	Ignition transformer - gas
UV	UV Scanner
VFOil	Delivery solenoid valve
VSOil	Safety solenoid valve
VPGas	Pilot solenoid
VROil	Return solenoid valve
V1	Main gas valve 1
V2	Main gas valve 2
VV	Vent valve (NO)
VV1	Vent valve 1 (NO)
X1	General supply terminal strip
X2	Aux terminal strip
XSM1	Air servomotor plug
XSM2	Gas servomotor plug

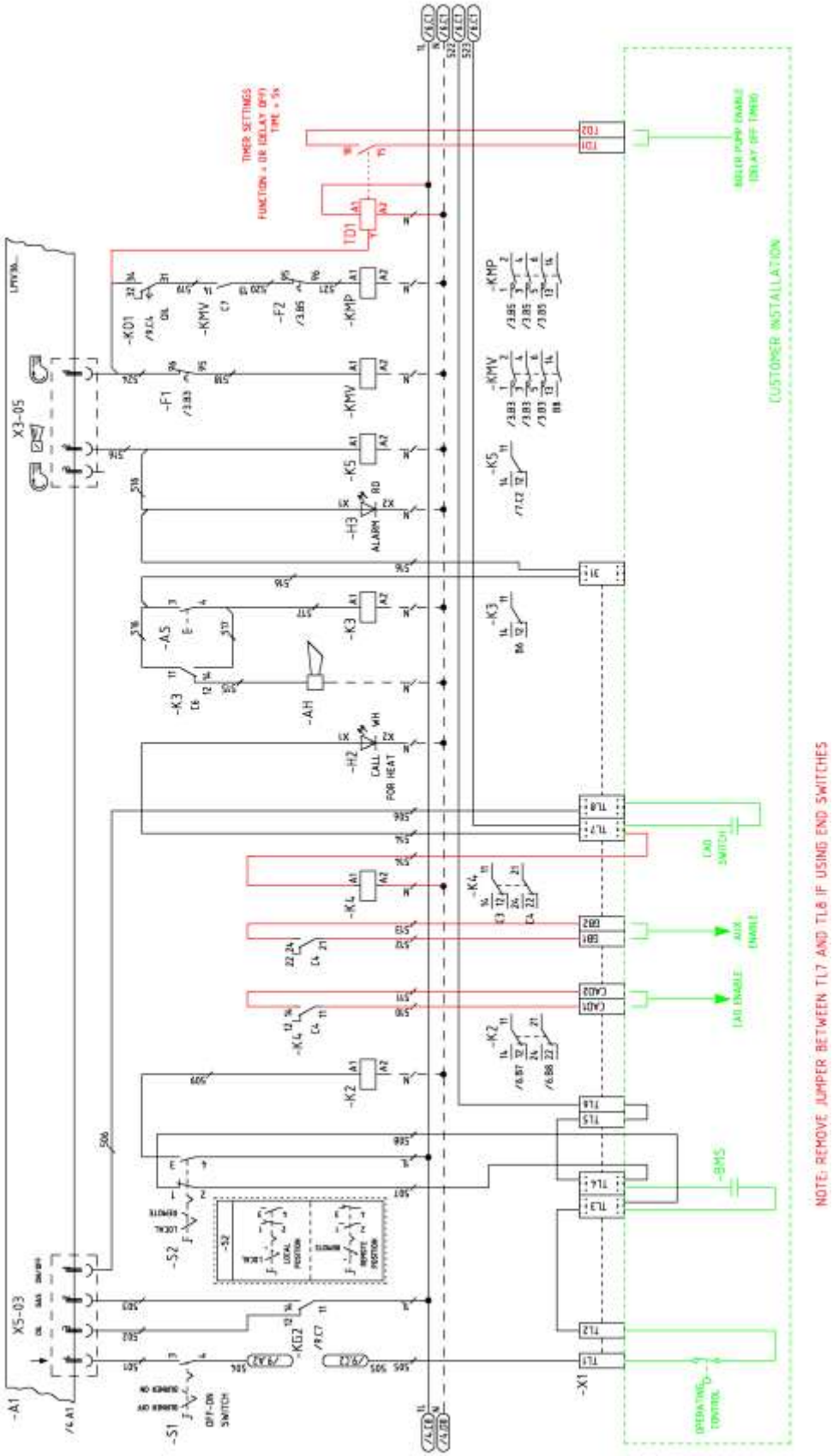
MFC 3000 / 4000 / 5000 / 6000 - 1 of 8 (sheet 3)



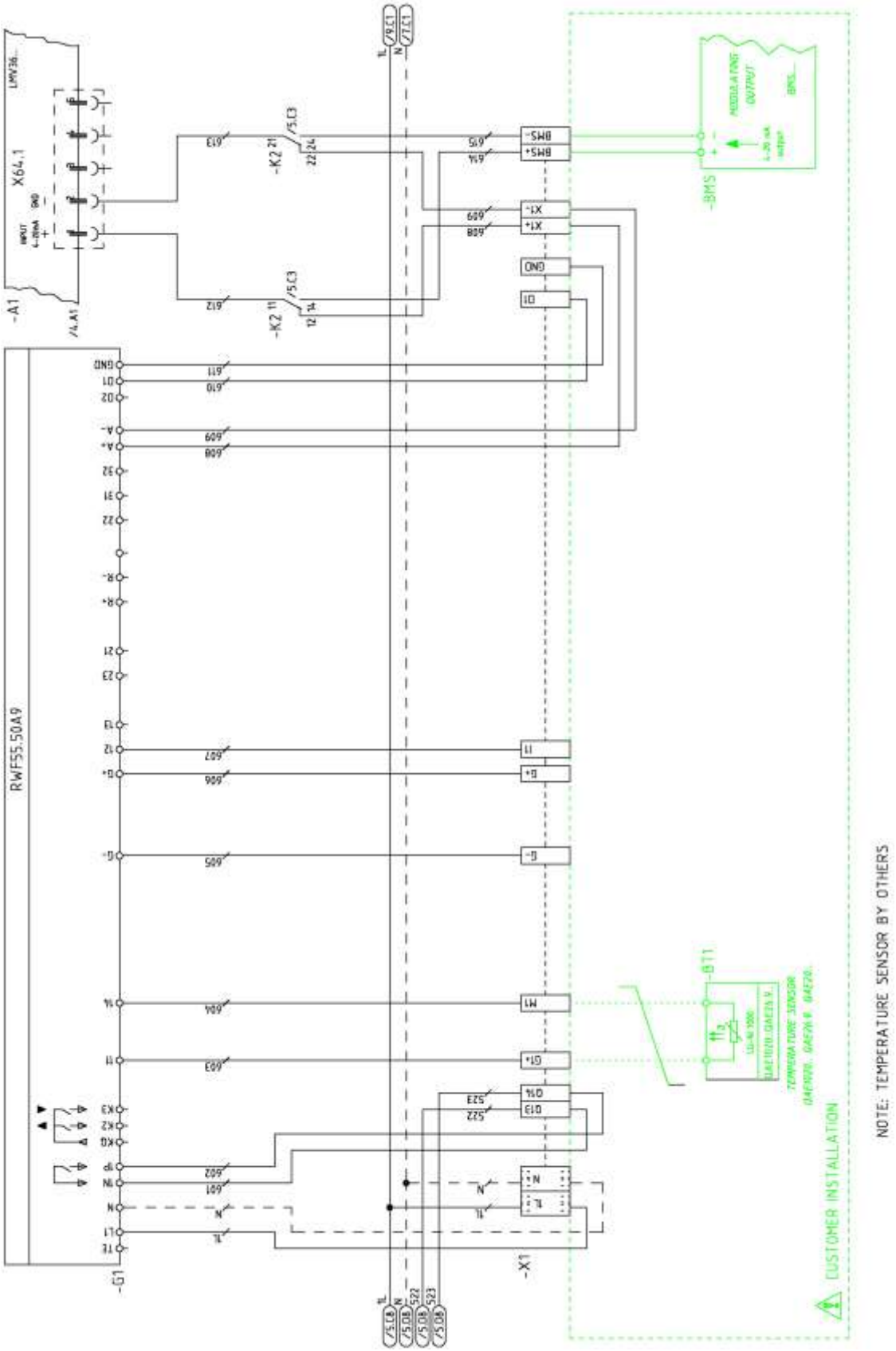
MFC 3000 / 4000 / 5000 / 6000 - 2 of 8 (sheet 4)



