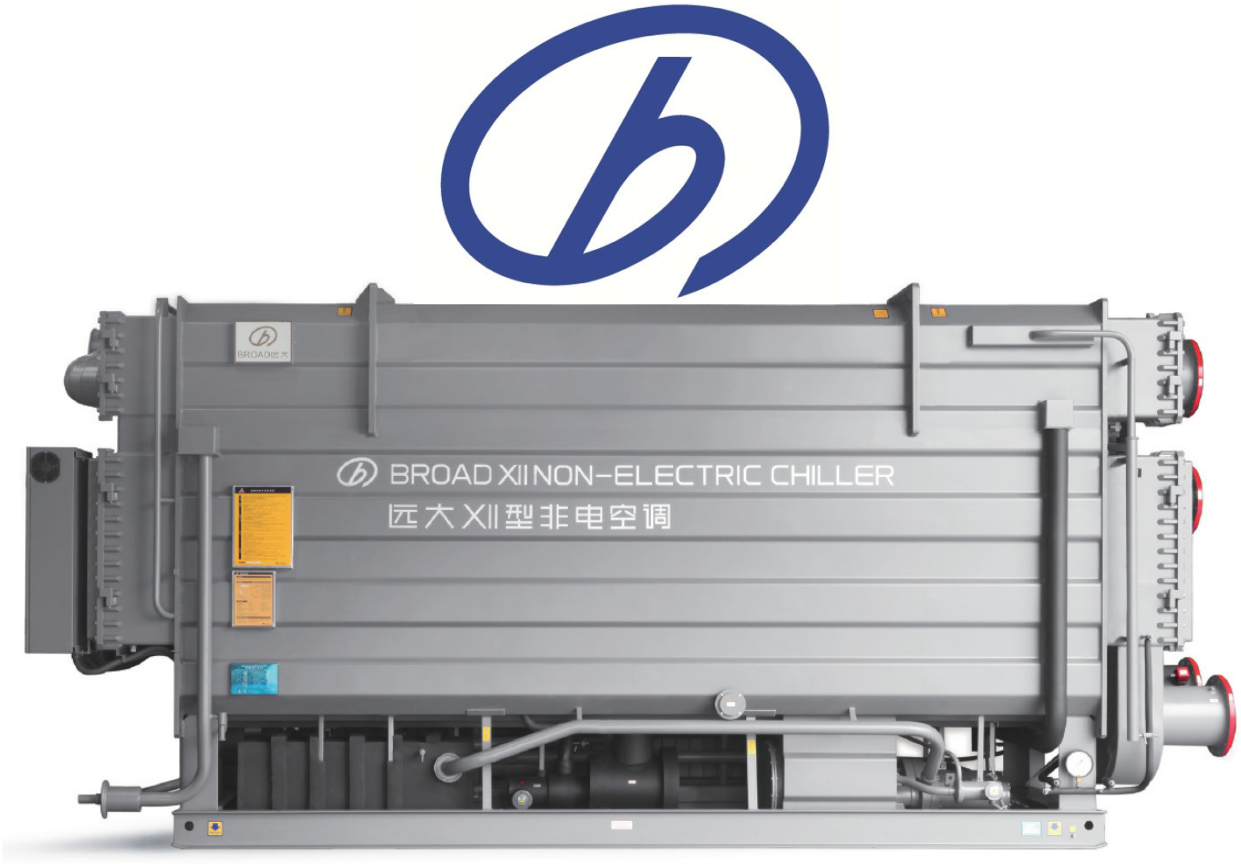
BROAD USA, INC. Submittal



Date:	July 16, 2018
Project:	Glendale HS Chiller Replacement
Customer:	Glendale High School
Engineer:	PocockDesignSolutions Inc.
Manufacturer:	BROAD
Equipment:	Direct-fired Absorption Chiller
Model:	BZ100-H1
Quantity:	1
Submission:	for Approval

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Project: Glendale HS Chiller Replacement

Engineers:

Stamps:

Comments

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These notes are in addition to the information offered in the submittal:

- Users' operation and maintenance manual, and manufacturer's test report for the chiller shall be sent in a separate transmittal.

Supply of BROAD double stage direct fired absorption chiller incorporating the followings –

- The machine shall be a complete absorber package with factory wirings, including heat exchangers, control panel, 12" colorful touch screen, power flame low NOx burner with gas train (ship loose), and additional vacuum pump (ship loose).
- The burner shall be provided with factory mutual (FM) approval and UL listed gas train.
- The burner shall be forced-draft type with full modulation.
- The burner shall be equipped with all necessary controls such as pressure regulators, switches, controls, ignition system and other devices required for proper and safe operation.
- The burner shall be interfaced with the chiller machine control system and all other required safety features.
- Both main shell and high temperature generator shell of the machine shall be made of high quality carbon steel.
- Combustion chamber shall be made of boiler quality plate steel.
- The machine shall be shot blasted to de-stress welds and electro-statically painted.
- Factory insulated machine for cold surfaces (with 0.79" K-flex foam insulation) and hot surfaces (with 2" fiber glass insulation) with maximum K value of 0.26.
- Heat exchangers for evaporator, absorber, condenser, low temperature generator, high temperature generator and solution heat exchangers.
- All heat exchanger tubes shall be expanded into tube sheets and replaceable.
- Internal components, directly in contact with Lithium Bromide (LiBr) solution, such as baffles and spray header, shall be made of stainless steel.
- Lithium Bromide solution shall contain a corrosion inhibitor, lithium molybdate, to minimize the rate of metal corrosion on the solution side of the unit.
- Solution heat exchangers shall be stainless steel plate heat exchangers with continuous resistance weld at the seams.
- Cross over pipe between condenser and absorber shall be provided by BROAD.
- The machine shall be equipped with O-ring sealed, hinged access marine type water boxes at both ends of the condenser, absorber and one end of the evaporator section of the main shell enabling easy access to the tube bundles. The water boxes shall be rated for 150 psig and tested for 187 psig.
- Sight glasses and valves shall be used and sealed to protect the machine hermetic integrity.

- Solution and refrigerant pumps shall be hermetically sealed (canned motor pumps), liquid cooled, and welded to the machine. Each pump shall have self-cleaning protective strainers with a 20-year capacity collection chamber.
- The machine shall be equipped with an OEM PLC based control panel. The control panel shall be able to control the machine operation, which shall include and not be limited to automatic start up and shut down, load adjustment, crystallization prevention, full diagnostics, automatic fault detection and annunciation.
- Factory mounted and pre-wired PLC based control panel shall be equipped with controls, starters, Internet modem and instrumentation for proper unit operation and 24/7 remotely monitoring by BROAD (with permanent IP address provided by the customer).
- The machine shall be capable of operating from 10% to 100% load.
- Two variable speed solution pumps shall be controlled by PLC to maintain the LiBr solution concentration level throughout the entire load range.
- The machine shall be equipped with auto purge and auto vent system to remove non-condensable gas to prevent corrosion and improve efficiency. Additional vacuum pump shall be supplied along with the machine to allow for maintenance and emergency.
- Auto purge system shall be equipped with all valves and connections for auto venting.
- The machine shall be equipped with 12” colorful display touch screen for graphics and annunciation.
- The machine shall be mounted with instruments for safety, and main power switch for power on and off.
- The machine shall be equipped and pre-installed with three flow switches in the chilled water loop (two at the inlet and one at the outlet), and one flow switch in the cooling water loop located at the inlet.
- The machine shall be ETL listed, and sub-components shall be UL listed.
- The machine shall be ISO 9001 certified.
- The machine shall be in line with AHRI Standard 560 “Absorption Water Chilling and Water Heating Packages”.
- Noise level for the machine shall be below 58dB(A) per ANSI/AHRI Standard 575.
- The machine shall be provided with a four-year supply of basic spare parts in a stainless steel toolbox (including gaskets, sight glass, and probes). A complete list of such parts shall be provided in this submittal package.
- The machine shall be independently sealed and pressurized with 2.9 psig Nitrogen after passing Factory Acceptance Test (FAT).
- FAT will be implemented on design conditions, and a test report shall be provided to the customer prior to shipment.

Add-on Features –

- BACnet for serial communication with building automation system
- Dry contact interface with building automation system
- The machine to be provided in 2 pieces
  - Main shell
  - High temperature generator (HTG)
  - LiBr solution in separate drums

Start-up Service –

- Supervise machine unloading and opening of packages
- Evacuation of Nitrogen holding charge in the machine
- Joining of HTG to the main shell
- Charge of LiBr solution
- Terminate power and control connections in the control panel
- Start-up and commissioning of the machine
- 8-hour customer training for operation, maintenance and commissioning
- Supply of one portable vacuum pump will be left on site for service purposes

Delivery Service –

- Deliver to the job site or the rigging yard (first destination) in US in an overseas container

Warranty –

- Standard one (1) year parts and labor warranty from the date of machine start-up, or 18 months from the date of shipping from BROAD Town factory China, whichever occurs first

Lead Time –

- 22 weeks from the date of approval of submittal and release to production

Customer and Contractor Duties –

- Inspection-upon delivery of the machine.
- Protect the machine from physical damage.
- Comply with manufacturer's installation instructions for transporting, unloading, lifting and rigging the machine.
- Install gas burner and assemble.
- Provision of Nitrogen for pressure test.

- Make system water connections.
- Bring electrical and Internet connection to main control panel.
- Mount remote control touch screen and bring 110V/1Ph/60Hz line to user interface.
- Bring control connection to remote touch screen and internet connections for monitoring.
- Any other items not specifically mentioned in BROAD USA's scope of work.

Absorption Principle

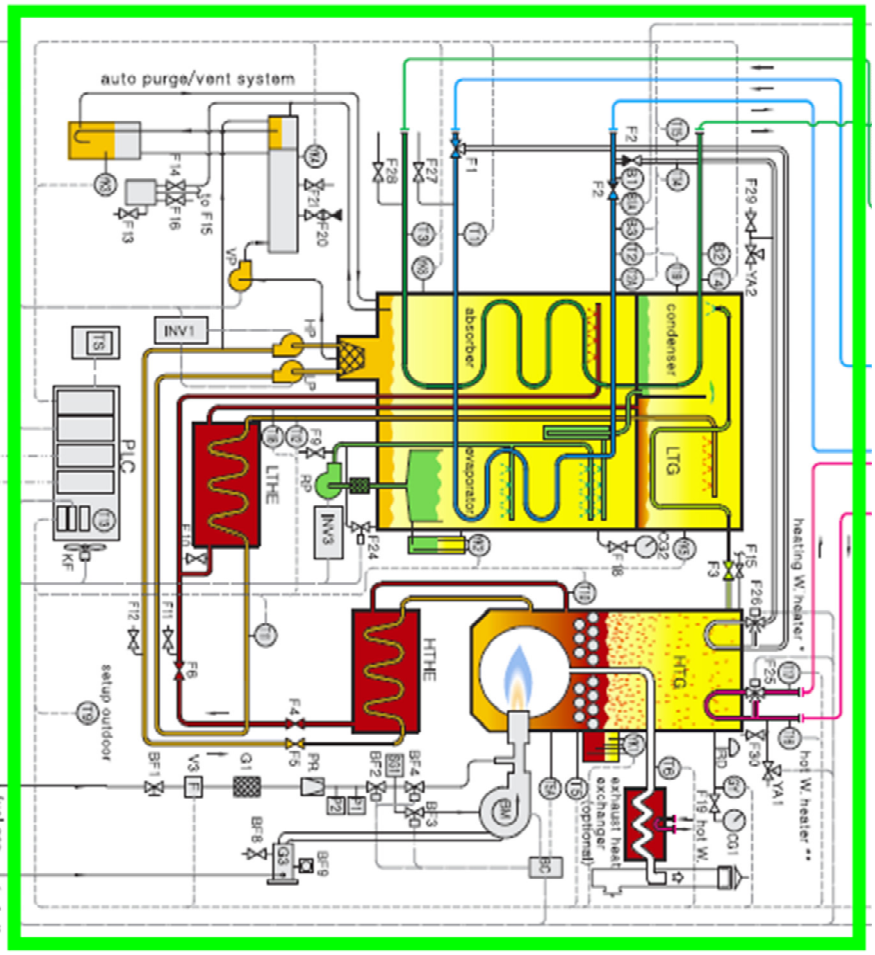
The Cooling Principle

The input heat energy heats LiBr solution to generate vapor, which is then condensed into water by cooling water. When the refrigerant water enters evaporator (in high vacuum condition), its temperature goes down immediately. And it is sprayed over the evaporator tubes to make cooling. The water absorbs heat from air conditioning system and evaporates, then is absorbed by concentrated LiBr solution from the generators. The cooling water takes away the heat and rejects it into the air. Diluted solution is pumped into HTG and LTG separately to be heated to begin the process all over again.

The Heating Principle

The input heat energy heats the LiBr solution. The vapor produced by the solution heats the heating water in tubes, while condensate returns to the solution to be heated and the cycle repeats. As "separate heating" is adopted, the heating cycle becomes very simple, just like a vacuum boiler.

Please see the PI&D diagram of the direct fired chiller on the next page.



Sensors:

T1	chilled W. inlet temp. sensor
T2	chilled W. outlet temp. sensor
T2A	chilled W. calibration temp. sensor
T3	cooling W. inlet temp. sensor
T4	cooling W. outlet temp. sensor
T5	HTG temp. sensor (to PLC)
T5A	HTG temp. control (to burner)
T6	exhaust temp. sensor
T9	ambient temp. sensor
T10	HTG crystallization sensor
T11	LTHE diluted solution inlet temp. sensor
T12	LTG crystallization sensor
T13	control cabinet temp. sensor
T14	heating W. inlet temp. sensor*
T15	heating W. outlet temp. sensor*
T16	hot W. inlet temp. sensor**
T17	hot W. outlet temp. sensor**
T18	LTG temp. sensor
T19	condenser temp. sensor
B1	chilled W. flow switch
B1A	chilled W. flow switch
B2	cooling W. flow switch
B3	chilled W. flow switch
GY	pressure control
YK1	HTG solution level probe
YK2	refrigerant level probe
YK3	non-condensable gas sensor
YK4	auto air vent probe
YK5	LTG solution level probe
YK6	absorber solution level probe
V3	gas flow meter
SG1	burner gas leakage sensor
SG2	machine room gas leakage sensor

Controlled objects:

RP	refrigerant pump
HP	HTG solution pump
LP	LTG solution pump
VP	air vent pump
F24	refrigerant motor valve
F25	hot W. 3-way valve**
F26	heating W. 3-way valve*
BF2	fuel gas main solenoid valve
BF3	fuel gas work solenoid valve
BF4	fuel gas ignition solenoid valve
KF	control cabinet fan
BM	burner

Others:

F1	chilled/heating W. switch valve
F2	chilled/heating W. outlet switch valve
F3	steam angle valve
F4	concentrated solution angle valve
F5	diluted solution angle valve
F6	HTG concentration regulating valve
F9	refrigerant sampling valve
F10	LTHE sampling valve
F11	HTHE sampling valve
F12	diluted solution sampling valve
F13	main purge valve
F14	direct purge valve
F15	HTG purge valve
F16	sampling purge valve
F18	main shell pressure
F19	HTG pressure detecting valve vacuum
F20	vent valve & manual valve nitrogen
F21	charging valve
F27	chilled W. drain valve
F28	cooling W. drain valve
F29	heating W. drain valve
F30	hot W. drain valve
YA1	hot W. pressure release valve
YA2	heating W. pressure release valve
BF1	fuel gas ball valve
BF8	fuel oil filter discharge valve
BF9	fuel oil filter vent valve
P1	lower limit pressure switch
P2	upper limit pressure switch
PR	fuel gas pressure regulator
G1	gas filter
G3	oil filter
GG1	HTG compound gauge
GG2	main shell compound gauge
RD	rupture disc

Control devices:

INV1	solution pump inverter
INV3	refrigerant pump inverter
TS	touch screen
PLC	programmable logic controller
BC	burner control

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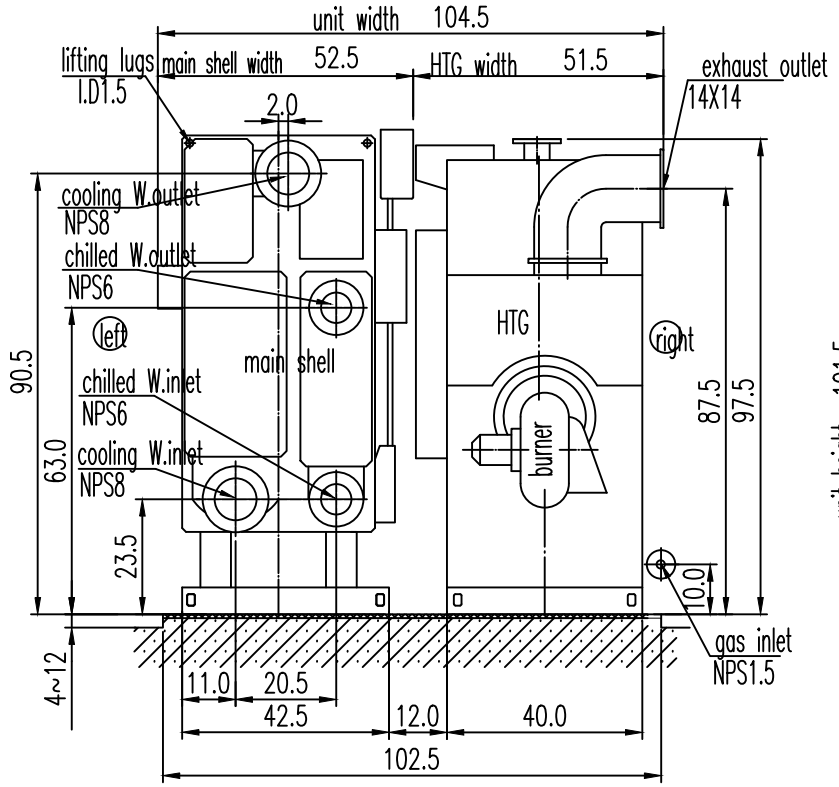
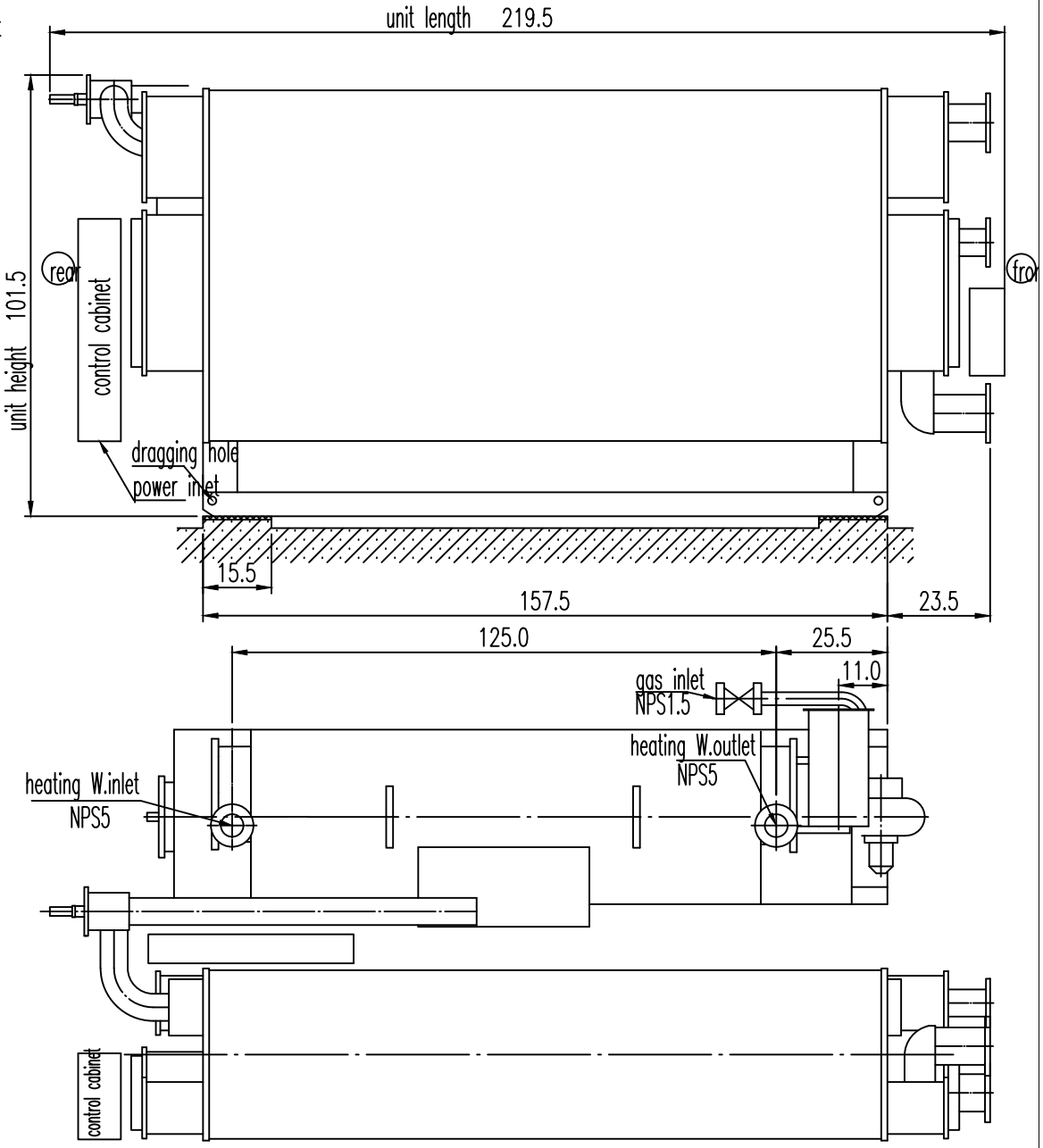
BROAD BZ (Direct Fired) Chiller/Heater Performance Sheet