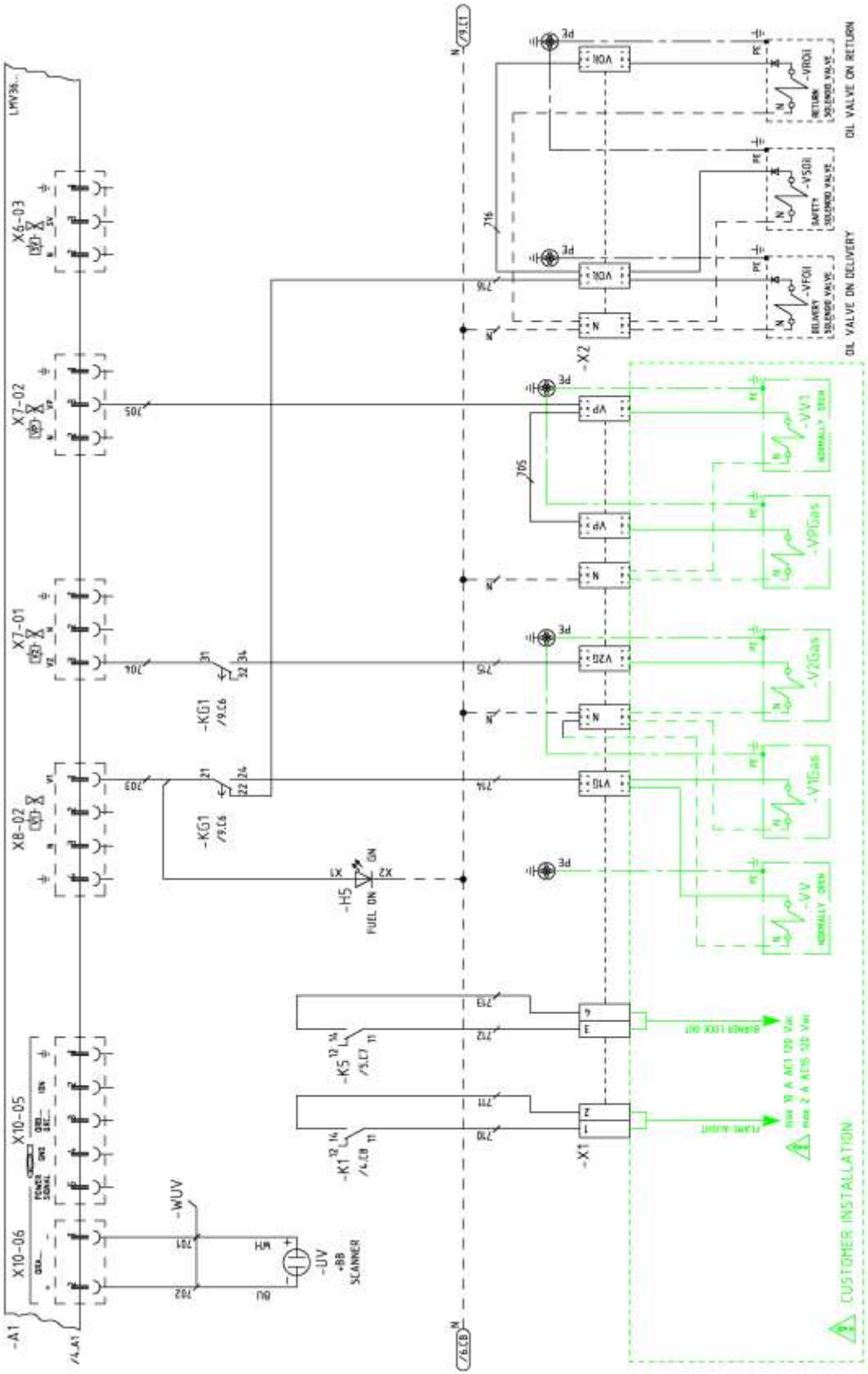
MFC 3000 / 4000 / 5000 / 6000 - 3 of 8 (sheet 5)



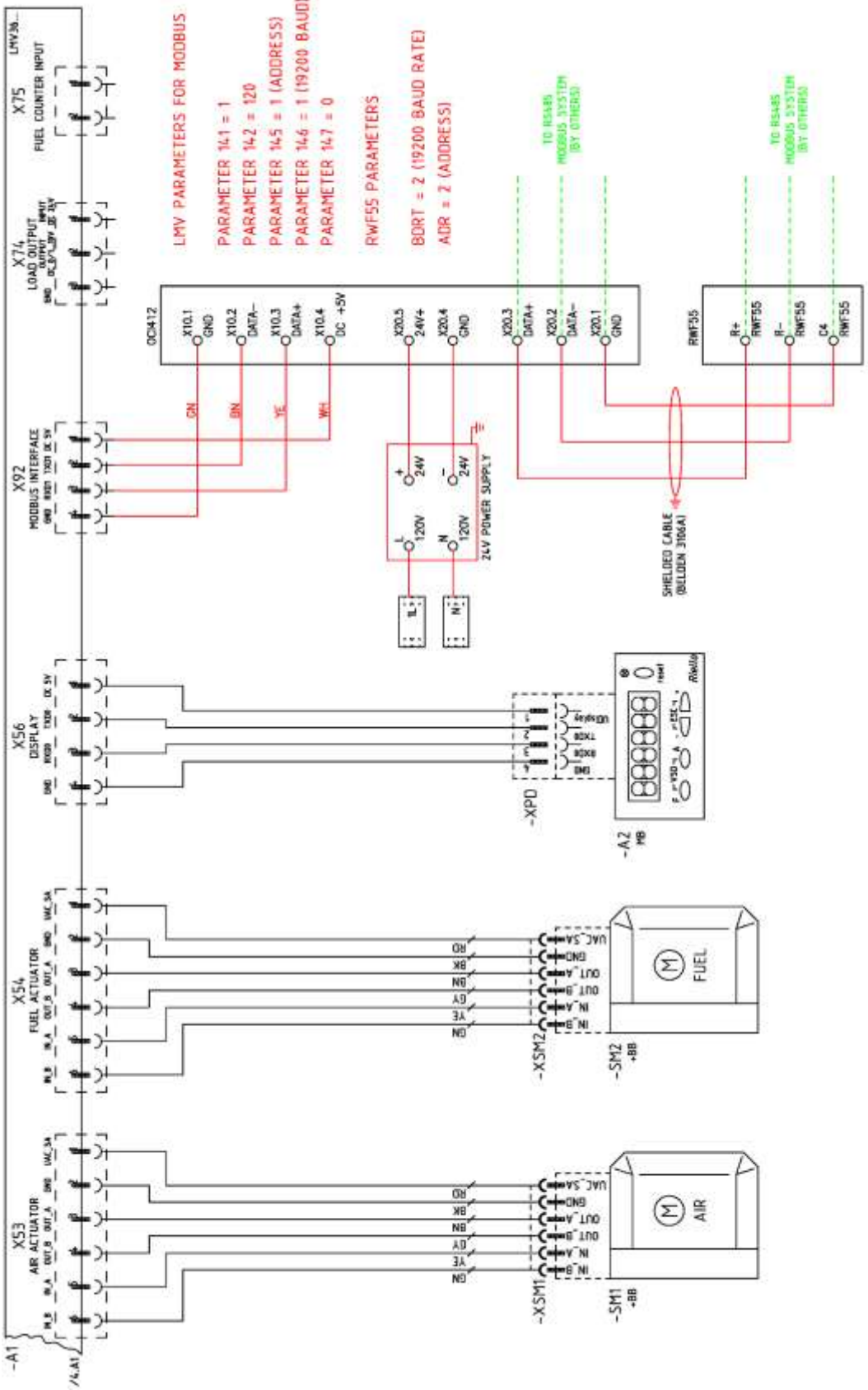
MFC 3000 / 4000 / 5000 / 6000 - 4 of 8 (sheet 6)