Project Name:	**Glendale HS Chiller Replacement**	**Rep Name:**	**NSWC**
Location:	**CA**	**Engineer:**	**PocockDesignSolutions**
Contact Info:	**Brandon Musich**	**Date:**	**7/16/2018**

		Customer's Request	BROAD Proposition
Model			**BZ 100 - H1**
Quantity		1	1
Cooling capacity	RT	300	300
Heating capacity	MBH	3570	3,570
Chilled Water			
Chilled W. outlet temp.	°F	44	44
Chilled W. inlet temp.	°F	56	56
Flowrate	GPM	887	600
Max. working pressure	Psig		150
Pressure drop (estimate)	ftH2O		15.0
Fouling factor	hr ft2 °F/Btu		0.0001
Cooling Water			
Cooling W. outlet temp.	°F	97.6	97.6
Cooling W. inlet temp.	°F	85	85
Flowrate	GPM	1117	974
Max. working pressure	Psig		150
Pressure drop (estimate)	ftH2O		20.0
Fouling factor	hr ft2 °F/Btu		0.00025
Heating Water			
Heating W. outlet temp.	°F	149	149
Heating W. inlet temp.	°F	131	131
Flowrate	GPM		397
Max. working pressure	Psig		150
Pressure drop (estimate)	ftH2O		15.0
Natural Gas			
Natural gas consumption for cooling	MBH	2648	2535
Natural gas consumption for heating	MBH	4620	3839
COP for cooling			1.42
COP for heating			0.93
Natural gas pressure			dynamic 2.3~5psig; static<7.3psig
Shell Construction			
Main shell			Q235B carbon structural steel
High temperture generator (HTG) shell			Q235B carbon structural steel
Component Construction			
Absorption pan			Q235B carbon structural steel
Intermediate HEX			316L/304 stainless steel
Spray headers			304 stainless steel
Materials and Dimension			
Evaporator			0.037"x0.75"OD Copper
Condenser			0.02"x1"OD Titanium
Absorber			0.02"x0.75"OD Titanium
HTG			0.157"x2"OD 20G BQ steel
Low temperature generator (LTG)			0.02"x0.75"OD Titanium
Others			
Power			460V/3p/60Hz/4wire
Chiller power consumption	kW		6.8
Unit operating Wt. (estimate)	klbs		39.5
Unit dimension (L*W*H)	inches		219.5*104.5*101.5

Technical specification is based upon AHRI 560 standard.





Note: subject to change as-built drawing.

Customer: Glendale High School		Project: Glendale HS Chiller Replacement
Design:	Stage: reference	Name: BZ100-H1 Dimension Drawing
Check:	No.: WXT100V-150315	
Approval:	Unit: inch	
Date:		BROAD AIR CONDITIONING

Machine room design and construction

Machine room selection

Installation location

When chiller is running, there shouldn't be any shaking, so the chiller can be installed on ground basement, roof or inside building. Broad suggestion is to install on ground level.

Installation environment

Ventilation: Poor ventilation leads to high humidity in the machine room, which may erode the unit, and combustion need fresh air, So good ventilation is required. The volume of combustion air for a DFA is estimated at 14 ft^3 for every MBH fuel.

Drainage:

1. Chiller foundation must be on a high level in the machine room.
2. All discharge pipes and drain pipes must be visible above the drainage.
3. Machine room in basement must be built above a water ditch, which is equipped with an auto level-controlled submerged pump.

Temperature:

Machine room temperature must be controlled within 41~109F. Lower temperature may crack tubes and water boxes when the chiller is shut off; higher temperature may damage electrical components.

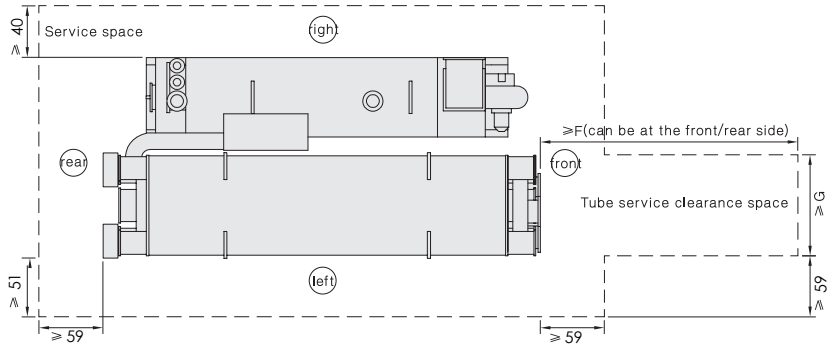
Humidity:

Machine room humidity must be lower than 85%. Higher humidity may impair insulation of electrical components.

Special attention

When the chiller is installed on the roof or inside the building, it should be considered about bearing of beam column and floor.

1. The height of the machine room must be 20inch higher than that of chillers.
2. Thermometer and over temperature alarm must be installed in machine room.



Chiller service space

Required dimension around the chiller for maintenance unit: inch

Type	20	50	75	100	125	150	200	250	300	400	500	600	800	1000
F	90.5	126.0	197.0	197.0	236.0	236.0	236.0	275.5	275.5	275.5	315.0	315.0	315.0	394.0
G	25.5	31.5	35.5	43.0	45.0	51.0	67.0	67.0	77.0	83.0	94.5	94.5	102.5	102.5

F, G is the tube clearance service, which can use space of water pumps, doors or windows and can also be shared by 2 chillers.

EQUIPMENT INSTALLATIONS

Transportation and installation

Shipping status

1. BY20 is to be shipped in one piece, while BY30, 50 in two pieces.
2. BY75~1000 chiller and pump set are to be shipped separately. BY500~1000: pump sets are to be shipped in 2 pieces (A/C water pump set, cooling water pump set)
3. When the unit reaches the machine room, the split pieces need to be connected by BROAD welders (with extra cost) or contractors. The customer needs to prepare welding facilities, pure nitrogen and other necessary help.
4. Solution is charged into the chiller when a unit is shipped in one piece, and packed separately for split shipment or for single-piece shipment with unit shipping weight over 30 tons.

Lifting & Leveling tips

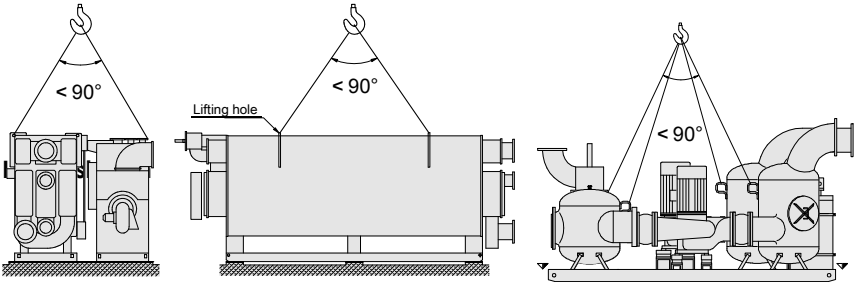
1. If there is no strong vibration source or a special anti-vibration requirement, the chiller can be located vertically without bolts. The pump sets shall be fixed by anchor bolts. Before the chiller arrives at jobsite, it should use concrete pour foundation and check level, leveling degree is＜1.5‰, foundation height is 6～12 inch. If there is no strong vibration source around chiller or there is no customer special request of quakeproof, then the chiller just needs to be installed on the foundation, without using fixed bolts. Pump sets should be fixed by foundation bolt according to the request.
2. For multiple chillers of split shipment, please Insure the original joining between HTG and the Main shell. Please locate the chiller according to chiller joint drawing and Insure the joint gap is less than 0.06 inch.
3. After locating the chiller, please adjust leveling and lay thin steel plate where it is uneven to guarantee compact contact between the chiller and base. Take tube sheet as the leveling point and make front/rear and left/right leveling (check level height of every part by acrylic tube). It should be leveled within 0.8/1000 both lengthwise and sidewise. Leveling must be done within 2 hours after locating the chiller, otherwise the chiller base will be damaged.
4. The chiller must be located levelly and its steel frame bases must match the plinth, the weight of the chiller must be evenly balanced on the plinth. Otherwise, the chiller may be twisted slowly, which will finally result in damage due to leakage.

⚠ Special attention

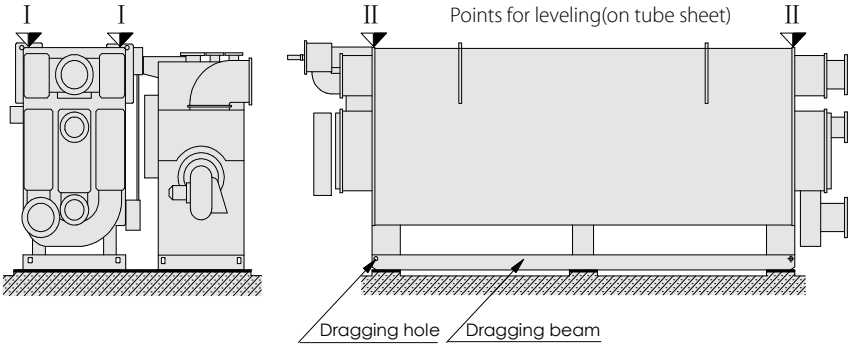
After chiller and parts arrive, customer should arrange responsible person to check and keep all goods safely.

1. During the installation ,customer should arrange responsible person to guard, it is forbidden to touch and twist any valve by irrelevant person.
2. Lifting must be done by qualified lifting companies that are properly insured.
3. When moving the chiller, it must follow the demand mark on the chiller ,otherwise it will damage the chiller!
4. The landing of the chiller must be carried out with care. Crash landing is strictly forbidden. Any impact on the chiller is strictly forbidden.
5. If the machine room is under construction, protective measures are needed to avoid damage or dirt to the chiller. Do not scrape the paint or insulation layer. The insulation layer should be kept until commissioning.
6. Before the chiller start-up, the customer should check the vacuum gauge of the chiller at least one per month. If the reading is far away from 0.02MPa (the first red dot on the gauge), the customer should inform BROAD service engineer immediately.

Lifting sketch



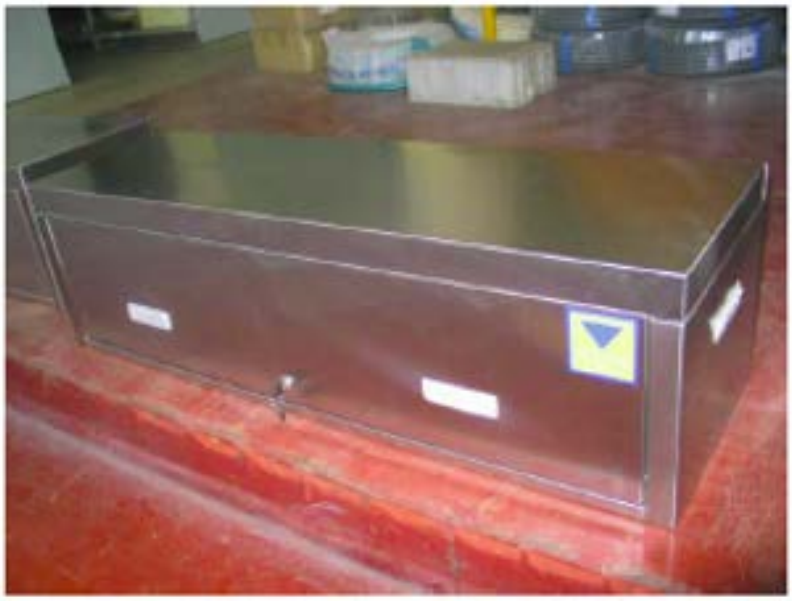
Leveling sketch



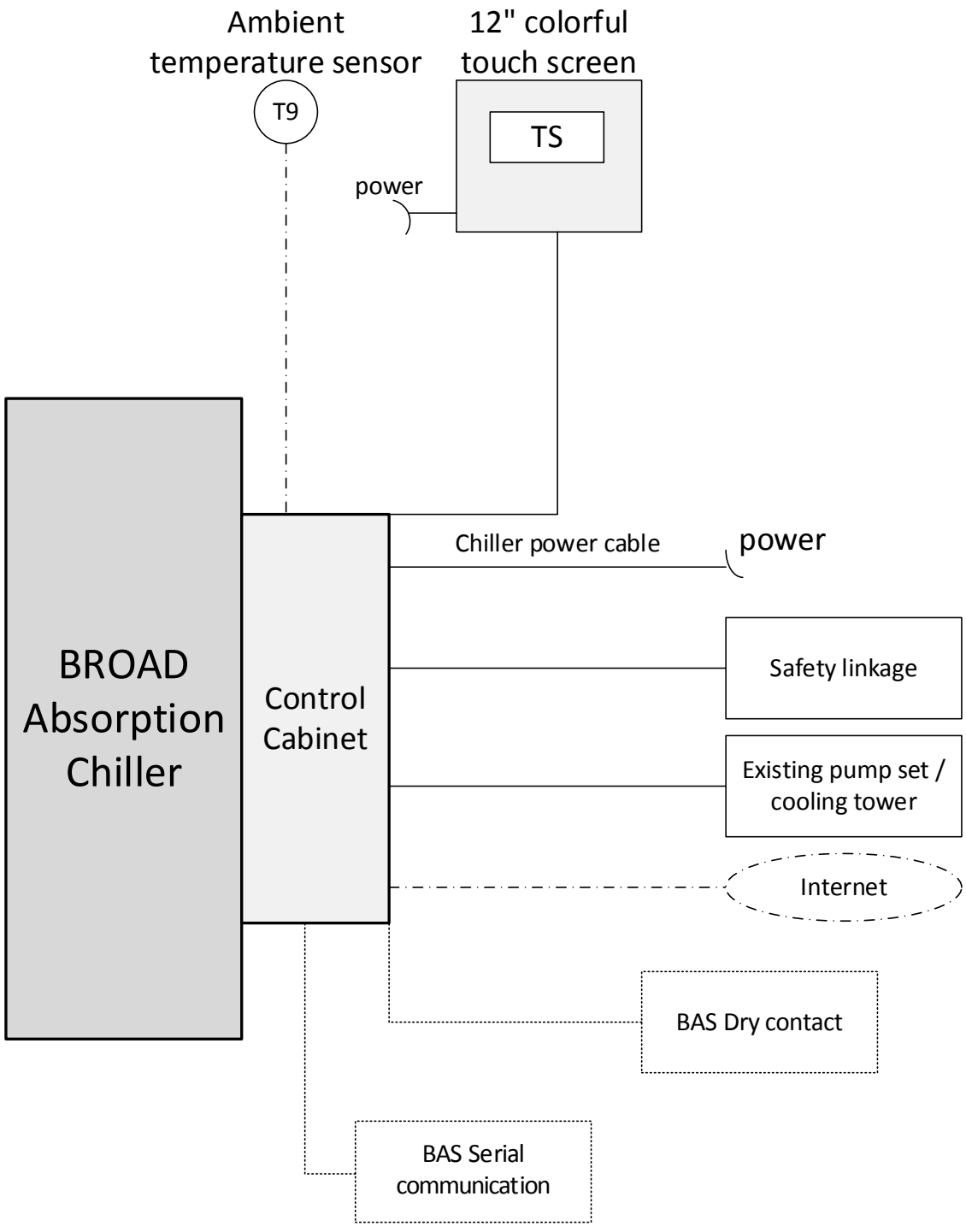
List of Basic Spare Parts in Stainless Steel Toolbox

No.	Item	Unit	Quantity	Function
1	Sealing element	Set	1	Maintenance
2	Vacuum valve clog (DN10)	Piece	2	Maintenance
3	Vacuum valve clog (DN20)	Piece	2	Maintenance
4	Vacuum valve with a nozzle (DN10)	Piece	1	Maintenance
5	Vacuum valve with a nozzle (DN20)	Piece	1	Maintenance
6	Sight glass piece (Ø 80)	Piece	1	Maintenance
7	Rupture disk (Ø 80)	Set	1	Maintenance
8	Fuse link (6A Ø5×20)	Piece	4	Maintenance
9	Fuse link (2A Ø5×20)	Piece	8	Alarm, PLC, outlets of each motor valve
10	Fuse link (4A Ø5×20)	Piece	4	Main control circuit, and solution/refrigerant level control
11	Automatic air vent	Set	1	Spare part for water box
12	Temp. sensor and socket (Pt100-60mm, Pt100-100mm)	Set	1	Maintenance
13	Bolts and nuts for water plate installation	Set	10	Maintenance
14	Vacuum grease	Piece	1	Maintenance
15	Sealing tape	Reel	1	Oil or water system sealing
16	Pin-connector	Piece	20	Wire fastening clip
17	Plastic belt	Piece	20	Wire fastening clip
18	Plastic wrapping ribbon	m	2	Wire fastening clip
19	Insulating tape	Reel	2	For electric insulation

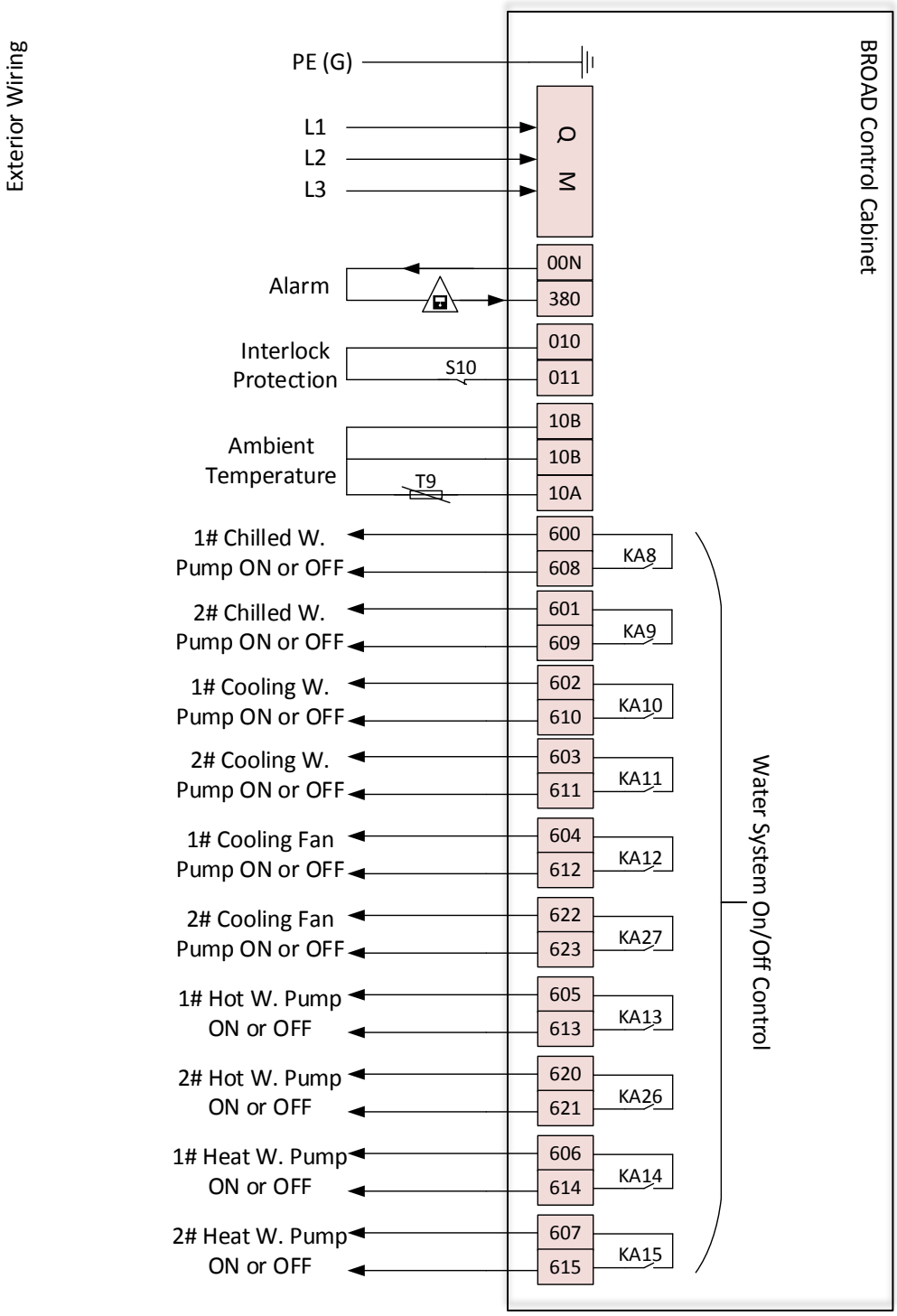
20	Solution/refrigerant level probe (L438)	Piece	1	Maintenance

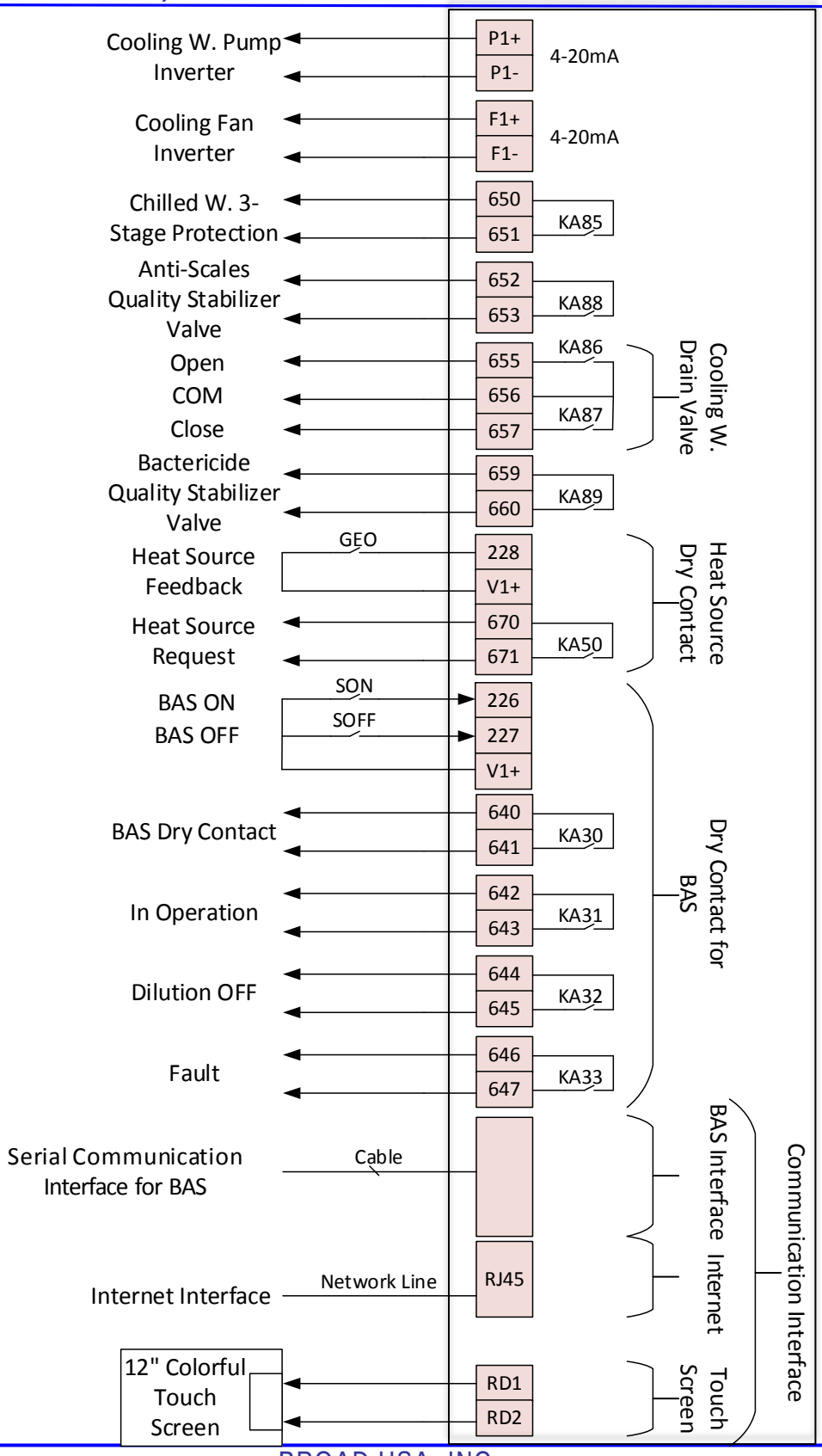


Overview of Control System



Exterior Wiring Diagram




Cooling W. Pump Inverter
P1+
P1-
4-20mA
Cooling Fan Inverter
F1+
F1-
4-20mA
Chilled W. 3-Stage Protection
650
651
KA85
Anti-Scales Quality Stabilizer Valve
652
653
KA88
Open
COM
Close
KA86
KA87
655
656
657
Cooling W. Drain Valve
Bactericide Quality Stabilizer Valve
659
660
KA89
GEO
Heat Source Feedback
228
V1+
Heat Source Request
670
671
KA50
Heat Source Dry Contact
BAS ON
BAS OFF
SON
SOFF
226
227
V1+
BAS Dry Contact
640
641
KA30
In Operation
642
643
KA31
Dilution OFF
644
645
KA32
Fault
646
647
KA33
Dry Contact for BAS
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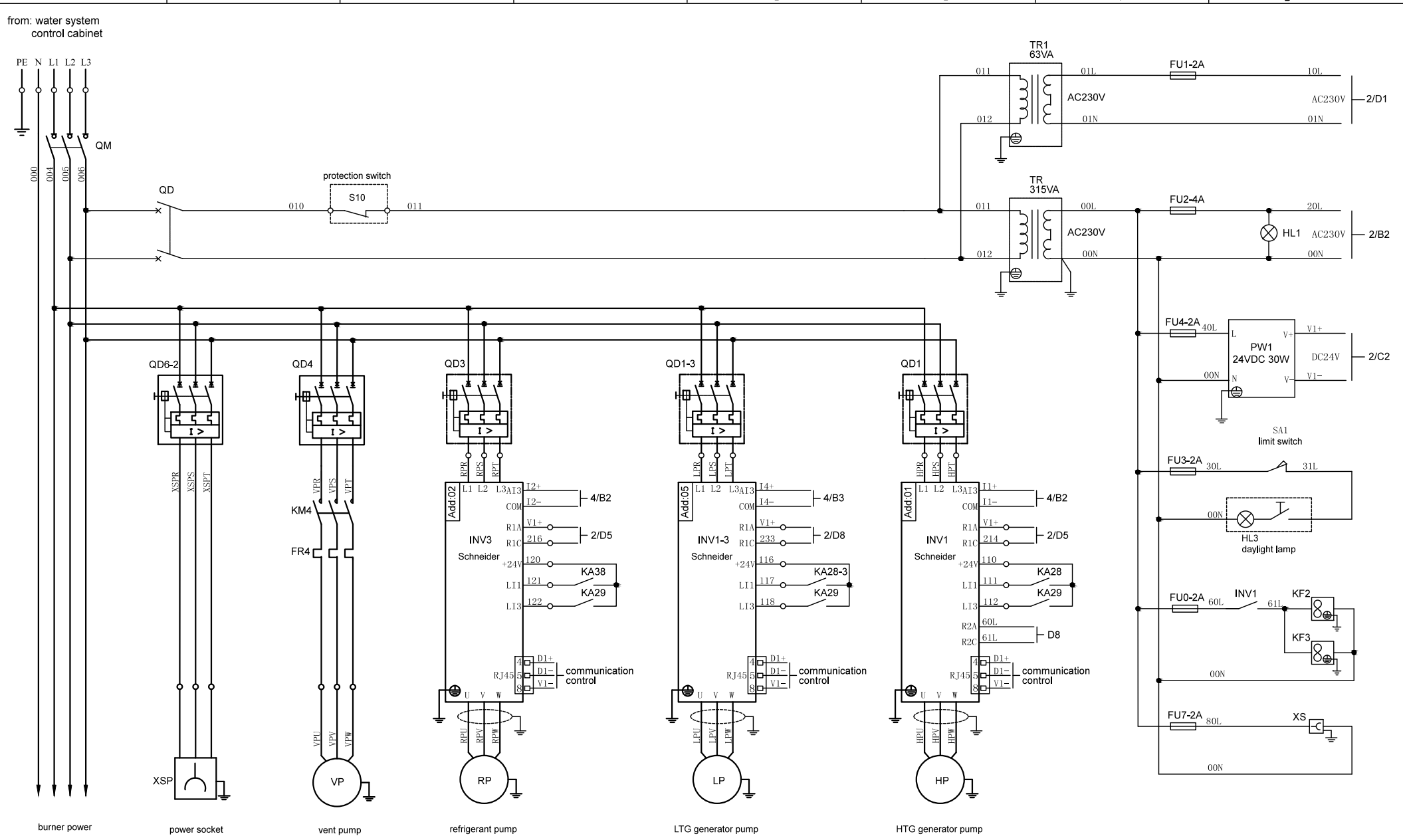
Internet
12" Colorful Touch Screen
RD1
RD2
Touch Screen
Communication Interface

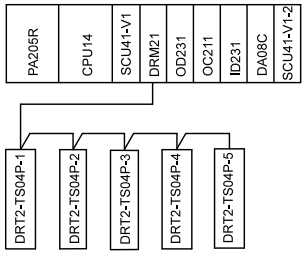


NOTE: 1.S10 is user fire fighting interlock protection switch, 010 and 011 terminals are circuited spotly.
2. Control Cabinet grounding terminals or chiller grounding bolts must be earthed with grounding resistance ≤10Ω.
3. No corresponding control circuit and spare parts when there are no KF3 for chillers.
4. Inverter communication control refers to " Communication Electric Principle Diagram".

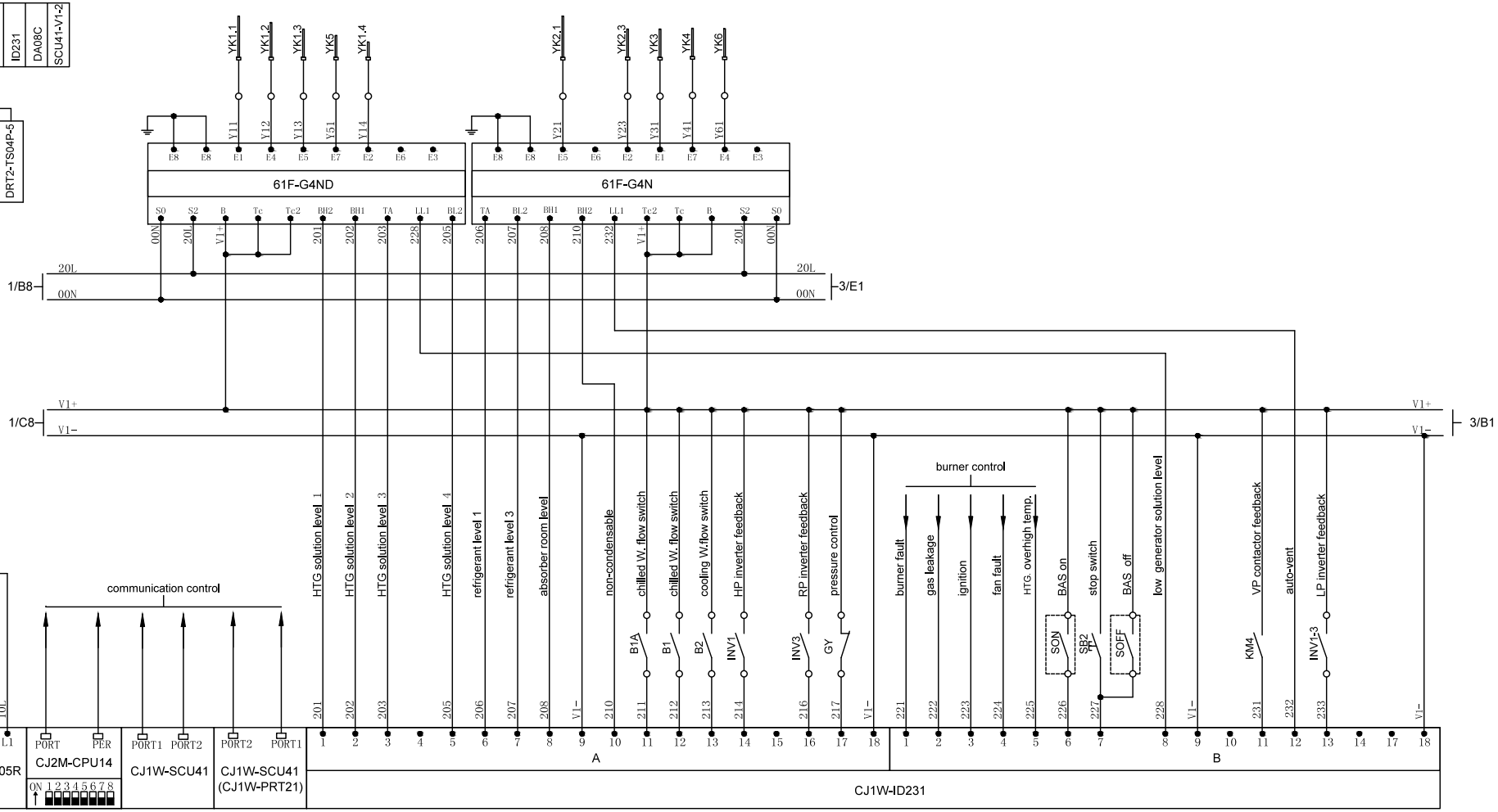
DRAFT NO.	BZ-T72-170525	EDITION	7.2
DESIGN		SCOPE	
CHECK		TOTAL 4 PAGES	PAGE 1
APPROVAL		DATE OF START	
STOP WHYS	☐ REJIGGER	☐ REMOVE	☐ ELSE
USER	☑ PRODUCE	☐ EXPERIMENT	☐ ELSE

BROAD AIR CONDITIONING
ICS ELECTRIC DIAGRAM

PLC arrangement diagram



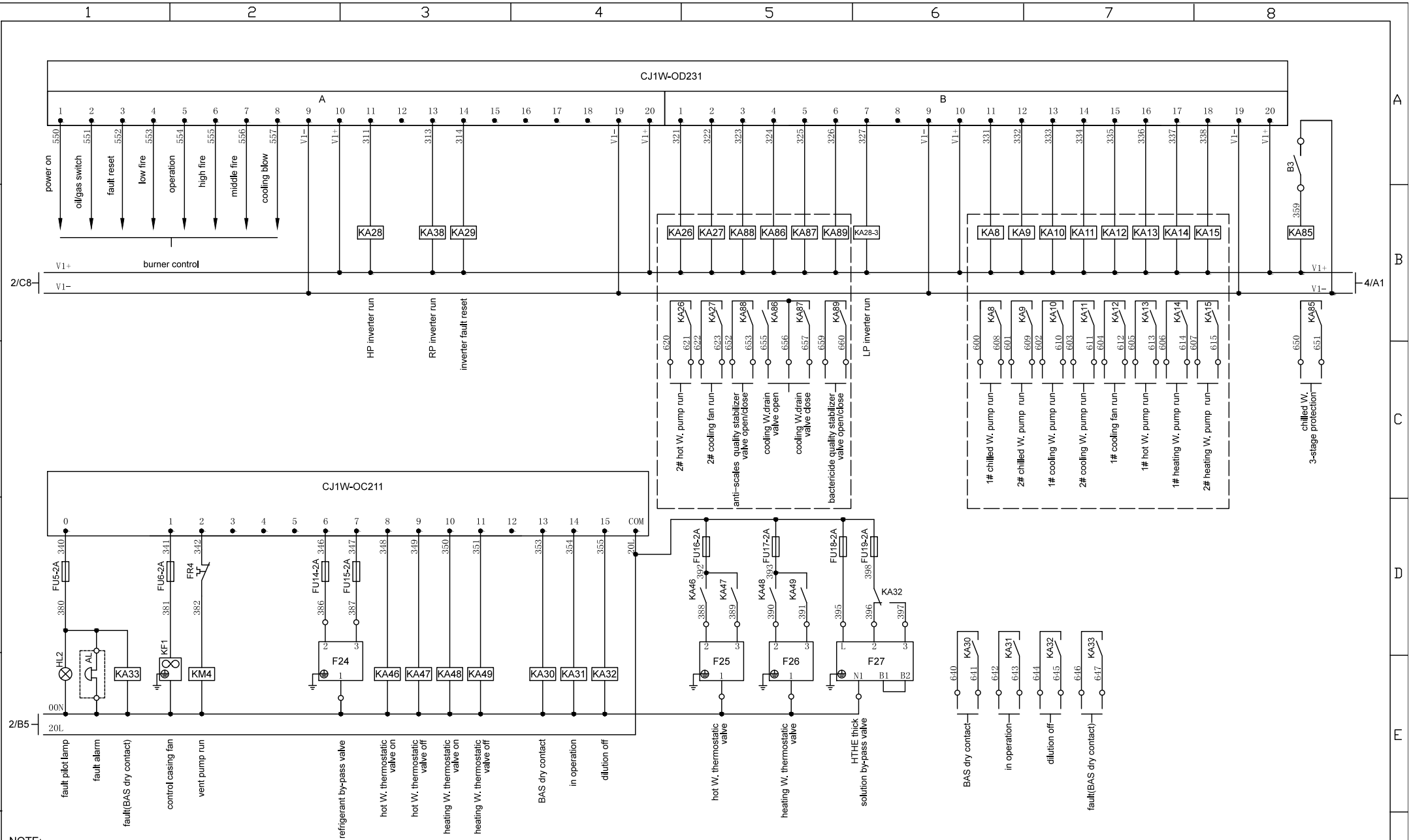
YK1:HTG solution level probe
YK2:refrigerant level probe
YK3:non-condensable probe
YK4:auto-vent probe
YK5:low generator solution level probe
YK6:absorber room probe



NOTE:
1.Liquid-control module 61F-11N of common sensitivity is introduced for YK2.X (corresponding to module U2、U4 & U5). Liquid-control module 61F-11ND of low sensitivity is introduced for other liquid level controls.
2.61F-G4ND circuit change: feet 2 and 3 exchange in module U1,feet 1 and 3 short-connected in module U5.
61F-G4N circuit change: feet 1 and 3 short-connected in module U5.
3.No SON and SOFF for chillers without BAS interface.
4.B1 are C/H W. flow switchs in outdoor package.
5.Burner control refers to "Burner Electric Principle Diagram".Communication control refers to " Communication Electric Principle Diagram".