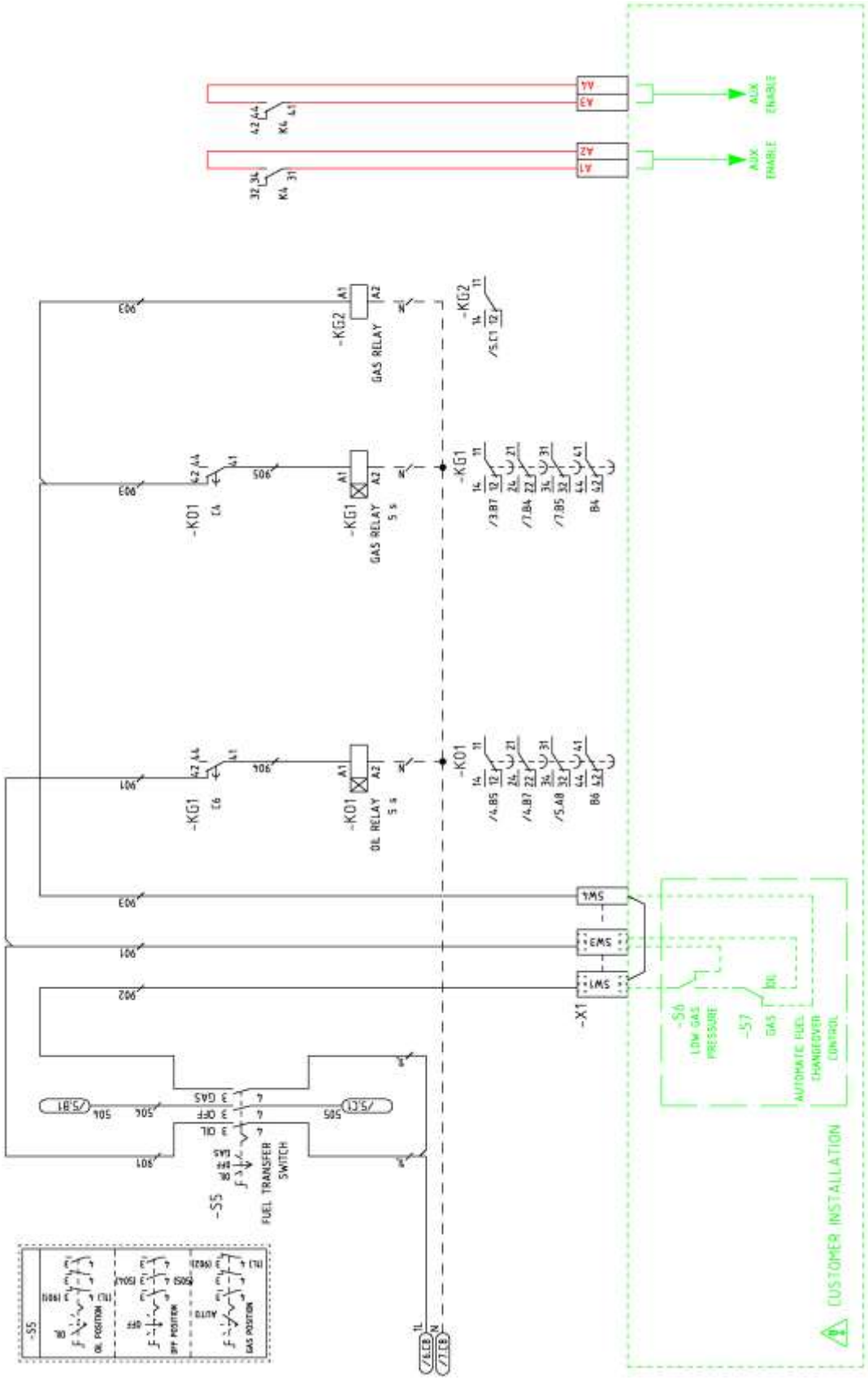
MFC 3000 / 4000 / 5000 / 6000 - 5 of 8 (sheet 7)



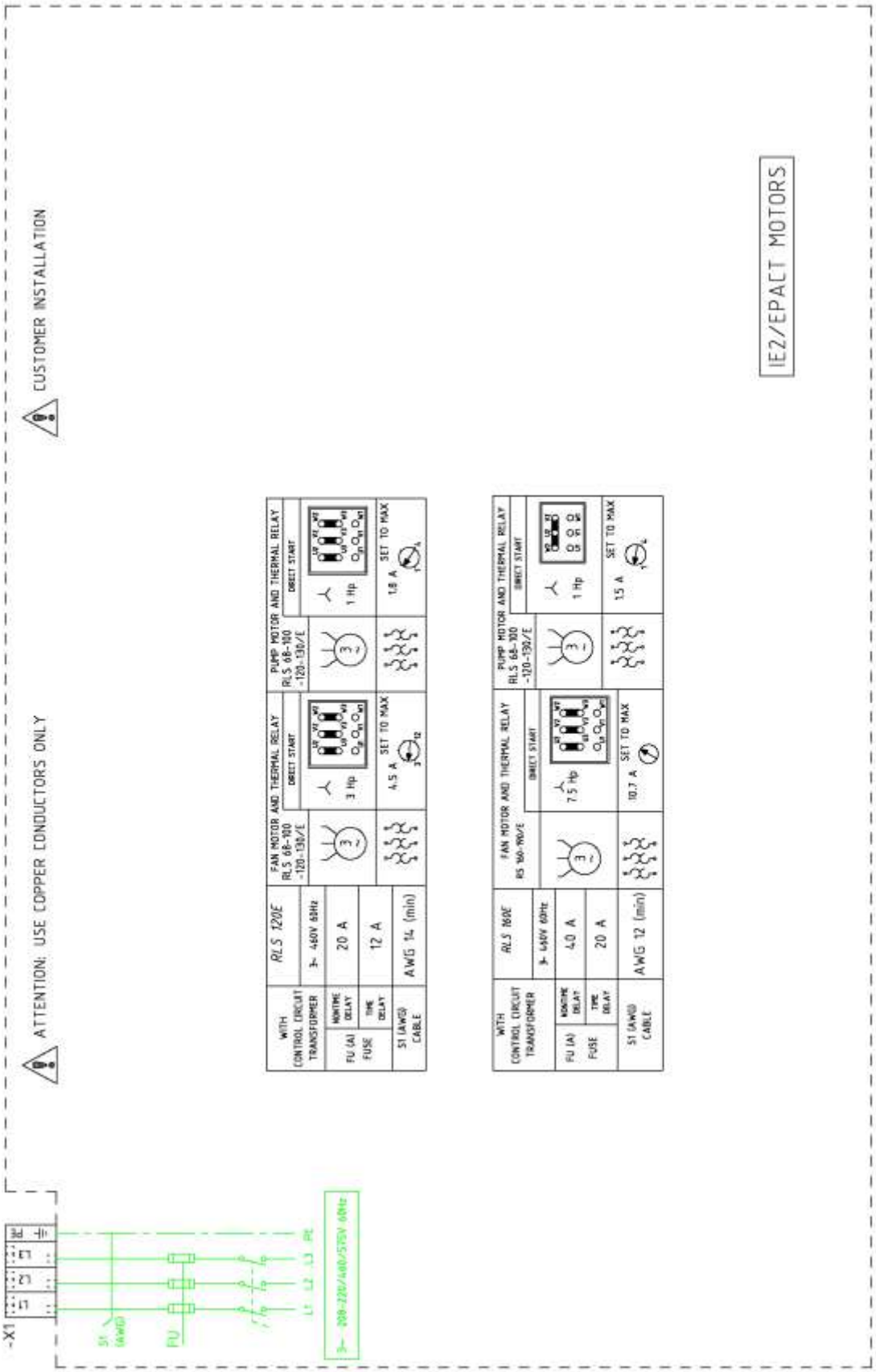
MFC 3000 / 4000 / 5000 / 6000 - 6 of 8 (sheet 8)