DRAFT NO.	BZ-T72-170525	EDITION	7.2
DESIGN		SCOPE	
CHECK		TOTAL 4 PAGES	PAGE 2
APPROVAL		DATE OF START	
STOP WHYS	☐ REJIGGER	☐ REMOVE	☐ ELSE
USER	☑ PRODUCE	☐ EXPERIMENT	☐ ELSE

BROAD AIR CONDITIONING
ICS ELECTRIC DIAGRAM

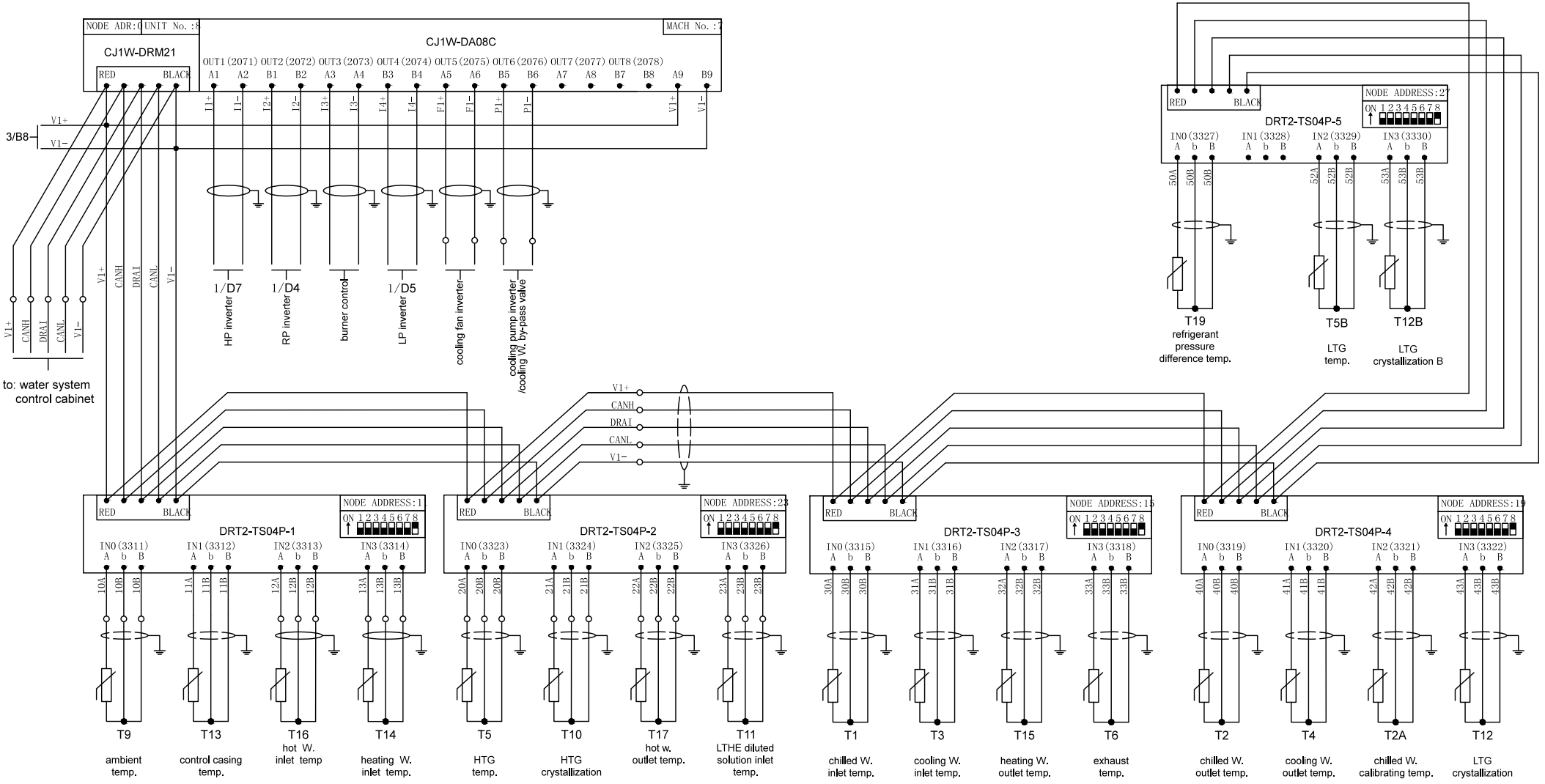


NOTE:

1.No KA48, KA49,FU17 & F26 for cooling-only ,cooling-heating and cooling-hot water type.
2.No KA46, KA47,FU16 & F25 for cooling-only ,cooling-heating and simultaneous cooling- heating operation(4-pipe system) type.
3.No KA14 and KA15, KA8 and KA9 are for chilled/heating water pump control in non-simultaneous cooling-heating operation(4-pipe system) type.
4.No KA30, KA31, KA32and KA33 for chillers without BAS interface.
5.No control circuit in the broken line rim for outdoor package.
6.Burner control refers to "Burner Electric Principle Diagram".

DRAFT NO.	BZ-T72-170525	EDITION	7.2
DESIGN		SCOPE	
CHECK		TOTAL 4 PAGES	PAGE 3
APPROVAL		DATE OF START	
STOP WHYS	☐ REJIGGER	☐ REMOVE	☐ ELSE
USER	☑ PRODUCE	☐ EXPERIMENT	☐ ELSE

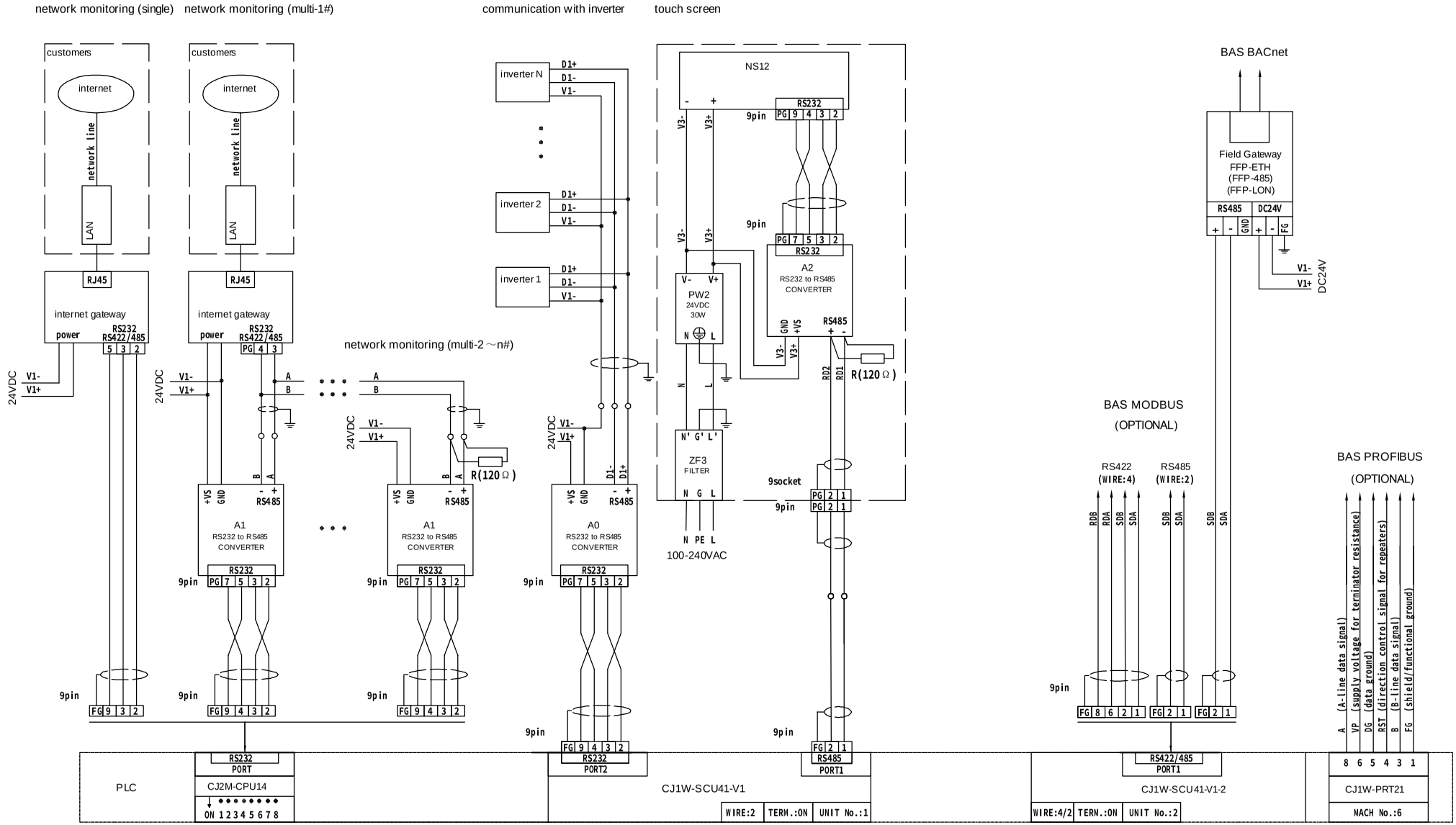
BROAD AIR CONDITIONING
ICS ELECTRIC DIAGRAM



NOTE: 1.Foot No. 6 in DIP switch is set as ON when Fahrenheit temperature is used.
No T12B for chillers without and LTG crystallization B.
2.T15,T17 and T9 must be field-installed and field-wired,
T9 needs to be installed on-site outdoors with good ventilated and no direct sunshine.
3.No T16 ,T17 for cooling-heating and simultaneous cooling-heating operation type,
No T14 , T15 for cooling-hot water type，No T14 ,T15,T16,T17 for cooling-only type.
4.No T14,T15, and analog signals P1+,P1-,F1+,F1- in outdoor package non-simultaneous cooling-heating operation(4-pipe system) type.
T1 and T2 are C/H W. inlet/outlet temp. in outdoor package non-simultaneous cooling-heating operation(4-pipe system) type.
5.Burner control refers to "Burner Electric Principle Diagram" .

DRAFT NO.	BZ-T72-170525	EDITION	7.2
DESIGN		SCOPE	
CHECK		TOTAL 4 PAGES	PAGE 4
APPROVAL		DATE OF START	
STOP WHYS	□ REJIGGER	□ REMOVE	□ ELSE
USER	☑ PRODUCE	□ EXPERIMENT	□ ELSE

BROAD AIR CONDITIONING
ICS ELECTRIC DIAGRAM



NOTE:

1.No interrelated equipments and circuitries for chillers without BAS interface through serial communication.
2.FFP-ETH is installed for BACnetIP type serial BAS,FFP-485 is installed for BACnet RS485 type serial BAS, FFP-LON is installed for Lonwork type serial BAS.

DRAFT NO.	BC-72-151221	EDITION	7.2
DESIGN		SCOPE	
CHECK		TOTAL 1 PAGES	PAGE 1
APPROVAL		DATE OF START	
STOP WHYS	☐ REJIGGER	☐ REMOVE	☐ ELES
USER	☐ PRODUCE	☐ EXPERIMENT	☐ ELES

BROAD AIR CONDITIONING ICS ELECTRIC DIAGRAM COMMUNICATION

BROAD Absorption Chiller BAS points List - BACnet

Type	BACnet MSTP, BACnet IP Device Instance：76800(default)			Scaling	Read/ Write	Description	Direct Fired (Gas/oil Burner)
	Object	Object Name	units				
Analog	AI 1	CHW_inlet_Temp	°F	0.1	R	Chilled water inlet temperature	■
Analog	AI 2	CHW_outlet_Temp	°F	0.1	R	Chilled water outlet temperature	■
Analog	AI 3	CW_inlet_Temp	°F	0.1	R	Cooling (condenser) water inlet temperature	■
Analog	AI 4	CW_outlet_Temp	°F	0.1	R	Cooling (condenser) water outlet temperature	■
Analog	AI 5	HTG_Temp	°F	0.1	R	High temperature generator temperature	■
Analog	AI 6	Exhaust_temperature	°F	0.1	R	Exhaust temperature	■
Analog	AI 7	LTG_Temp	°F	0.1	R	Low temperature generator or Generator temperature	
Analog	AI 8	HTG_Heat_Source_In_Temp	°F	0.1	R	HTG heat source inlet temperature (Steam, Hot water, Exhaust)	
Analog	AI 9	HTG_Heat_Source_Out_Temp	°F	0.1	R	HTG heat source Outlet temp (condensate, Hot water, Exhaust)	
Analog	AI 10	LTG_Heat_Source_In_Temp	°F	0.1	R	LTG heat source inlet temperature (Hot water ,Steam)	
Analog	AI 11	LTG_Heat_Source_Out_Temp	°F	0.1	R	LTG heat source Outlet temperature (Hot water ,Steam)	
Analog	AI 12	HTG_Crystal_Temp	°F	0.1	R	HTG crystallization temperature	■
Analog	AI 13	LTHE_diluted_LiBr_Temp	°F	0.1	R	LTHE diluted solution inlet temperature	■
Analog	AI 14	LTG_Crystal_Temp	°F	0.1	R	LTG crystallization temperature	■
Analog	AI 15	Ambient_Temp	°F	0.1	R	Ambient temperature	■
Analog	AI 16	Cabinet_Temp	°F	0.1	R	Control cabinet temperature	■
Analog	AI 17	SP_ frequency	Hz	0.1	R	Solution pump frequency	■
Analog	AI 18	RP_frequency	Hz	0.1	R	Refrigerant pump frequency	■
Analog	AI 19	Burner_Output	%	0.1	R	Burner openness (DFA only)	■

Analog	AI 20	HTG_heat_source_valve	%	0.1	R	HTG heat source valve opening	
Analog	AI 21	LTG_heat_source_valve	%	0.1	R	LTG heat source valve opening	
Analog	AI 22	CW_pump_frequency	Hz	0.1	R	Cooling water pump frequency	■
Analog	AI 23	Cooling_tower_fan_frequency	Hz	0.1	R	Cooling tower fan frequency	■
Analog	AI 24	CW_bypass_valve	%	0.1	R	Cooling water by-pass valve opening	■
Analog	AV 1	CHW_setting_Temp	°F	0.1	R/W	Chilled w. outlet target temp. setting	■
Analog	AV 2	CW_setting_Temp	°F	0.1	R/W	Cooling w. inlet target temp. setting	■
Analog	AV 3	Heating_W_Setting_Temp	°F	0.1	R/W	Heating w. outlet target temp. setting	■
Analog	AV 4	DHot_W_Setting_Temp	°F	0.1	R/W	Domestic Hot w. outlet target temp. setting	■
Type	Object	Object Name	Inactive Text	Active Text	Read/ Write	Description	
Digital	BI 1	Cooling_mode	No	Yes	R	Cooling mode	■
Digital	BI 2	Heating_mode	No	Yes	R	Heating mode	■
Digital	BI 3	Hot_W_mode	No	Yes	R	Domestic Hot water mode	■
Digital	BI 4	Chiller_Run	Off	On	R	Chiller operation status	■
Digital	BI 5	Dilution_off	Off	On	R	Dilution off status	■
Digital	BI 6	Complete_off	Off	On	R	Complete off status	■
Digital	BI7	Fault_stop	No Fault	Fault	R	Fault stop, Chiller will shut off, need restart	■
Digital	BI 8	Fault_alarm	No Alarm	Alarm	R	Fault alarm, Chiller keep run, auto reset fault.	■
Digital	BI 9	HTG_Level_A	OFF	A Zone	R	HTG solution level remains at A zone	■
Digital	BI 10	HTG_Level_B	OFF	B Zone	R	HTG solution level remains at B zone	■
Digital	BI 11	HTG_Level_C	OFF	C Zone	R	HTG solution level remains at C zone	■

Digital	BI 12	HTG_Level_D	OFF	D Zone	R	HTG solution level remains at D zone	■
Digital	BI 13	HTG_Level_E	OFF	E Zone	R	HTG solution level remains at E zone	■
Digital	BI 14	HTG_Level_F	OFF	F Zone	R	HTG solution level remains at F zone	■
Digital	BI 15	Refri_Level_A	OFF	A Zone	R	Refrigerant level remains at A zone	■
Digital	BI 16	Refri_Level_B	OFF	B Zone	R	Refrigerant level remains at B zone	■
Digital	BI 17	Refri_Level_C	OFF	C Zone	R	Refrigerant level remains at C zone	■
Digital	BI 18	Refri_Level_D	OFF	D Zone	R	Refrigerant level remains at D zone	■
Digital	BI 19	SP_Run	OFF	On	R	Solution pump running	■
Digital	BI 20	RP_Run	OFF	On	R	Refrigerant pump running	■
Digital	BI 21	AP_Run	OFF	On	R	Absorber pump running	
Digital	BI 22	Burner_Low_Fire	OFF	Low fire	R	Burner low fire running (DFA only)	■
Digital	BI 23	Burner_Mid_Fire	OFF	middle fire	R	Burner middle fire running (DFA only)	■
Digital	BI 24	Burner_High_Fire	OFF	High fire	R	Burner high fire running (DFA only)	■
Digital	BI 26	CHW_Pump_Run	OFF	On	R	Chilled water pump running	■
Digital	BI 28	CW_Pump_Run	OFF	On	R	Cooling water pump running	■
Digital	BI 30	Heating_W_Pump_Run	OFF	On	R	Heating water pump running	■
Digital	BI 32	DHot_ W_Pump_Run	OFF	On	R	Domestic Hot water pump running	■
Digital	BI 34	Cooling_Tower_Fan_Run	OFF	On	R	Cooling fan running	■
Digital	BI 35	CHW1_FlowSwitch_Close	Open	Close	R	1# chilled water flow switch status	■
Digital	BI 36	CHW2_FlowSwitch_Close	Open	Close	R	2# chilled water flow switch status	■
Digital	BI 37	CW_FlowSwitch_Close	Open	Close	R	Cooling water flow switch status	■

Digital	BV 1	Start_Command	Not Start	Start	R/W	Start Command	■
Digital	BV 2	Dilution_off_Command	Not Stop	Stop	R/W	dilution off Command	■
Digital	BV 3	Fault_Reset_Command	Don't Reset	Reset alarm	R/W	fault reset Command	■

BROAD Chiller Start and Stop Control Sequence

Control sequence

BROAD strongly advises to use the chiller's linkage control operation mode whenever the chiller needs to be turned ON and OFF.
In order to avoid the freeze of evaporator copper tubes, BROAD requests to strictly follow the chiller's start-up and stop sequence.

- **Do not jump out or adjust the safety value of the flow switches.**
- **Condenser water flow can NOT run alone without chilled water flow.**
- **Do not shut off chilled water system pump manually or close the valves to reduce the chilled water flow when BROAD chiller is in operation and in dilution cycle.**

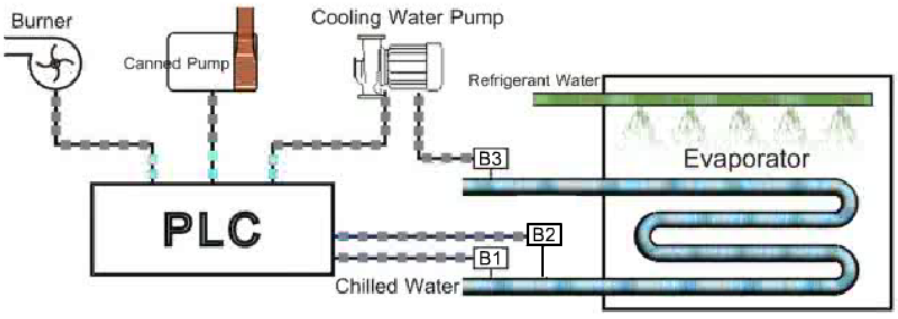
BROAD has dry contract signals to request for enabling/disabling the chilled and condenser water flow, which should be linked into water pump or valve control loop. The chiller PLC safety program can well protect the unit via automatically controlling water flow loop.

If BMS control system is available, BMS must be interlocked between chilled water pump and condenser water pump by hardware and software. Never make the condenser water go through machine alone without the chilled water flow.

Three-level safety protection for Evaporator copper tubes

BROAD provides three flow switches. Two flow signals (B1,B2) will be sent to PLC control interlock program sequence, and the other flow signal (B3) will control relay KA85. This relay dry contact (**wire # 650, 651**,normally open) has to be wired to condensation water inlet motor valve(or condenser water pump) control circuit for protection.

The working sequence is shown as below:
Once chilled water flow failure occurs, the flow signal B3 is open, and the KA85 Relay will open and request for shut off the condenser water inlet motor valve (or condenser water pump) to stop absorption cooling cycle and keep heat in chiller for the protection of evaporator copper tubes far away from frozen conditions.
The condensation water inlet motor valve will never be open until the chiller receives chilled water flow again.



1st level: Flow switch(B1)
2nd level: Flow switch(B2)
3rd level: Flow switch(B3)

Local control

The chiller unit can be controlled from BROAD screen with start/stop button; Chilled water pump and cooling water pump will start/stop by dry-contact or manually.

Start-up sequence

1. Start chiller on control screen, after start button turns to green color, enable Chilled Water Flow and check the chilled water pressure drop between inlet/outlet. Chilled water flow detection time is 7 min.

2. Enable Condenser Water Flow and check the pressure drop. Condenser water flow detection time is 30 sec.

3. After Chiller Start Preconditions have been met by step 1 and 2, the chiller will start the solution pump.

4. The solution pump will be running after 30 sec. When the HTG solution level reaches B zone for double stage chiller, the burner will start or the heat source valve will be open. The chiller will be automatically running.

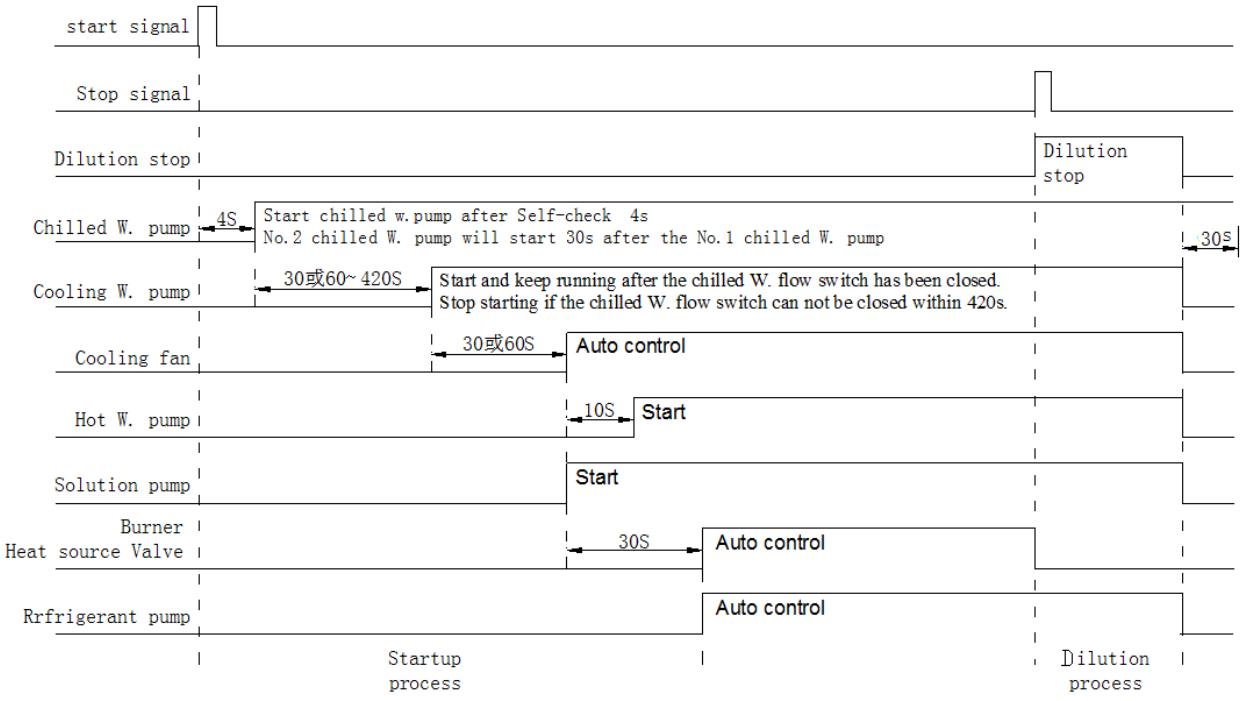
Dilution off sequence

1. Stop chiller on control screen. The burner will stop or the heat source valve will close when receiving the chiller off command, and the chiller goes into the dilution cycle. Solution pump, chilled water pump and cooling water pump will keep running.

2. Once the chiller completes the dilution cycle, the solution pump will be off, and the Condenser Water Flow **MUST** be disabled **FIRST.**

3. After 30 sec (condenser water flow detection time), the Chilled Water Flow can be disabled.

Chiller start/stop sequence chart



BMS control

The chiller unit can be controlled by Building Management System (BMS) as well as optional. BMS can start/stop the chiller, Chilled water pump, cooling water pump, cooling tower and maintain the cooling water inlet temperature.

Start-up sequence

1. BMS sends start command to the chiller to start cooling.

2. The start button on the chiller touch screen will turn to green color, and then the chiller sends back the signal to BMS to request for starting the chilled water pump (or chilled water flow) (420 seconds as the chilled water flow detection time).

3. Once it detects the chilled water flow via flow switches, the chiller will send back the signal to BMS to request for starting the condenser water pump (or condenser water flow) (30 seconds as the condenser water flow detection time).

4. Th solution pump will be running after 30 sec. When the HTG solution level reaches B zone for double stage chiller, the burner will start or the heat source valve will be open. The chiller will be automatically running.

5. BMS maintains the cooling water inlet temperature at 82F (80-85F).

Dilution off sequence

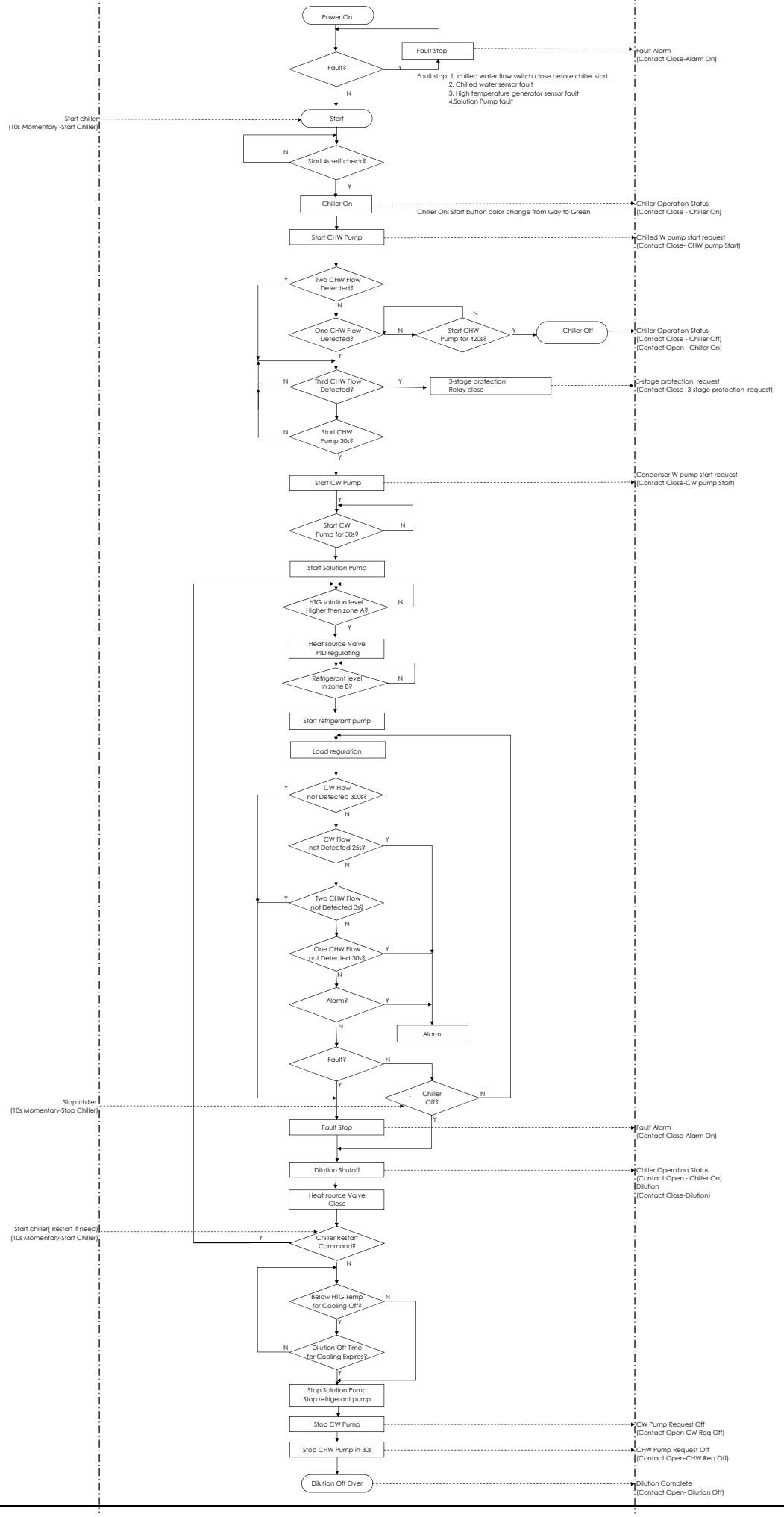
1. BMS sends stop command to the chiller to stop the cooling operation.

2. The stop button on the touch screen will turn to red color, and then the chiller goes into dilution cycle to cool down. The Chilled and condenser water flow should be kept running until the dilution cycle is complete.

3. Once the chiller completes the dilution cycle, the unit will send back the signal to BMS to stop the condenser water pump (or condenser water flow) (30sec as the condenser water flow detection time), and then the signal to BMS to stop the chilled water pump (or chilled water flow) (30sec as the chilled water flow detection time).

4. The stop button on the touch screen will change the color from red to white.

Start Flow Chart for System Linkage by BROAD



Notes:

CHW - Chilled Water
CW - Condenser Water

----------▸ Link or signal between Broad& BAS

NOVA PLUS 2
ULTRA LOW NOx
COMBUSTION
SYSTEMS

GAS

400,000 –
8,600,000
BTU

Power Flame® Nova Plus 2™

The Power of Choice

Power Flame's Premixed, Surface Stabilized Combustion Burner

The Power Flame NOVA Plus 2™ Combustion System employs a fully premixed, surface stabilized combustion technology to provide proven ultra-low NOx solutions –**Sub 9 to 20 PPM –** without FGR for commercial, industrial and process applications.

Premixing fuel and air assures complete combustion with minimal levels of CO and unburned hydro-carbons.

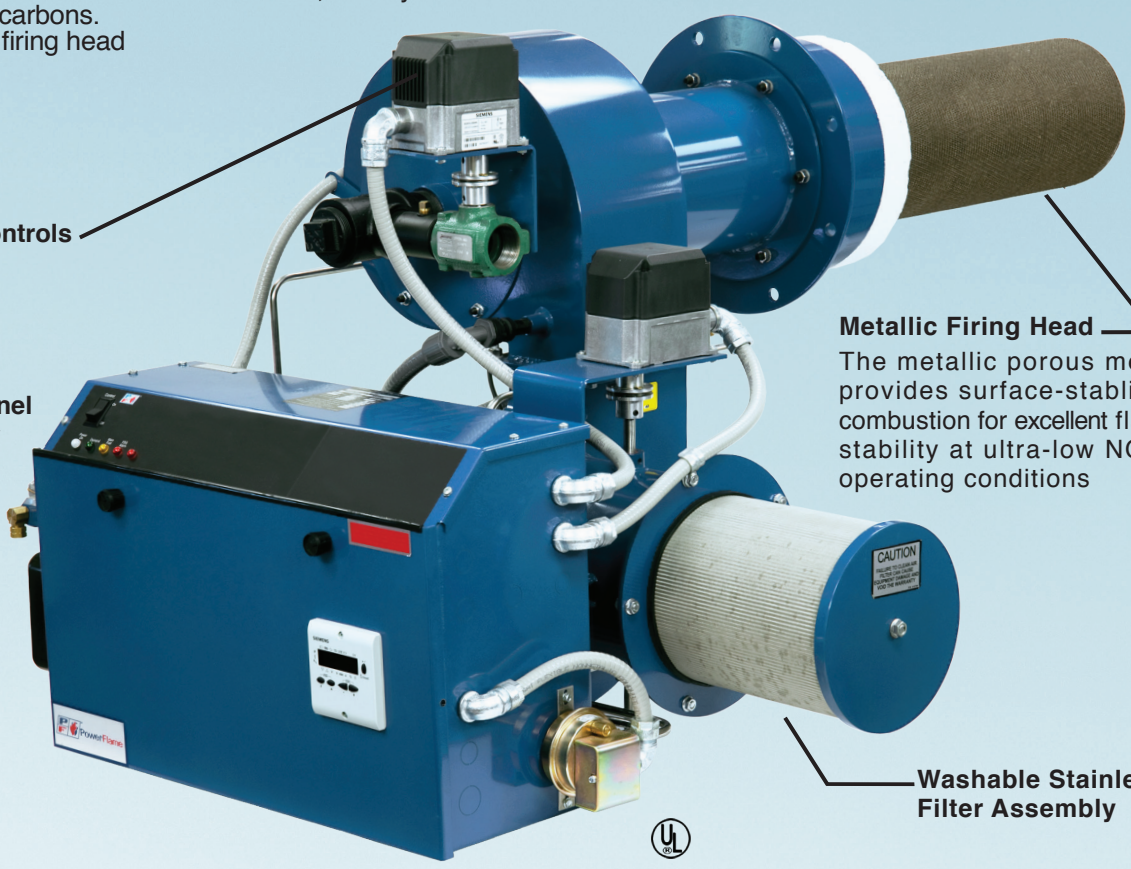
The all metallic firing head guarantees reliable and consistent performance at the operating conditions necessary to provide single digit NOx emissions.

The NOVA Plus 2 is a simple, cost effective, field proven system designed to meet today's most stringent emissions requirements.

Power Flame provides a U.L. listed, factory tested package, tailored to your job specific requirements. The NOVA Plus 2 is suitable for use on firetube and watertube boiler applications, as well as process heaters. It will operate with uniform heat flux and excellent flame stability over a broad range of operating conditions.

The modular concept that is the basis for all Power Flame burners keeps the initial investment low and maintenance costs at a minimum across the life of the burner.

The NOVA Plus 2 is equipped with a state of the art control system and integral panel. The parallel positioning combustion control safely operates the burner and minimizes the start-up time.



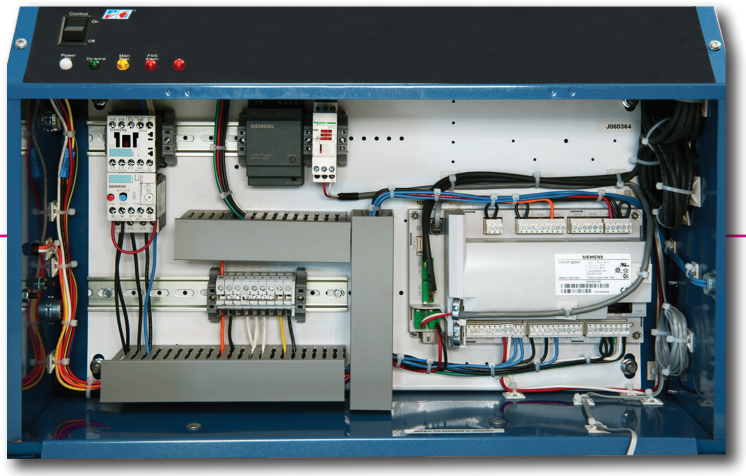
NP2–0812

Power Flame

The Power to Manage Energy

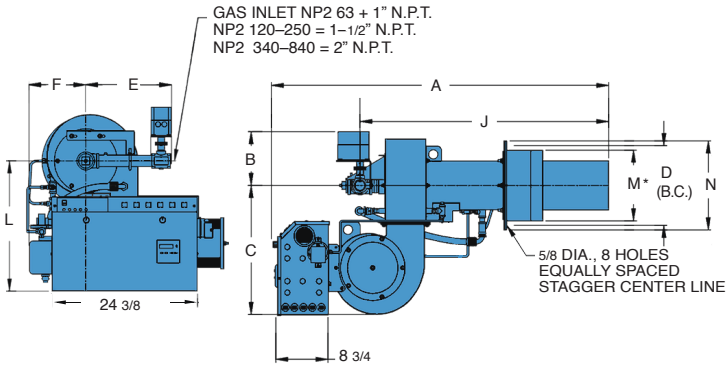
STANDARD EQUIPMENT

- Metallic fiber combustion head
- Blower assembly with 3450 RPM motor
- Variable frequency drive (optional)
- Combustion control with UV scanner
- Gas electric pilot with ignition transformer
- Main and pilot gas trains
- Linkageless controls
- Washable stainless steel filter assembly

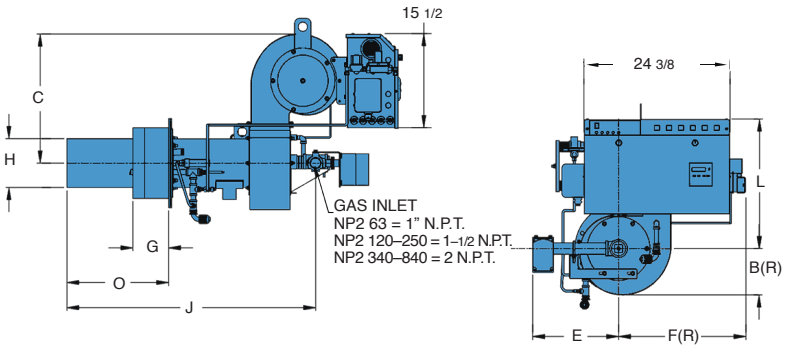


Nova Plus 2 is furnished with the exclusive Alpha System LED display. Modulating control is achieved through the use of linkageless controls mounted in the control panel.

MODEL NP2



MODEL NP2R



* ADD 3/8" TO "M" FOR OPENING IN HEAT EXCHANGER FRONT PLATE

DIMENSIONS (Inches) Standard Models

RATINGS & SPECIFICATIONS

Burner Model	A	B	B(R)	C	D(B.C.)	E	F	F(R)	G	H	J	L	M	N	O	CAPACITY[1] BLOWER MOTOR H.P. MAX.	STD. GAS TRAIN SIZE	NAT. GAS MBH MAX. (9 PPM)	NOMINAL BOILER BHP (9 PPM)	GAS PRESS (IN.W.C.)[2] MIN. (9 PPM)	NAT. GAS MBH MAX. (20 PPM)	NOMINAL BOILER BHP (20 PPM)	GAS PRESS. (IN.W.C.)[2] MIN. (20 PPM)
NP2–G–63	48 3/8	10 7/8	6 1/2	16 5/8	11 1/8	13 7/8	11	19 7/8	4	5 3/4	33 1/4	19 1/2	9 5/8	12 5/8	10 1/4	1/2	1"	700	16.7	7.7	750	17.9	8.3
NP2–G–120	53 3/8	10 7/8	6 1/2	16 5/8	11 1/8	13 7/8	11	19 7/8	4	5 3/4	38 1/4	19 1/2	9 5/8	12 5/8	15 1/4	3/4	1 1/2"	1,230	29.3	8.4	1,360	32.4	9.7
NP2–G–170	56 3/8	10 7/8	7 3/4	21 1/4	13 1/8	14 1/4	9 1/2	21 1/4	6	8 1/8	41 1/4	21 1/2	11 5/8	14 5/8	17 1/4	1.0	1 1/2"	1,740	41.4	11.4	1,900	45.2	12.7
NP2–G–250	62 3/8	10 7/8	7 3/4	21 1/4	13 1/8	14 3/8	9 1/2	21 1/4	6	8 1/8	47 5/8	21 1/2	11 5/8	14 5/8	23 1/4	2.0	1 1/2"	1,998	47.5	12.5	2,770	66.0	13.7
NP2–G–340	66 3/8	10 7/8	7 3/4	21 1/4	13 1/8	14 3/8	9 1/2	21 1/4	6	8 1/8	51 5/8	21 1/2	11 5/8	14 5/8	27 1/4	2.0	2"	3,200	76.2	13.1	3,470	82.6	14.1
NP2–G–420	67	10 7/8	7 3/4	21 1/4	15 1/8	14 3/8	9 3/4	21	6	9 7/8	53 7/8	21 1/2	13 5/8	16 5/8	28 1/4	3.0	2"	4,375	104.2	14.4	5,020	119.5	15.8
NP2–G–520	74 7/8	11 1/2	7 3/4	23 3/4	15 1/8	14 1/2	9 3/4	21	6	9 7/8	59	24 1/8	13 5/8	16 5/8	33 1/4	5.0	2"	4,998	119.0	20.0	6,100	145.2	21.4
NP2–G–630	86	11 1/2	11 1/8	29	21 1/2	14 1/4	11 3/4	40 1/8	8 1/2	12	60 3/8	29 7/8	20	23	33 7/8	7.5	2"	6,300	150.0	16.0	7,350	175.0	18.0
NP2–G–840	94	11 1/2	11 1/8	29	21 1/2	14 1/4	11 3/4	40 1/8	8 1/2	12	68 3/8	29 7/8	20	23	41 7/8	10.0	2"	8,400	200.0	32.0	8,600	209.7	32.5

® Power Flame Incorporated
2001 South 21st Street Phone 620-421-0480
Parsons, KS 67357 Fax 620-421-0948
Web Site: http://www.powerflame.com
E-Mail: csd@powerflame.com

Note 1. Capacities listed are based on +1.0" W.C. positive pressure. Refer to capacity curves for derates based upon combustion chamber pressure.
2. At inlet to main manual shutoff cock to obtain P/F certified ratings with standard U.L. gas train. Optional gas trains available for lower pressures.
3. Maximum Gas Pressure 56 in wc.