MFC 3000 / 4000 / 5000 / 6000 - 7 of 8 (sheet 9)



MFC 3000 / 4000 / 5000 / 6000 - 8 of 8 (sheet 10)



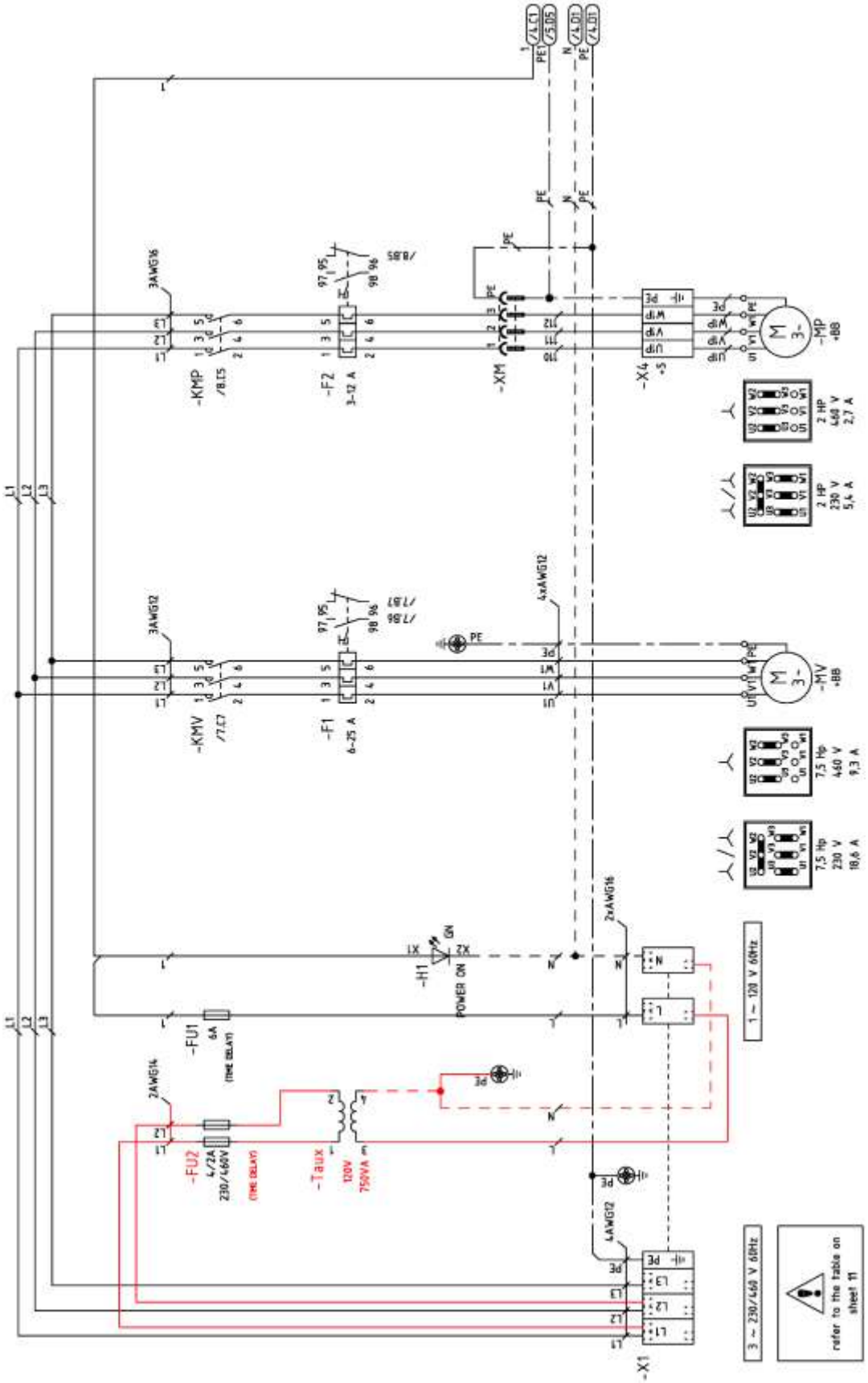
A2. MFC 8000-10000 - Electrical Diagrams 1-9

DIAGRAM LEGEND

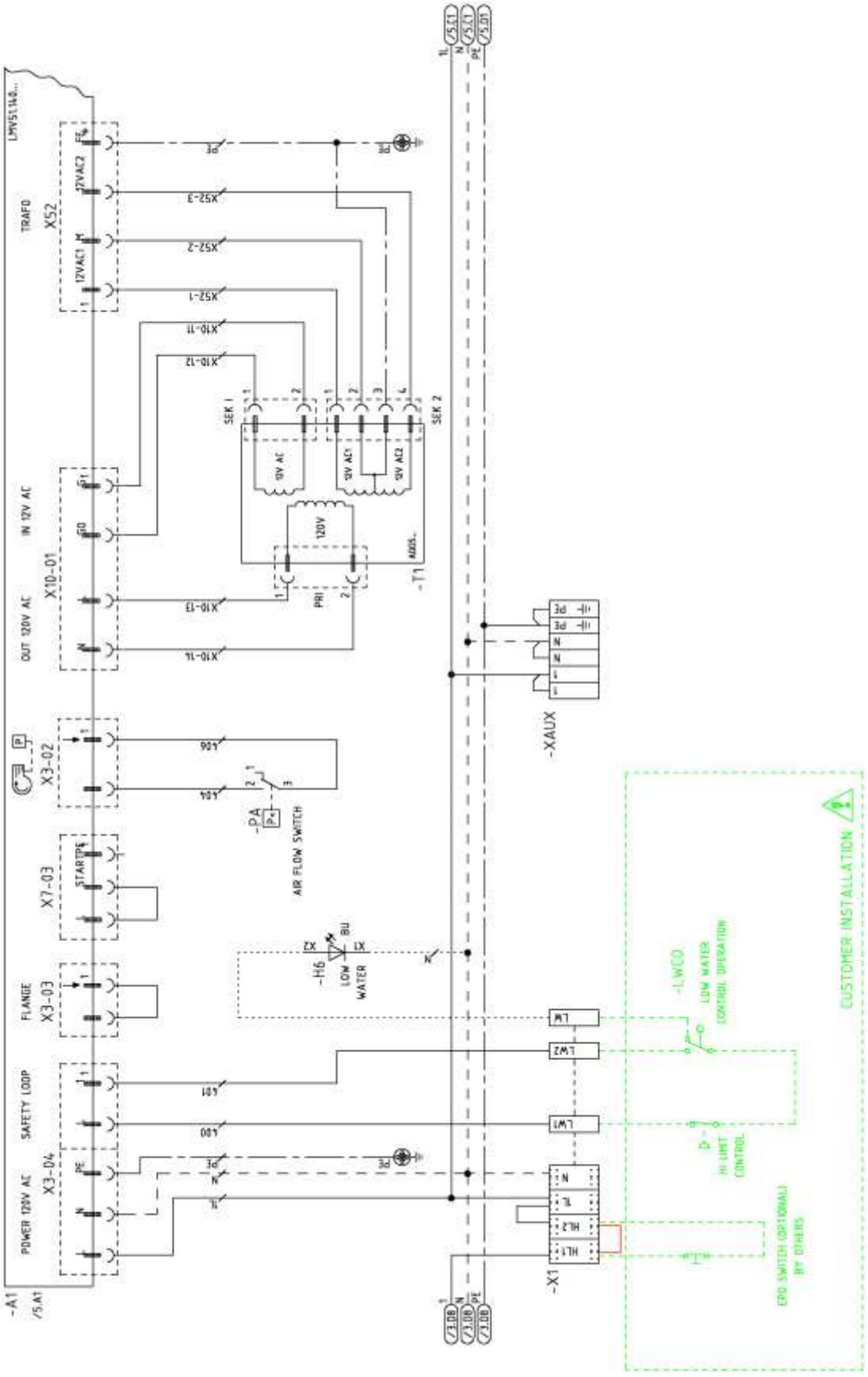
MFC 8000 / 10000 Electrical Diagrams 1-9 (sheet 2)

AZL AZL display and operating unit
AL Alarm Horn
AS Alarm Silence Switch
BA2 Load indicator
BT1 Temperature sensor Pt/Ni1000
BP 7MF pressure sensor
BMS Building management system (remote enable)
FGR FGR switch
FU1 Control circuit fuse
F1 Fan motor thermal overload
F2 Pump motor thermal overload
H1 Indicator Light power on (Green)
H5 Main fuel on light (Green)
H6 Low water light (Blue) (optional)
K1 Burner on relay
K2 Local/Remote relay
K3 Alarm silence relay
K4 CAD enable relay (optional)
K5 Alarm relay
K6 Fan on relay
K7 Overload relay
K11 Enable/disable relay (optional)
KMP Pump motor contactor
KMV Fan motor contactor
KO1 Oil relay
KG1 Gas relay
KG2 Gas relay
KTR1 Time delay relay
MV Fan Motor
MP Pump Motor
PA Air Pressure Switch
PE Burner ground
PGMax High gas pressure switch
PGMin Low gas pressure switch
POilMin Low oil pressure switch
POC Gas proof of closure switch
QRI Infrared sensor
RS Remote reset
SM1 Air actuator
SM2 Fuel actuator
S2 Local/Remote swtich
S5 Fuel transfer switch
SH3 Alarm light and reset
T1 Electronic cam transformer
TA Ignition transformer
VFOil Delivery solenoid valve
VSOil Safety solenoid valve
VPGas Pilot solenoid
V1Gas Main gas valve 1
V2Gas Main gas valve 2
VV Vent valve (NO)
VV1 Vent valve 1 (NO)
X1 General supply terminal strip
X2 Aux terminal strip
X70 Aux terminal strip
XAZL Plug for AZL
XAUX Aux terminal strip

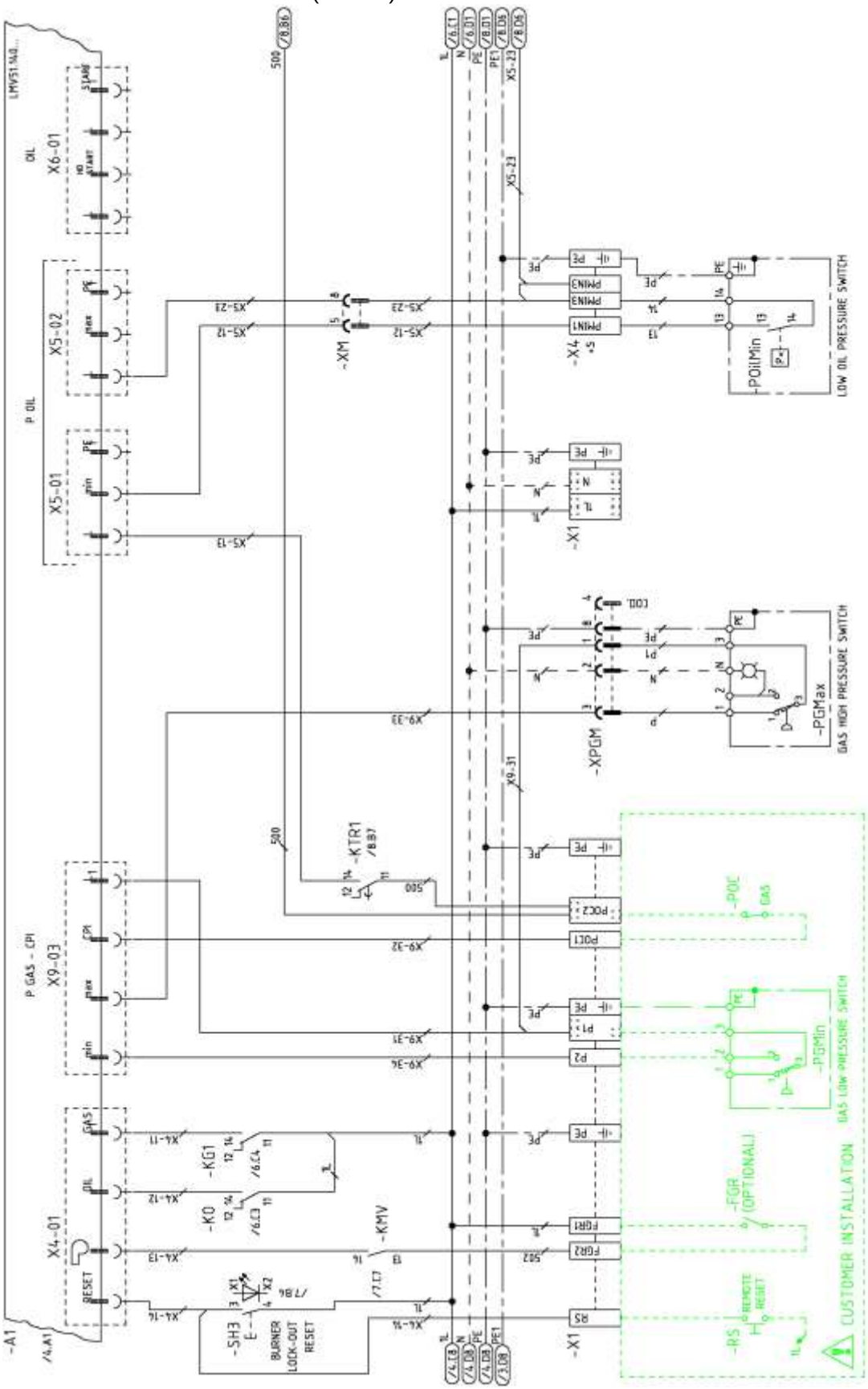
MFC 8000 / 10000 - 1 of 9 (sheet 3)