FX series 系列

高可靠性真空泵

High quality vacuum pump

FX8 FX16 FX32 FX60

FIRST

使用说明书

OPERATION MANUAL

直联旋片式真空泵

DIRECT-DRIVE OIL ROTARY VANE VACUUM PUMPS

Supply of one portable vacuum pump will be left on site for service purposes

上海富斯特真空泵有限公司

SHANGHAI FIRST VACUUM PUMP CO.,LTD.

1. Product overview:

FX (2XZ) two-stage rotary vane vacuum pumps is direct linked structure, its performance composed with high-pressure stage and low-pressure stage, The inlet of the pump is connected to a vacuum device.The air in the vacuumn device will be sucked into the pump and pumped out through the outlet of the pump.The high-pressure valve will be closed when the vaccum device get the required vacuum.The ultimate vaccum pressure of the pump is 4x10^-2Pa.The pump is connected with the motor which operates in high speed with small dimension.2XZ vacuum pumps are used for pumping the air, make the vacuum pressure up to 4X10^-2Pa.widely used in HVAC , air conditioning and refrigeration, vacuum coating,vacuum plastic forming markets.

2. Purpose &use

FX (2XZ) Direct type vacuum pump is used for pumping the air in the sealed container ,make the vacuum pressure up to 4X10-2Pa.It can be used separately, or as the before pump for booster pump , diffusion pump& molecular pump. It can be also used for pumping the mixed condensable gases. The pump can be used in vacuum smelting, vacuum brazing, vacuum drying, vacuum packaging, vacuum distillation, vacuum degassing, vacuum, vacuum experimental equipment and other ancillary operations, and refrigeration equipment, air conditioners, refrigerators, color TV production lines and so on. FX8 and FX16 vacuum pump are produced with small size, light weight, low noise, especially suitable for laboratory use.

3 technical parameters:

Brand: First (We specialize in manufacturing and developing vaccum pumps for 18years.)

Model: FX32 （2XZ-8B）

Model		FX8(2XZ-2B)	FX16(2XZ-4B)	**FX32(2XZ-8B)**	FX60(2XZ-15B)
Geometry pumping speed m^3/h(L/s)		7.2（2）	14.4（4）	33.4（9.3）	63.0（17.5）
Nominal pumping speed m^3/h(L/s)		8（2.2）	16（4.4）	28.8（8.0）	54.0（15.0）
Ultimate partial pressure（Pa）	Without gas ballast	≤4X10^{-2}	≤4X10^{-2}	≤2X10^{-2}	≤2X10^{-2}
	With gas ballast	≤8X10^{-2}	≤8X10^{-2}	≤8X10^{-2}	≤8X10^{-2}
Ultimate total pressure (Pa)	Without gas ballast	≤5X10^{-1}	≤5X10^{-1}	≤5X10^{-1}	≤5X10^{-1}
	With gas ballast	≤6X10^{-1}	≤6X10^{-1}	≤6X10^{-1}	≤6X10^{-1}
NoiseLw:dB(A)	Without gas ballast	62	65	69	70
	With gas ballast	65	67	71	72
Allowable pressure of vapor（Pa）		2000	2500	3000	4000
Pumping rate of vapor（L/h）		360	500	600	1200
InletΦ		DN25ISOKF	DN25ISOKF	DN40ISOKF	DN40ISOKF
OutletΦ		DN25ISOKF	DN25ISOKF	DN25ISOKF	DN25ISOKF
Oil consumption（L）		1.1	1.5	2.8	4
Oil brand		HFV-A200	HFV-A200	HFV-A200S	HFV-A200S
Rotating speed(r/min)		1400	1420	1400	1420
Motor power（Kw）		0.37	0.55	1.1	2.2
Weight		1Phase:29kg 3 Phase：27kg	1Phase:34kg 3Phase：29kg	61	70
Dimension（mm）		510X170X260	550X170X260	630X240X410	690X240X410

4. Operational instructions:

1 . Check the oil level. Too low level, the exhaust valve seals can not work which will damage the vaccum pressure.Too high level , it may cause oil injection.It is normal that the oil level will increased during pump working.Please add the recommended vacuum pump oil, and add from the “add oil hole”. After refueling complete, should be a spin on the plug. Oil should be filtered , to avoid debris into the plug hole.

2 . FX (2XZ) rotary vane vacuum pumps can be a starter in the atmosphere or through any vacuum. If attached pump port solenoid valves, and pumps should be operated simultaneously .

3 . When the ambient temperature is too high , the oil temperature rises, the viscosity decreases , the saturation vapor pressure increases , causing decrease in the ultimate vacuum , particularly as measured by a thermocouple full pressure . Such as enhanced ventilation , or improve pumping performance, ultimate vacuum can be improved.

4 . Check the rotary vane vacuum pump ultimate vacuum compression mercury vacuum gauge to prevail , such as meter calibration after full pre-pumping , pump temperature to stabilize , pump port directly connected with the meter , running within 30 minutes , to reach ultimate vacuum . The total value of the measured pressure gauge and vacuum gauge and pump oil to regulate the error about , and sometimes even a great error , only for reference.

5. If the relative humidity is high , or pumping gas containing more condensable vapor is pumped after turning the container should open the gas ballast valve , running 20 to 40 minutes after turning off the gas valve . Before stopping the pump , gas ballast valve open -load exercise for 30 minutes in order to prolong the life of the oil pump .

6. FX (2XZ) rotary vane vacuum pump oil options: the viscosity of the oil pump starting power and influence ultimate vacuum pumps , high vacuum degree of viscosity favorable starting power is larger. Oil saturation vapor pressure at the pump will affect the temperature limit of the total pump pressure, the lower the better .

(1) We recommend the use of Huifeng brand HFV-200 (2L and 4L pump), HFV-200S (8L and 15L)

(2) If the degree of vacuum less demanding and frequent replacement of contaminated oil , vacuum pump oil supply difficulties , No. 50 machine oil can be used instead.

(3) If the ambient temperature is low, difficult to start , ultimate vacuum less demanding , the viscosity can be slightly lower than the true home on or mechanical oil pump oil

FX (2XZ) rotary vane vacuum pump maintenance and repair .

5.Note:

1 . Please make sure the vacuum pump oil is clean,prevent debris from entering the pump.

2 .Please check the oil level is proper.

3 . You can turn on the gas ballast and let the pump running when the water vapor or volatile matter are mixed into the pump.If this can not recover the vacuum pressure after several hours ,please try to change the oil.Oil Change Method: pump runs about half an hour , the oil thinning, stop the pump discharge oil from the drain hole , and then open the air inlet run 10 to 20 seconds from the suction port here can slowly add a small amount of clean oil pump , memory to replace the oil pump chamber . Out as dirty oil , which can be repeated .

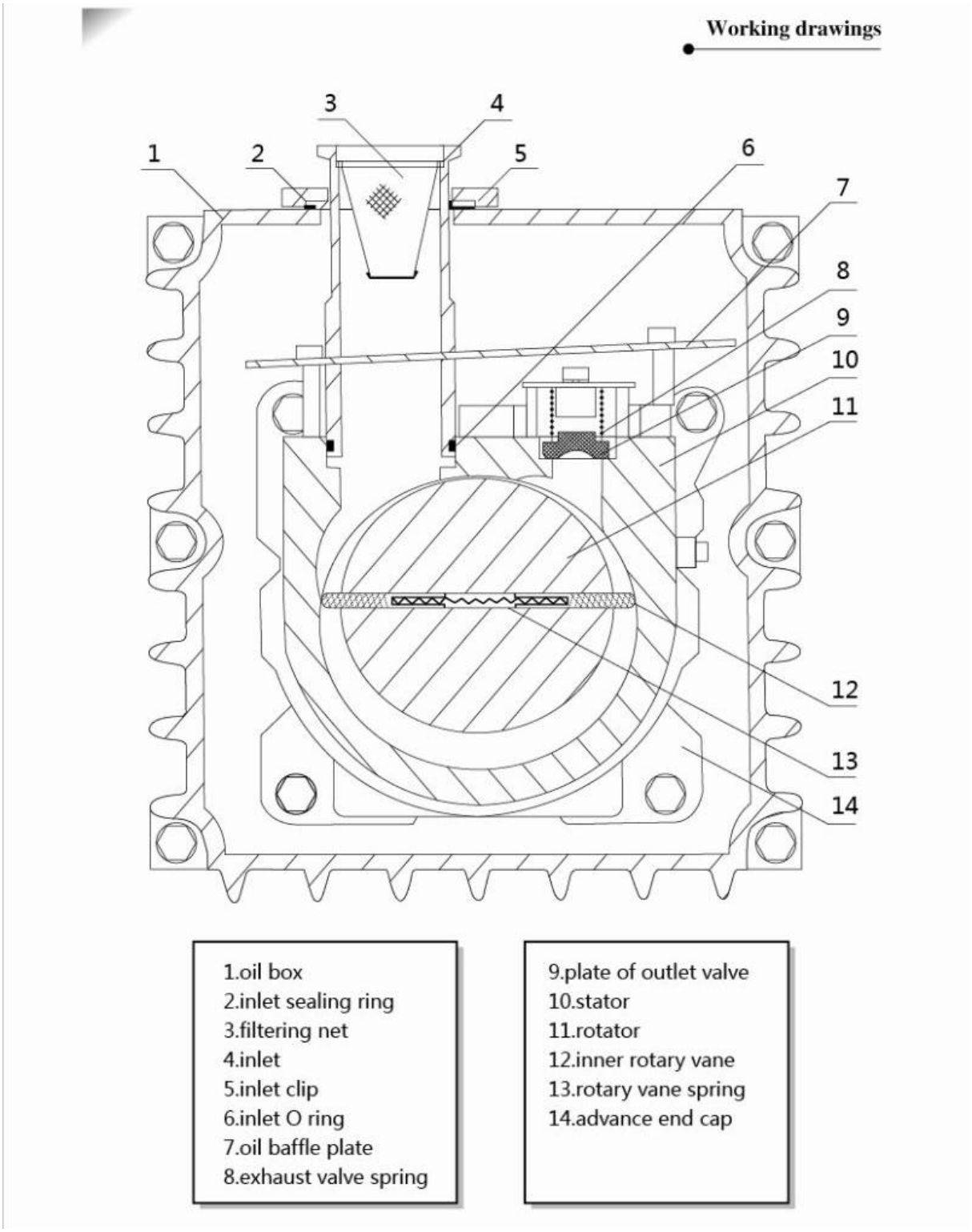
4 . FX (2XZ) rotary vane vacuum pumps can not be mixed with diesel fuel , gasoline and other large oil saturation vapor pressure , so reducing the ultimate vacuum . When washable pump parts , that can generally wipe with gauze . Wife metal debris , mud or sand when other hazardous substances must be washed , scrubbed available gasoline , dry before assembly , do not use gasoline soaked .

5. If required by the pump apart for cleaning or maintenance, disassembly steps must be taken to avoid damage to the parts.

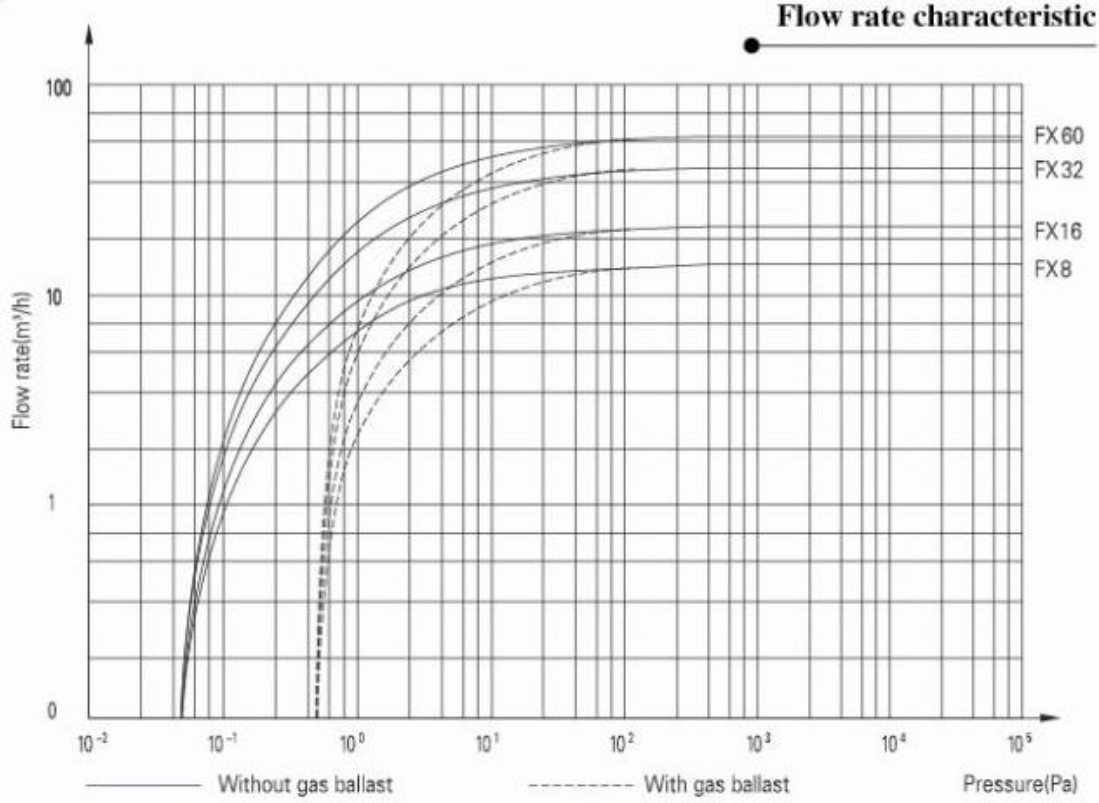
6. Warranty:

1. Standard: Products are strict produced and tested with national standards
2. Standard equipment: Certificate of quality,warranty card and instruction manual.
3. maintenance: One year warranty .
4. packing : Standard wooden packaging .
5. Technical support: 24-hour hotline service

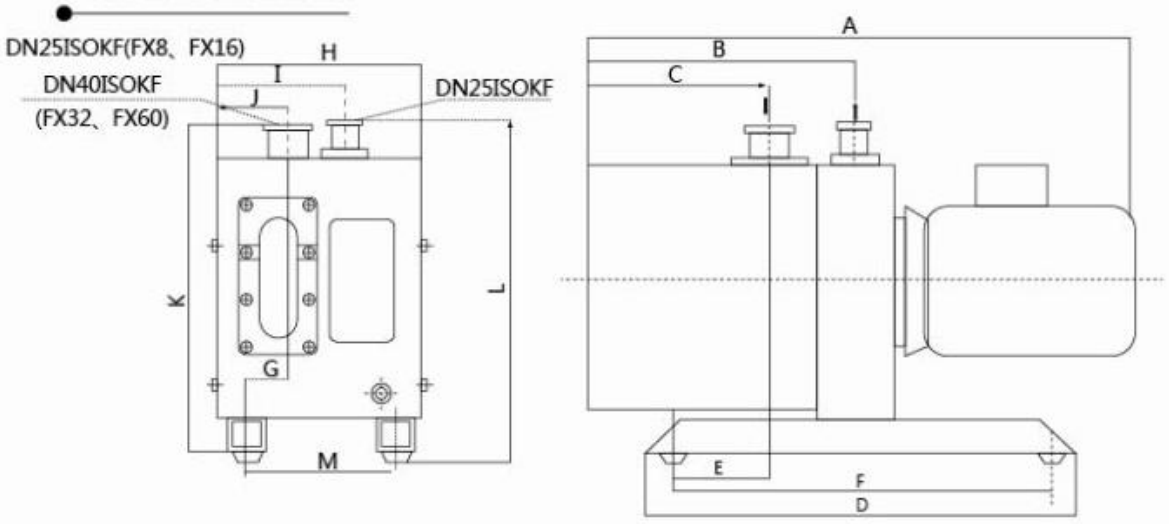
7. Working drawings and dimensions



Flow rate characteristic



Overall dimensions



The dimension for FX series pump(mm)

TYPE	A	B	C	D	E	F	G	H	I	J	K	L	M
FX8	500	224	150	336	68	296	26	170	130	62	280	300	110
FX16	540	264	190	336	68	296	26	170	130	62	280	300	110
FX32	630	310	211	485	117	420	40	230	115	83	380	410	170
FX60	690	370	271	485	117	420	40	230	115	83	380	410	170

8. Operation

I. Overview of rotary vane vacuum pumps

FX (2XZ) rotary vane vacuum pump system directly linking the high-speed two-stage rotary vane vacuum pump structure (hereinafter referred to as the pump) . It has eccentrically mounted rotor in the pump chamber , rotor and vane groove . When the rotor is rotated , the rotary vane wall close , the intake and exhaust ports separated , and to plot the intake chamber and the suction volume cyclically expanded , the volume of the discharge chamber and the compressed gas out periodically , open exhaust valve exhaust , resulting vacuum . Figure I is a single stage pump working principle diagram . Two-stage two single-stage series.

FX pump is equipped with gas ballast valve, with prolonged use of time and prevent pump oil pump oil mixing with water effect.

FX pump has a small size, light weight, low noise, and easy starting . In addition, measures to prevent the return of oil and oil seals to prevent leakage of contaminated sites .

II: rotary vane vacuum pumps Purpose and scope

1 pump is one of the basic equipment used in addition to pumping gas airtight container . It can be alone , but also as a booster pump, diffusion pump , molecular pump before the pump to maintain the pump , pre- titanium pump pumping pumps . Vacuum device can be used for manufacturing, manufacturing thermos vacuum welding, printing, plastic , refrigeration equipment repair and other ancillary instruments . Because it has a small size, light weight, and low operating sound , it is more suitable for laboratory use .

2 pumps in an ambient temperature range of 540 , the inlet pressure is less than the conditions under 1.3X103 Pa allow long-term continuous operation , was pumping gas relative humidity greater than 90% , you should open the gas ballast valve.

3 continuous flow pump inlet air operation shall not exceed a minute .

4 . The pump does not apply to extraction of metals corrosion to pump oil from a chemical reaction , the gas containing dust particles , and high oxygen , explosive , toxic gases.

Four: Application

The pump is used to seal containers of basic equipment in addition to the gas pump . It can be used alone , can also be used as a booster pump, diffusion pump , molecular pump before the pump to maintain the pump , pre- titanium pump pumping pumps ; electric vacuum vessel can be used for manufacturing, vacuum welding , printing, photogravure , food packaging , vacuum , refrigeration equipment maintenance and equipment, instrumentation and laboratory and other ancillary equipment . Widely used in laboratory aerospace, semiconductor , coating , food packaging , drying, cooling , scientific , medical , electronics, chemicals, pharmaceuticals and other professional institutes and universities and other departments , laboratories .

Five: Product Features:

Pump material : compacted graphite iron

High vacuum

Maintain a high pumping speed until the ultimate pressure

Low noise

Built mandatory pumps, lubrication sufficient, reliable performance

Reliable mechanism to prevent the discharge of oil , the oil does not return

When the gas runs the town remains high ultimate vacuum

In addition to strong water vapor pumping capacity

While keeping the intake air pressure 1.33X10 3 Pa, is still sustainable operation

Not leaking

Six: rotary vane vacuum pump operating instructions

1 . Check the oil level in the pump stops when oiling to the center of the oil standard is appropriate . Low exhaust valve seals can not play the role , impact vacuum. Too high , it may cause when you start injector through the atmosphere . When running, the oil level was increased , a normal phenomenon.

Oil mining

Clean with a vacuum pump oil grade requirement , from filling hole to join. After refueling complete, should be a spin on the plug. Oil should be filtered , to avoid debris into the plug hole.

2 . Pump can be a starter in the atmosphere or through any vacuum. If attached

pump port solenoid valves, and pumps should be operated simultaneously .

3 . When the ambient temperature is too high , the oil temperature rises, the viscosity decreases , the saturation vapor pressure increases , causing decrease in the ultimate vacuum , particularly as measured by a thermocouple full pressure . Such as enhanced ventilation , or improve pumping performance, ultimate vacuum can be improved.

4 . Check the vacuum pump to limit compression of mercury vacuum gauge prevail , such as meter calibration after full pre-pumping , pump temperature to stabilize , pump port directly connected with the meter , running within 30 minutes , to reach ultimate vacuum . The total value of the measured pressure gauge and vacuum gauge and pump oil to regulate the error about , and sometimes even a great error , only for reference.

5. If the relative humidity is high , or pumping gas containing more condensable vapor is pumped after turning the container should open the gas ballast valve , running 20 to 40 minutes after turning off the gas valve . Before stopping the pump , gas ballast valve open -load exercise for 30 minutes in order to prolong the life of the oil pump .

6. Oil options: pump oil viscosity effects starting power and ultimate vacuum pumps , high vacuum degree of viscosity favorable starting power is larger. Oil saturation vapor pressure at the pump will affect the temperature limit of the total pump pressure, the lower the better . # 3 high-speed vacuum pump oil diffusion pump oil and viscosity compared to the 1st big oil pump , vacuum pump saturation vapor pressure compared to the 1st low oil, but 3 # diffusion pump oil prices higher . Specific choose what oil can be combined with the specific requirements based on the description to choose.

(1) In general, the total pressure in wishing 6X10-2 Pa over Shanghai high-speed vacuum pump oil production . 4 l / sec small pump vacuum pump can also be used on the 1st generation 8 l / sec or more direct the pump can be used oil diffusion pump # 3 generations .

(2) If the degree of vacuum less demanding and frequent replacement of contaminated oil , vacuum pump oil supply difficulties , No. 50 machine oil can be used instead.

(3) If the ambient temperature is low, difficult to start , ultimate vacuum less

demanding , the viscosity can be slightly lower than the true home on the pump oil or machine oil .

Rotary vane vacuum pump maintenance and repair

First, note:

1 . Ensure clean the pump , to prevent debris from entering the pump .

2 . Maintaining the oil level.

3 . When stored under water or other volatile substances into the pump affect ultimate vacuum , you can purify the gas ballast valve open , observe the ultimate vacuum pick-up case, a few hours ineffective , replace the oil pump can be replaced again if necessary. Oil Change Method: pump runs about half an hour , the oil thinning, stop the pump discharge oil from the drain hole , and then open the air inlet run 10 to 20 seconds from the suction port here can slowly add a small amount of clean oil pump , memory to replace the oil pump chamber . Out as dirty oil , which can be repeated .

4 . Can not be mixed with diesel fuel , gasoline and other large oil saturation vapor pressure , so lower ultimate vacuum . When washable pump parts , that can generally wipe with gauze . Wife metal debris , mud or sand when other hazardous substances must be washed , scrubbed available gasoline , dry before assembly , do not use gasoline soaked .

5. If required by the pump apart for cleaning or maintenance, disassembly steps must be taken to avoid damage to the parts.

AUTHORIZATION TO MARK

This authorizes the application of the Certification Mark(s) shown below to the models described in the Product(s) Covered section when made in accordance with the conditions set forth in the Certification Agreement and Listing Report. This authorization also applies to multiple listee model(s) identified on the correlation page of the Listing Report.

This document is the property of Intertek Testing Services and is not transferable. The certification mark(s) may be applied only at the location of the Party Authorized To Apply Mark.

Applicant:	Broad Air Conditioning	**Manufacturer:**	Broad Air Conditioning
Address:	Broad Town, Changsha Hunan 410138, P.R. China	**Address:**	Broad Town, Changsha Hunan 410138, P.R. China
Country:	CHINA	**Country:**	CHINA
Contact:	Mr. Tan Yong Qiang	**Contact:**	Mr. Tan Yong Qiang
Phone:	86-731-84086688	**Phone:**	86-731-84086688
FAX:	86-731-84610087	**FAX:**	86-731-84610087
Email:	Tanyq@broad.net	**Email:**	Tanyq@broad.net

Party Authorized To Apply Mark: Same as Manufacturer
Report Issuing Office: Dallas, TX

Control Number: 3018577 **Authorized by:** Patricia Sweet
for William T. Starr, Certification Manager

C ETL LISTED US
Intertek

This document supersedes all previous Authorizations to Mark for the noted Report Number.

Intertek Testing Services NA Inc.
165 Main Street, Cortland, NY 13045
Telephone 800-345-3851 or 607-753-6711 Fax 607-756-6699

Standard(s):	American National Standard/Canadian Gas Association Standard for Gas-Fired, Heat Activated Air-Conditioning And Heat Pump Appliance (ANSI Z21.40.1-1996, CGA 2.91a-M96, first edition, revisions through and including addenda ANSI Z21.40.1a-1997, CGA 2.91a-M97
Product:	Outdoor Package Air Conditioner DFA (BZY)

Intertek

AUTHORIZATION TO MARK

Models:	Broad Outdoor Package Air Conditioner DFA: BZY, BZHY, BZSY, BZEY, BHY, BSY, BEY, BDHY, BDSY, BDEY, BHEY and BZHEY followed by 20, 30 or 50 for cooling capacity followed by X for design code followed by C, D or E for heating value, may be followed by K, D or W for model function and may be followed by H1 for enlarged heating capacity. Example model nomenclature: BZY 20 X D – K – H1 BZY ---------- Broad Outdoor Package Air Conditioner (H=hot water, S=steam, E=exhaust, D=single stage) 20 ---------- Cooling capacity 20*104 kcal/hr X ---------- Design Code

Intertek

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Intertek

Control Number: 3018577 **Authorized by:** Patricia Sturm

-pt William T. Starr, Certification Manager

This document supersedes all previous Authorizations to Mark for the noted Report Number.

Intertek Testing Services NA Inc.
165 Main Street, Cortland, NY 13045
Telephone 800-345-3851 or 607-753-6711 Fax 607-756-6699

Applicant:	Broad Air Conditioning	**Manufacturer:**	Broad Air Conditioning
Address:	Broad Town, Changsha Hunan 410138	**Address:**	Broad Town, Changsha Hunan 410138
Country:	P.R. China	**Country:**	P.R. China
Contact:	Mr. Tan Yong Qiang	**Contact:**	Mr. Tan Yong Qiang
Phone:	+86-731-84086688	**Phone:**	+86-731-84086688
FAX:	+86-731-84610087	**FAX:**	+86-731-84610087
Email:		**Email:**	

Party Authorized To Apply Mark: Same as Manufacturer
Report Issuing Office: Columbus

Standard(s):	Standard for Gas-Fired, Heat Activated Air-Conditioning And Heat Pump Appliance (ANSI Z21.40.1-1996, CGA 2.91a-M96, first edition), (ANSI Z21.40.1a-1997, CGA 2.91a-M97 (R2002))
Product :	Direct Fired Absorption Chiller/Heaters
Models:	Broad N DFA Direct Fired Absorption Chiller/Heaters assemblies; BZ, BZE, BZH, BZHE and BZS followed by 20, 30, 50, 75, 100, 125, 150, 200, 250, 300, 400, 500, 600, 800 and 1000, followed by X followed by D. May be followed by other designations

1285 Walt Whitman Road
Melville, New York 11747-3081
United States Country Code (1)
(516) 271-6200
FAX No. (516) 271-8259
http://www.ul.com

Underwriters Laboratories Inc.®

100 a century of public safety est. 1894

CERTIFICATE OF COMPLIANCE

CERTIFICATE NUMBER: 050799
ISSUE DATE: 03/11/99

Issued to:

Broad USA LTD
Suite 7929
1 World Trade Center
New York, NY 10048

Report Reference: MH19712, Volume 1

This is to Certify that representative samples of:

Absorption Air Conditioning Equipment, Models BZXXXVIB, BZXXXVIBC, BZXXXVIBS, BZXXXVIC have been investigated by Underwriters Laboratories Inc. in accordance with the Standard(s) indicated on this Certificate.

Standard(s) for Safety: UL 795, Commercial-Industrial Gas Heating Equipment
UL 726, Oil-Fired Boiler Assemblies
UL 296, Oil Burners

Only those products bearing the UL Listing Mark should be considered as being covered by UL's Listing and Follow-Up Service

The UL Listing Mark generally includes four elements as follows: the name "Underwriters Laboratories Inc." in various forms and type styles, or abbreviations such as "Und. Lab. Inc." or the symbol "UL in a circle": the word "Listed"; a control number (may be alphanumeric) assigned by UL; and, the product or category name (product identifier) as indicated in the appropriate UL Directory.

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Engineer:
Richard Taylor
Senior Engineering Assistant
Underwriters Laboratories Inc.

Reviewer:
Robert DellaValle
Associate Managing Engineer
Underwriters Laboratories Inc.

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BROAD AIR CONDITIONING
LIMITED W A R R A N T Y C E R T I F I C A T E

BROAD Air Conditioning, BROAD Town, Changsha P.R. China, (hereinafter called the Manufacturer) warrants its equipment manufactured by it and bearing its nameplate (hereinafter called Warranted Equipment) in the respects and exclusively for the benefit of those users described herein. **This limited warranty shall extend solely to those persons who are Owners of the Warranted Equipment during the warranty period hereinafter defined and who use such Warranted Equipment in the project and for the purpose for which such warranted Equipment was acquired from the Manufacturer.** The Manufacturer warrants its equipment to be free from defects in the material and workmanship under normal use and service for a period of one year commencing at the time the Warranted Equipment is placed in operation, but in no event for longer than 18 months from the date of shipment.

BROAD U.S.A. Inc., of 401 Hackensack Avenue, Hackensack, NJ (hereinafter called the Seller) is assigned by the Manufacturer as the single source of responsibility to the Owner of the Warranted Equipment for the warranty of the Warranted Equipment. **This warranty is contingent upon storing, installing, operating, servicing and maintaining the Warranted Equipment by Owner as per the Manufacturer's written instructions, and start-up and commissioning of the Warranted Equipment by Seller or its authorized personnel, and the warranty will be voided if start-up and commissioning is performed by anyone else.**

If any person becomes entitled to a claim under this warranty, such person shall, as a condition precedent to securing warranty performance, contact the Seller at 401 Hackensack Avenue, Hackensack, NJ, for evaluation of the warranty claim. If the Warranted Equipment is found by Seller to be defective for a cause and within a time covered by this warranty, such equipment shall be repaired or replaced without charge. If inspection of the Warranted Equipment discloses defects not covered by this warranty Owner shall assume the cost of inspection and all related expenses at Sellers prevailing rates. Equipment that is repaired or replaced shall carry a warranty equal to the unexpired portion of the original warranty. Seller will schedule the inspection of any Warranted Equipment within reasonable time after receipt of a warranty claim. Warranty obligation hereunder will be performed only between the hours of 9:00 a.m. and 4:00 p.m. Monday through Friday and excluding holidays. **In all events, Seller will not be liable for and will not reimburse any labor, material, or other repair charges incurred by anyone other than Seller on any Warranted Equipment, unless Seller has specifically authorized such charges in advance in writing. Excluded from any coverage under this warranty are defects in Warranted Equipment from damage in shipment, faulty installation, unauthorized start up, misuse or negligence; operation of the Warranted Equipment with fuel, water and power non conforming to the Manufacturer's written specifications; electrical components such as motors, contactors; instruments such as pressure gauges, thermometers, pressure switches; replacement or repair of parts normally consumed in service, such as seals, gaskets, oil, chemicals, and all material considered as part of routine maintenance and upkeep and such parts are not eligible for repair or replacement under this warranty. Excluded from any coverage under this warranty are the burner and vacuum pump that are covered by the warranty provided by their manufacturers.**

The Manufacturer makes no other warranty expressed or implied and SPECIFICALLY DISCLAIMS ANY IMPLIED WARRANTY AS TO THE MERCHANTABILITY OF THE WARRANTED EQUIPMENT OR AS TO ITS FITNESS FOR ANY PARTICULAR PURPOSE. The Manufacturer is not responsible for consequential or incidental damages of any nature resulting from such things as, but not limited to, defects in design, material, workmanship, or delays in delivery, replacements, or repairs.

Broad U.S.A. Inc., 401 Hackensack Avenue, Suite 503, Hackensack, NJ 07601

(201) 678-3010 www.broadusa.com Fax (201) 678-3011

Bell & Gossett
a xylem brand

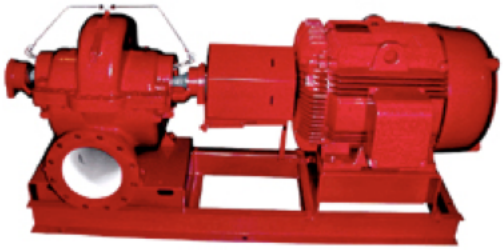
Submittal

Job/Project:	**Representative:** Dawson Company	
ESP-Systemwize: WIZE-F4589F **Created On:** 03/07/2019	**Phone:** (626) 797-9710	
Location/Tag:	**Email:** sales@dawsonco.com	
Engineer:	**Submitted By:**	**Date:**
Contractor:	**Approved By:**	**Date:**

Small and Medium Double Suction Split Case Pump

Series: HSC-S

Model: 4x6x14L



Features & Design

- Externally flushed mechanical seals
- Easy-Maintenance Design
- ANSI/OSHA Coupling Guard
- Heavy Duty Base Plate

*Double-suction, base-mounted Series HSC-S pumps are available in 2" through 10" sizes. Motor sizes through 300 HP. Flows to 6500 GPM and heads to 600 feet.

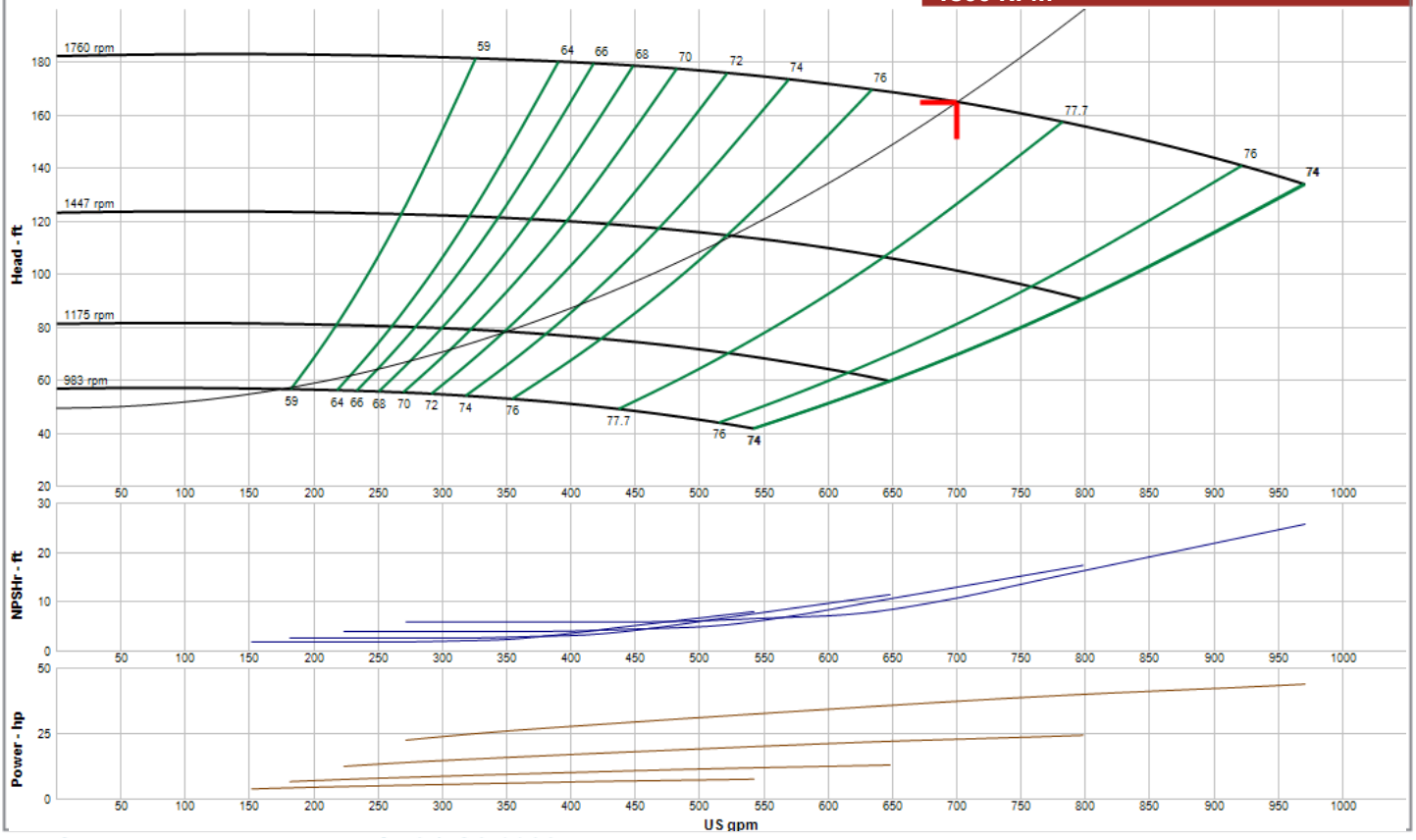
http://bellgossett.com/pumps-circulators/double-suction-pumps/series-hsc-s/

Pump Selection Summary

Pump Capacity	700 US gpm
Pump Head	165 ft
Control Head	49.5 ft
Duty Point Pump Efficiency	77.1 %
Pump PLEVv Efficiency	71.6 %
Impeller Diameter	13.1 in
Motor HP	50 hp
Duty Point Power	37.4 bhp
Motor Speed	1800 rpm
RPM @ Duty Point	1760 rpm
NPSHr	10.9 ft
Minimum Shutoff Head	182 ft
Minimum Flow at RPM	274 gpm
Flow @ BEP	782 gpm
Fluid Temperature	120 °F
Fluid Type	Water
Weight *(approx. - consult rep for exact)*	1530 lbs
Pump Floor Space Calculation	11.86 ft²