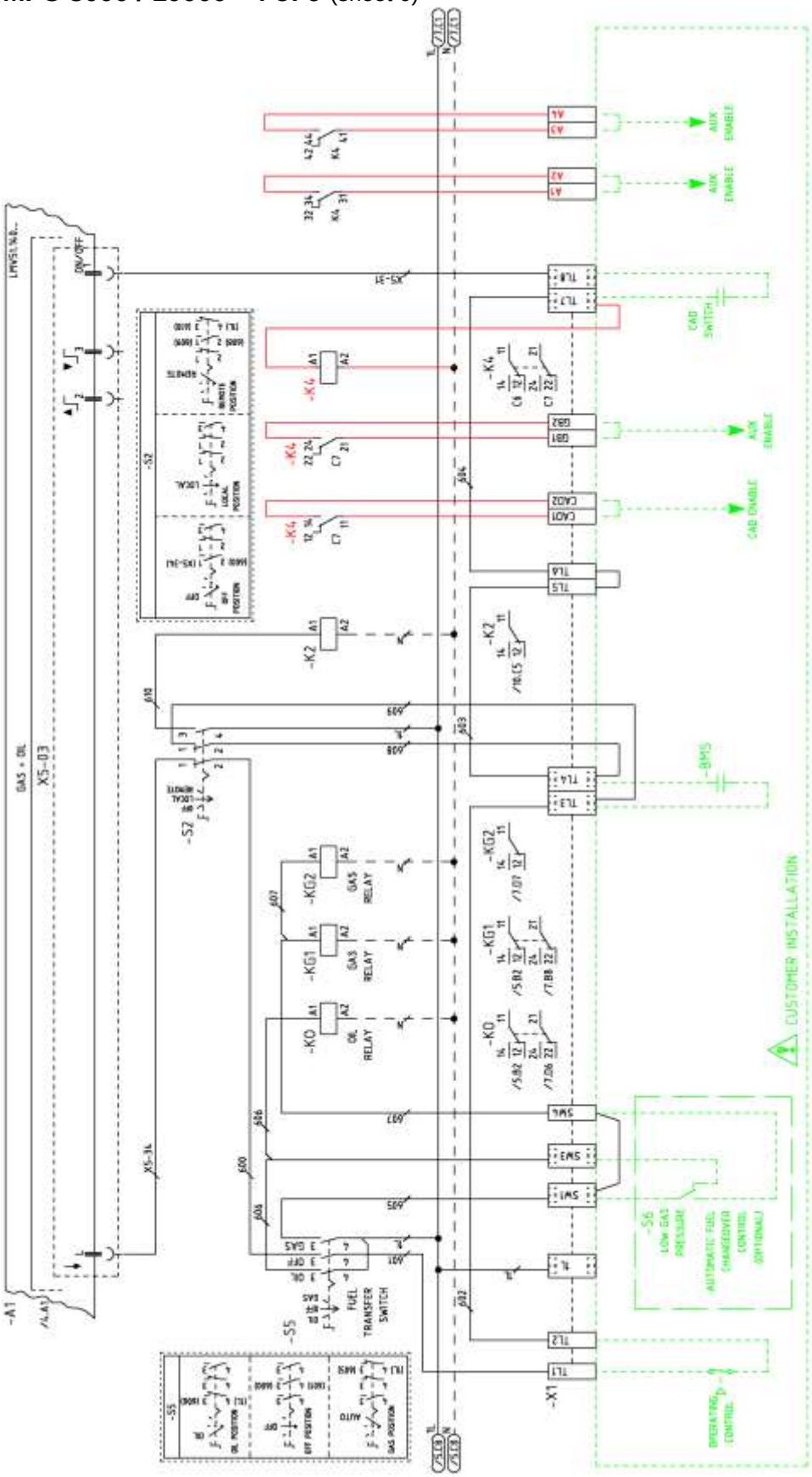
MFC 8000 / 10000 - 2 of 9 (sheet 4)



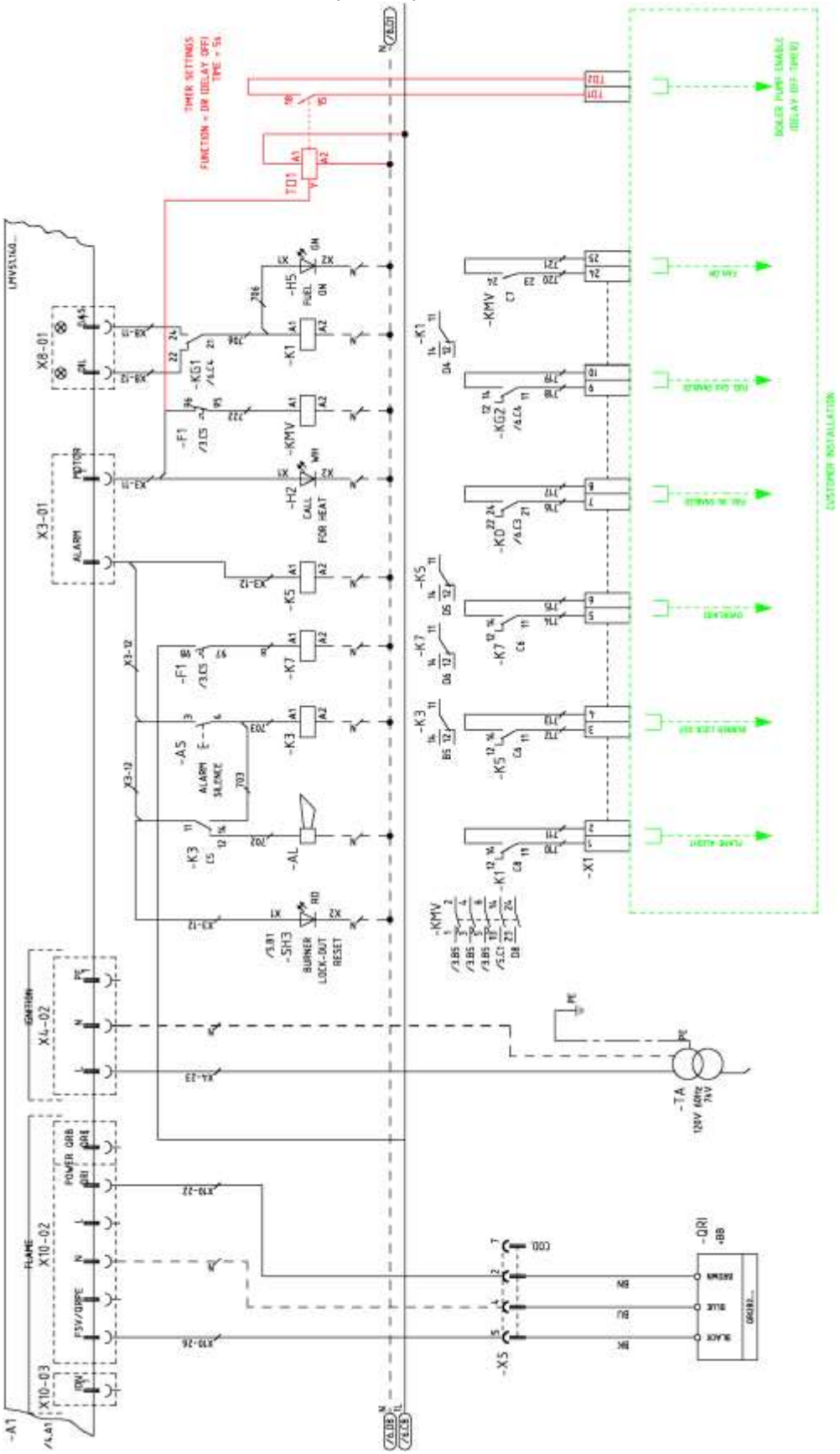
MFC 8000 / 10000 - 3 of 9 (sheet 5)



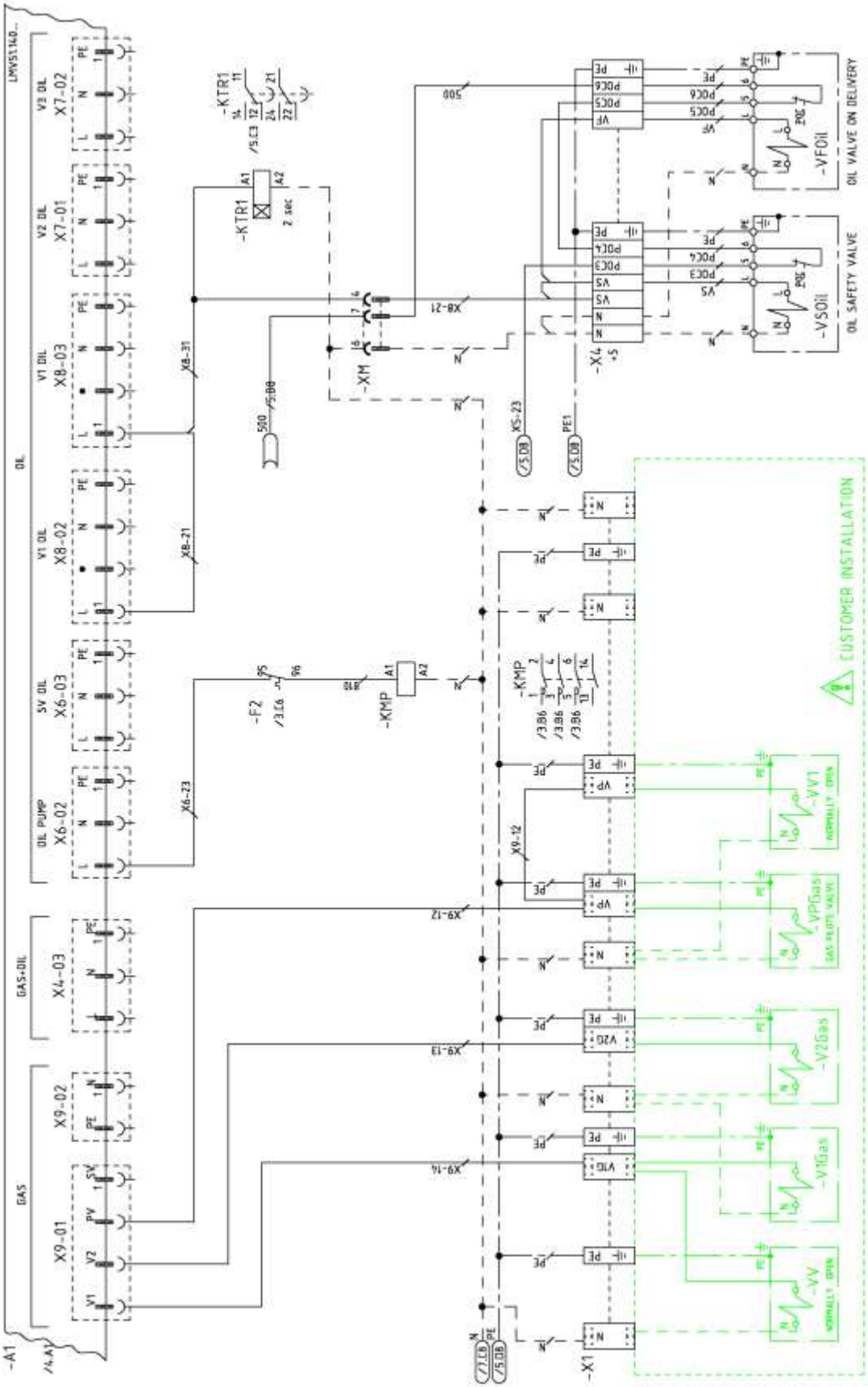
MFC 8000 / 10000 - 4 of 9 (sheet 6)



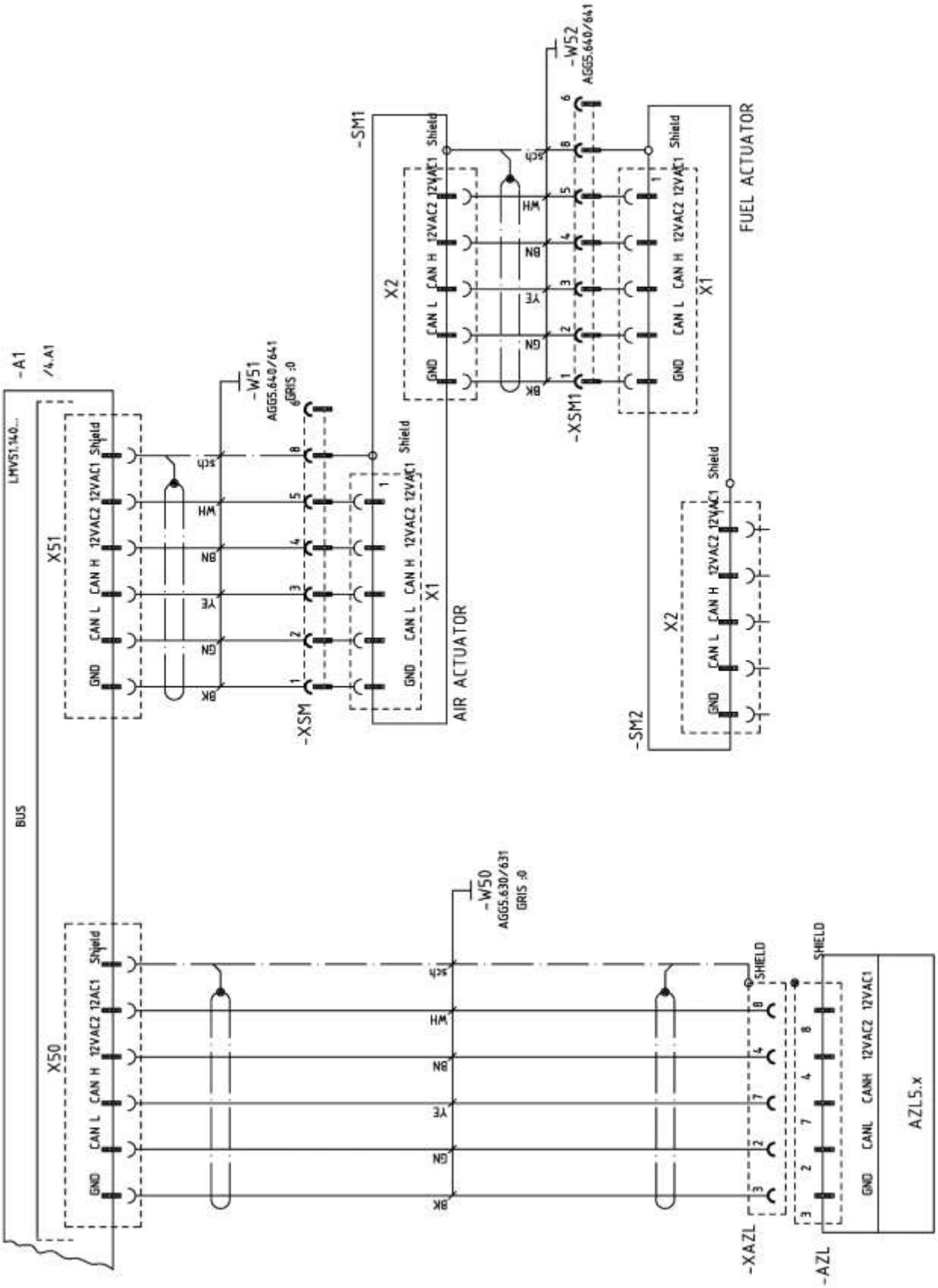
MFC 8000 / 10000 – 5 of 9 (sheet 7)



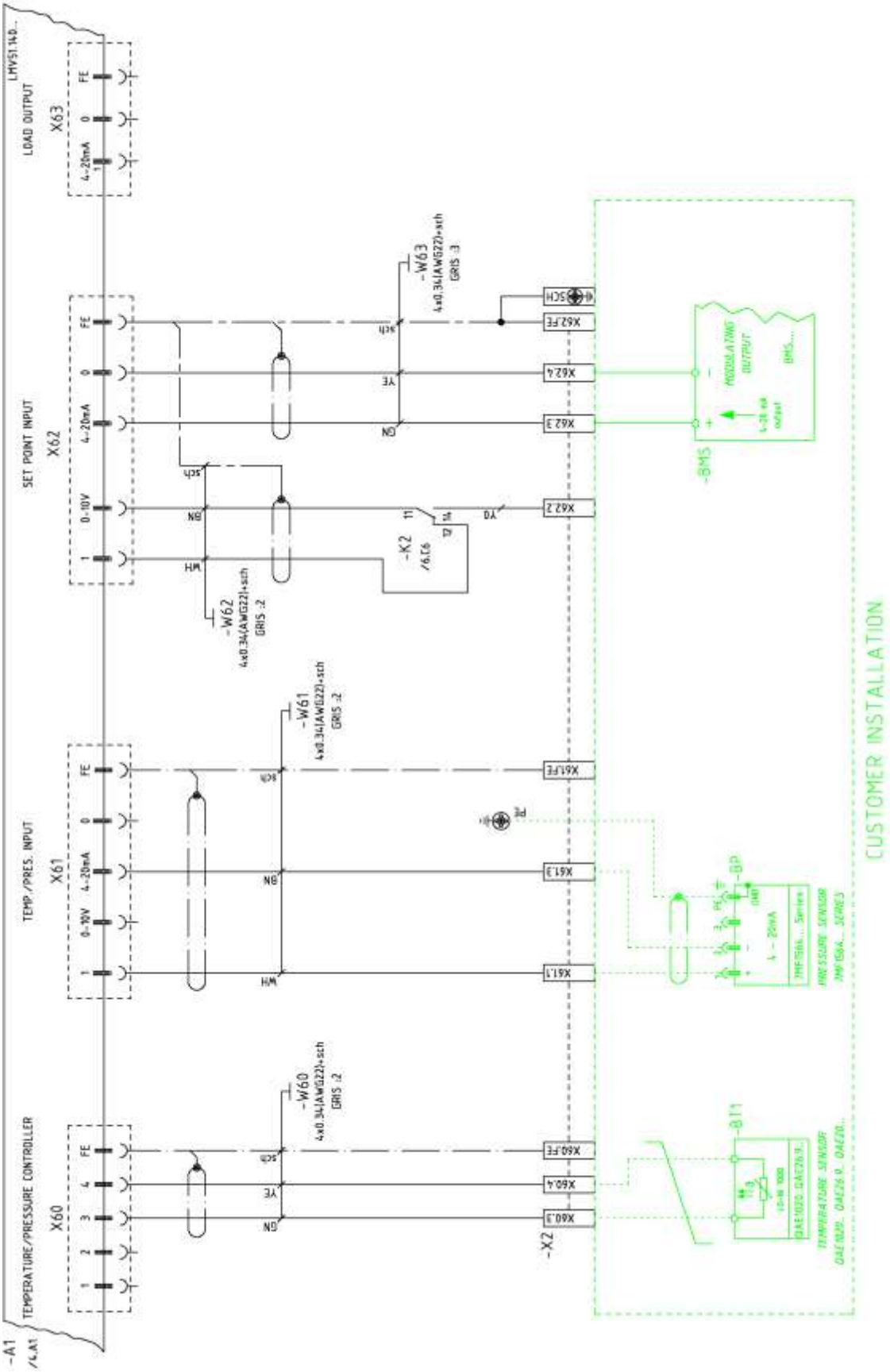
MFC 8000 / 10000 - 6 of 9 (sheet 8)



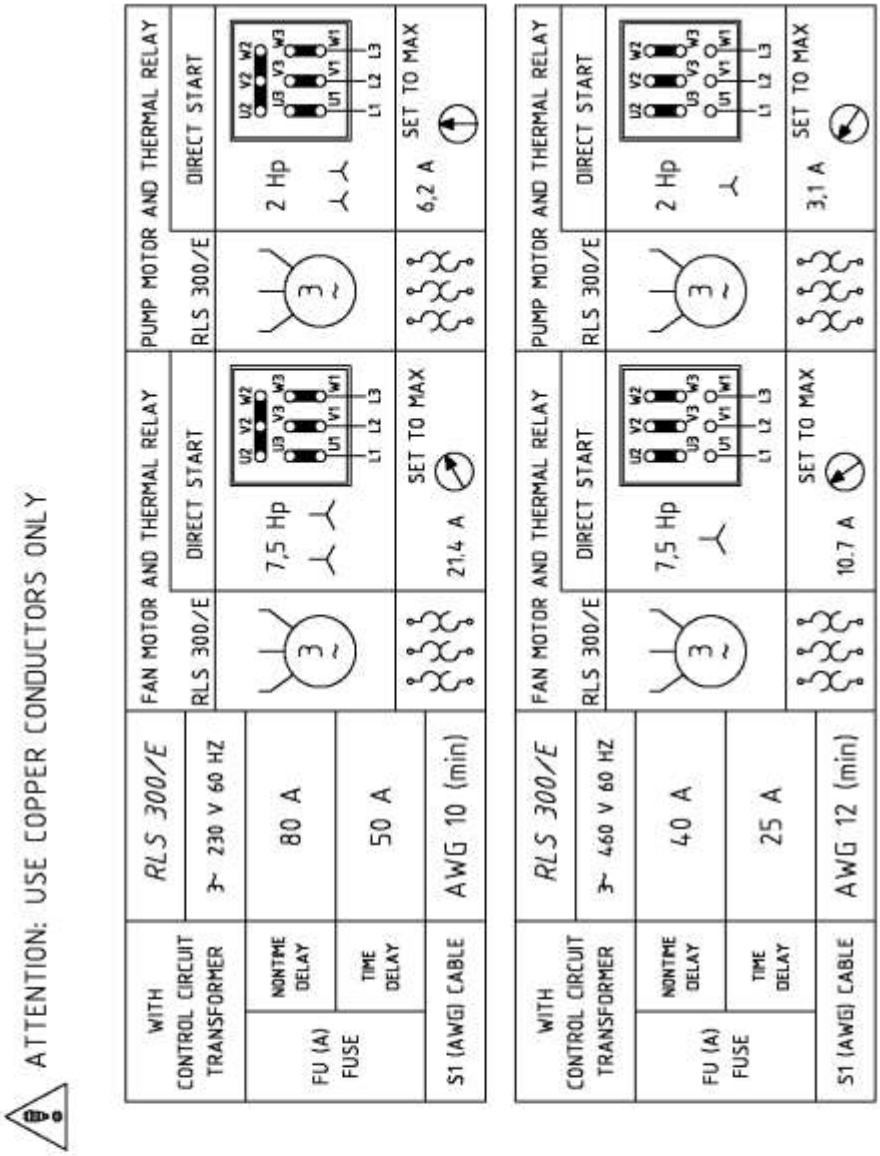
MFC 8000 / 10000 - 7 of 9 (sheet 9)

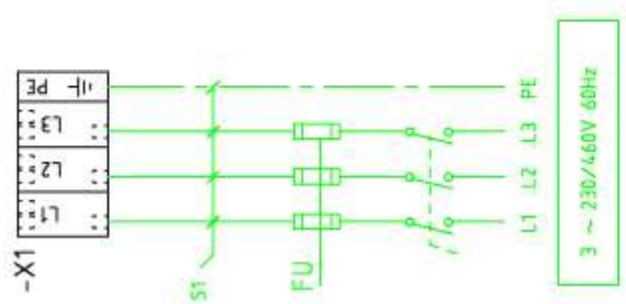


MFC 8000 / 10000 - 8 of 9 (sheet 10)



MFC 8000 / 10000 - 9 of 9 (sheet 10)





NOTES:

Change Log:

Date	Description	Changed By
8/13/2018	**Rev C:** **DIR 18-43: Page 7**, added notes about removing parts and accessories needed to complete the installation that are stowed inside the combustion chamber.	Chris Blair
1/30/2019	**Rev D:** Updated formatting, updated certifications on front cover	Chris Blair