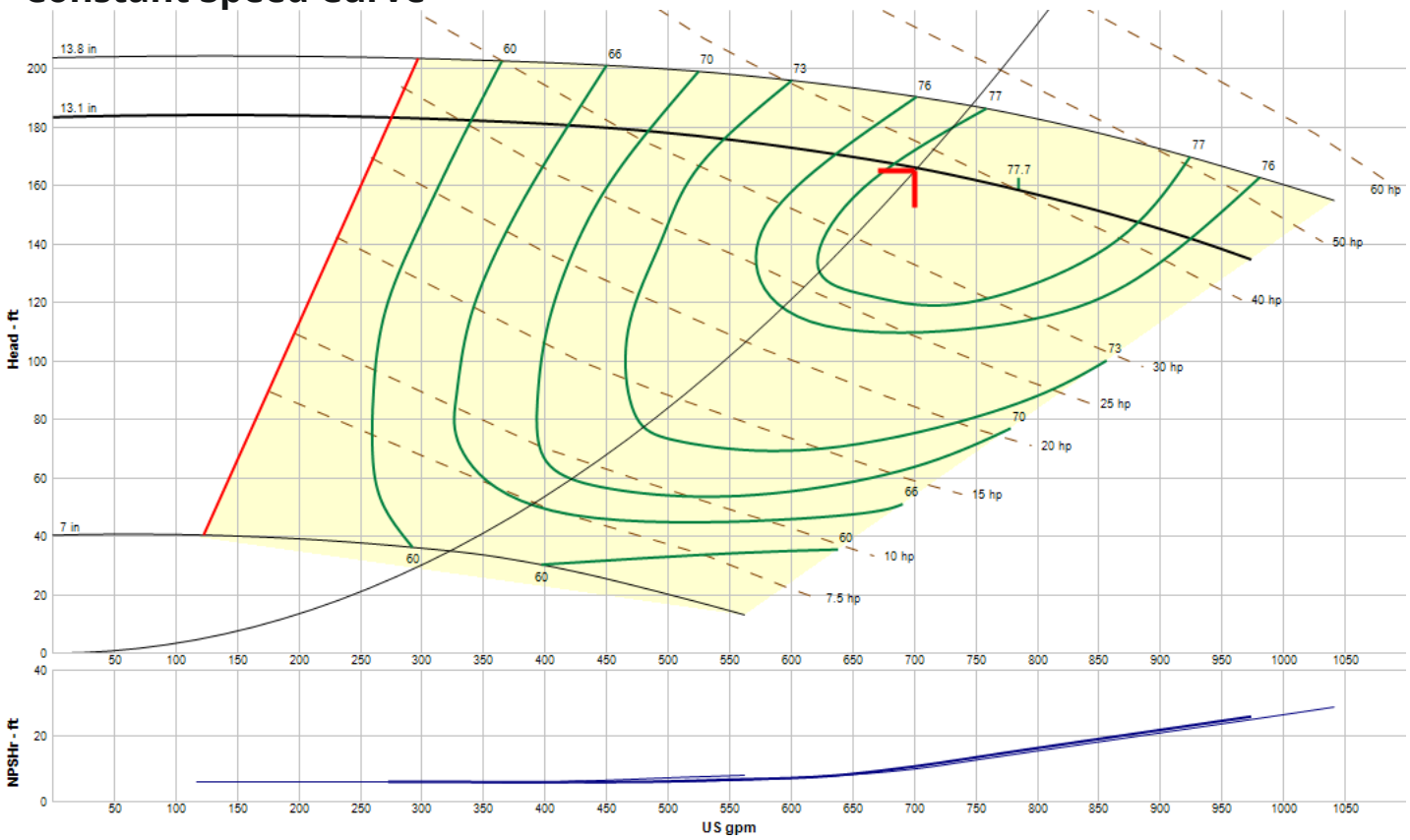
Performance Curve

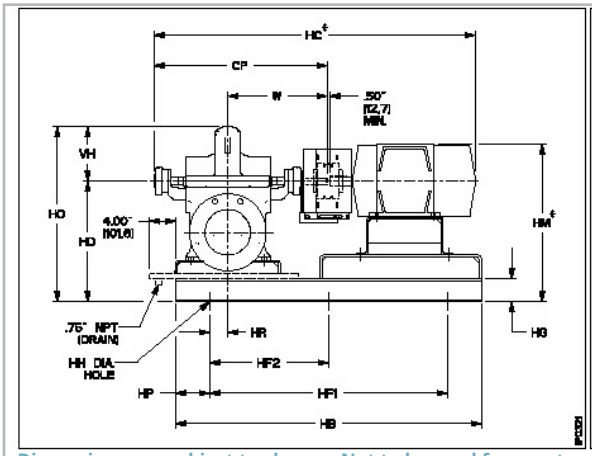
HSC-S
4x6x14L
1800 RPM

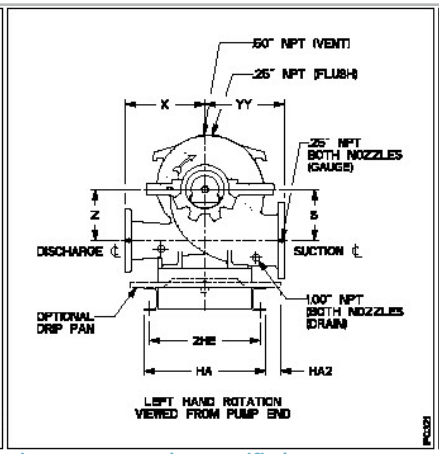


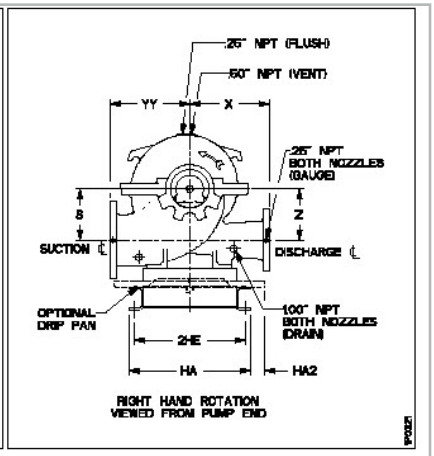
Performance curve meets 14.6 / ISO 9906 acceptance criteria

Constant Speed Curve









Dimensions are subject to change. Not to be used for construction purposes unless certified

Motor Frame: 326	CP-Dim: 30.75	HA-Dim: 24	HB-Dim: 58	HC-Dim: 61
HD-Dim: 19.25	HE2-Dim: 22	HF1-Dim: 46	HF2-Dim: 23	HG-Dim: 4
HH-Dim: 1	HM-Dim: 28	HO-Dim: 29	HP-Dim: 6	HQ-Number of Holes: 3
HR-Dim: 3.25	S-Dim: 7.75	VH-Dim: 9.62	W-Dim: 17.5	X-Dim: 11.5
YY-Dim: 13	Z-Dim: 7.75	CAD model unit system: inch/pound		

Xylem Inc.
8200 N. Austin Avenue, Morton Grove, IL 60053
Phone: (847)966-3700 Fax: (847)965-8379
www.bellgossett.com

Standard Materials of Construction *contact your local rep for optional ES Bearing Frame

Construction:	Bronze Fitted
Shaft:	416 Stainless Steel
Volute:	Cast Iron ASTM A48 Class 35A
Impeller:	Bronze ASTM B584-876
Shaft Sleeve:	N/A
Impeller Key:	ANSI 416 Stainless Steel
Volute Ring:	Bronze ASTM B584-932
Volute Gasket:	Paper (Vollumoid 505)
Baseplate:	Welded Structural Steel
Coupler:	Spacer, Jaw Type
Coupler Guard:	ANSI/OSHA Compliant, Fully Enclosed

Pump Options *contact your local rep to configure

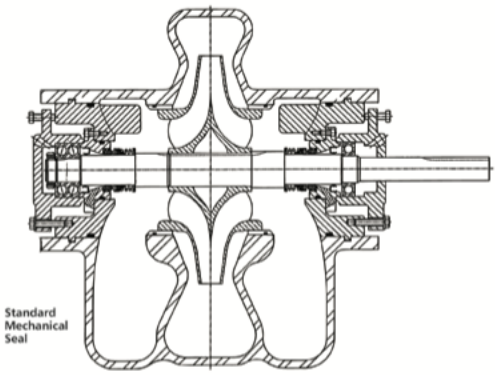
Spacer Coupling	
Galvanized Drip Pan	

Standard Mechanical Seal Assembly

Elastomer:	Buna
Rotating Face:	Carbon
Stationary Face:	Ceramic
Hardware	Stainless Steel/Brass

Maximum Working Pressure

Max Working Pressure (standard)	175 psi (12 bar) W..P.
Max Working Suction Pressure (standard)	100 psi (17 bar) W.P. w 125#FF ANSI flange



xylem
Let's Solve Water

Xylem Inc.
8200 N. Austin Avenue, Morton Grove, IL 60053
Phone: (847)966-3700 Fax: (847)965-8379
www.bellgossett.com

Bell & Gossett
a xylem brand

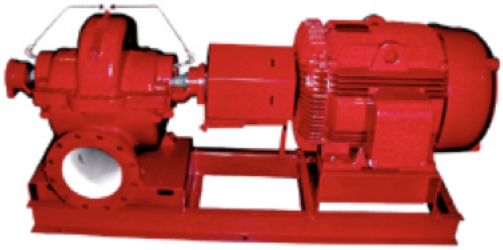
Submittal

Job/Project:	**Representative:** Dawson Company	
ESP-Systemwize: WIZE-78DBAE **Created On:** 03/07/2019	**Phone:** (626) 797-9710	
Location/Tag:	**Email:** sales@dawsonco.com	
Engineer:	**Submitted By:**	**Date:**
Contractor:	**Approved By:**	**Date:**

Small and Medium Double Suction Split Case Pump

Series: HSC-S

Model: 4x6x14L



Features & Design

- Externally flushed mechanical seals
- Easy-Maintenance Design
- ANSI/OSHA Coupling Guard
- Heavy Duty Base Plate

*Double-suction, base-mounted Series HSC-S pumps are available in 2" through 10" sizes. Motor sizes through 300 HP. Flows to 6500 GPM and heads to 600 feet.

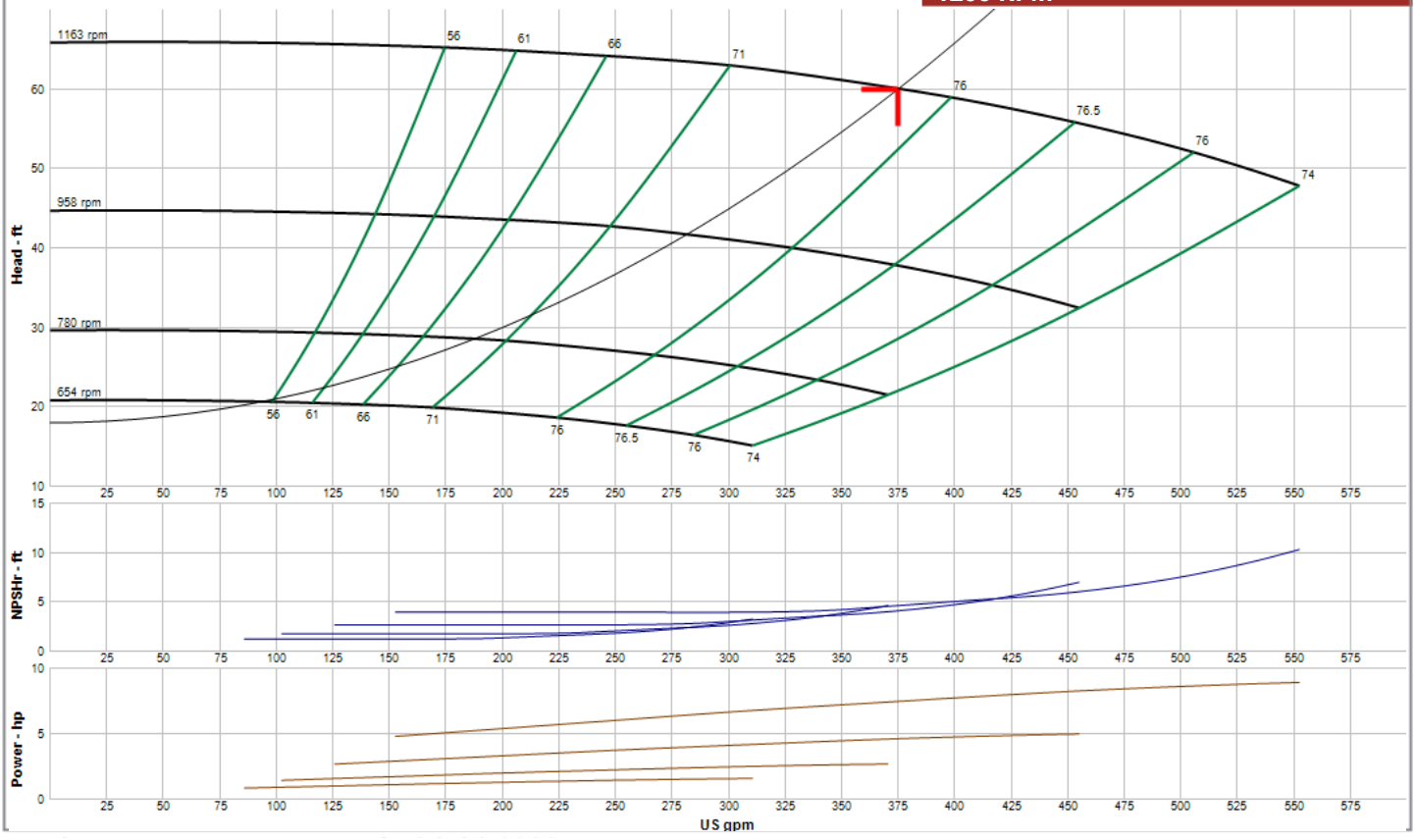
http://bellgossett.com/pumps-circulators/double-suction-pumps/series-hsc-s/

Pump Selection Summary

Pump Capacity	375 US gpm
Pump Head	60 ft
Control Head	18 ft
Duty Point Pump Efficiency	75.2 %
Pump PLEVv Efficiency	68.8 %
Impeller Diameter	11.9 in
Motor HP	10 hp
Duty Point Power	7.48 bhp
Motor Speed	1200 rpm
RPM @ Duty Point	1163 rpm
NPSHr	4.64 ft
Minimum Shutoff Head	65.9 ft
Minimum Flow at RPM	159 gpm
Flow @ BEP	453 gpm
Fluid Temperature	120 °F
Fluid Type	Water
Weight *(approx. - consult rep for exact)*	895 lbs
Pump Floor Space Calculation	10.52 ft²

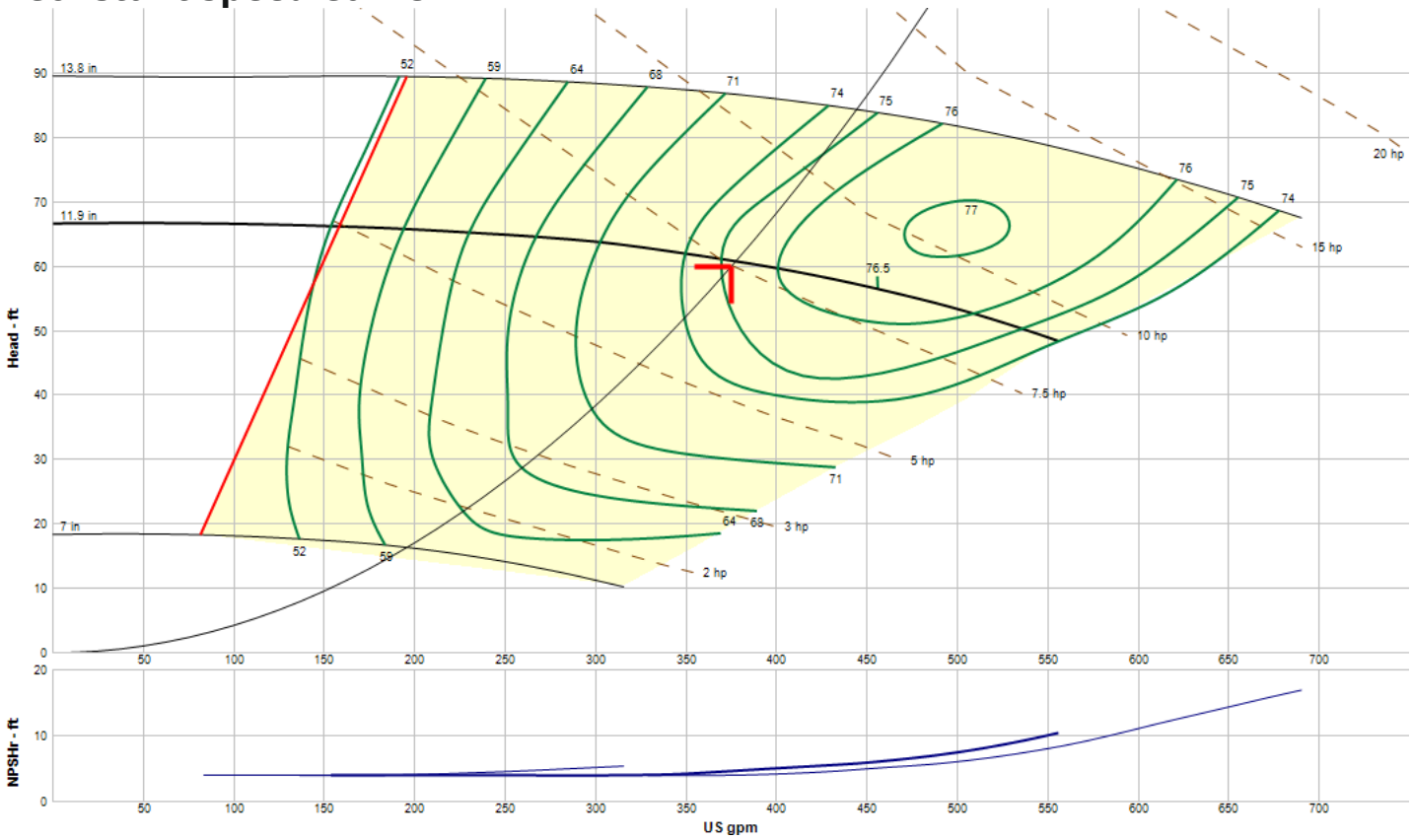
Performance Curve

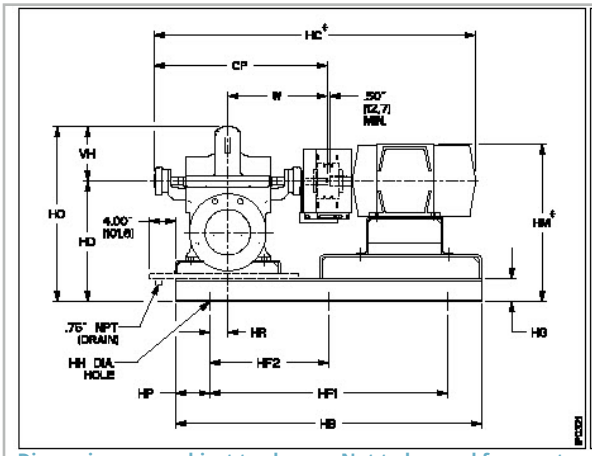
HSC-S
4x6x14L
1200 RPM

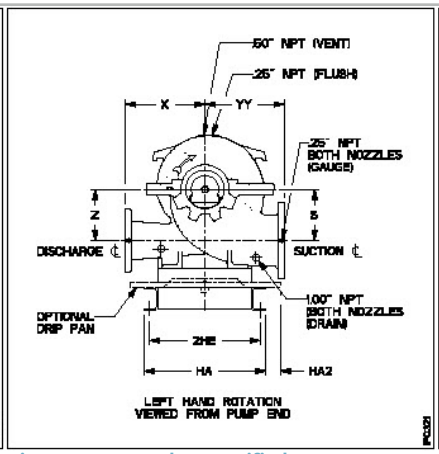


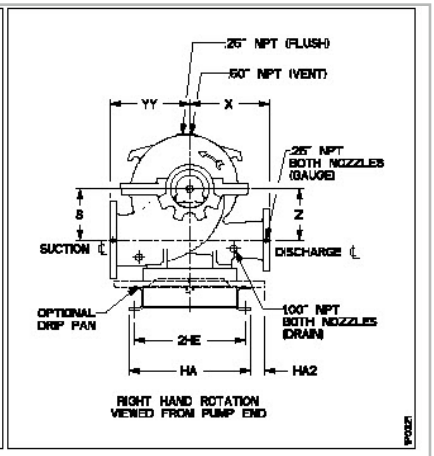
Performance curve meets 14.6 / ISO 9906 acceptance criteria

Constant Speed Curve









Dimensions are subject to change. Not to be used for construction purposes unless certified

Motor Frame: 256	CP-Dim: 30.75	HA-Dim: 24	HB-Dim: 50	HC-Dim: 55
HD-Dim: 19.25	HE2-Dim: 22	HF1-Dim: 38	HF2-Dim: 19	HG-Dim: 4
HH-Dim: 1	HM-Dim: 26	HO-Dim: 29	HP-Dim: 6	HQ-Number of Holes: 3
HR-Dim: 3.25	S-Dim: 7.75	VH-Dim: 9.62	W-Dim: 17.5	X-Dim: 11.5
YY-Dim: 13	Z-Dim: 7.75	CAD model unit system: inch/pound		

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Standard Materials of Construction *contact your local rep for optional ES Bearing Frame

Construction:	Bronze Fitted
Shaft:	416 Stainless Steel
Volute:	Cast Iron ASTM A48 Class 35A
Impeller:	Bronze ASTM B584-876
Shaft Sleeve:	N/A
Impeller Key:	ANSI 416 Stainless Steel
Volute Ring:	Bronze ASTM B584-932
Volute Gasket:	Paper (Vollumoid 505)
Baseplate:	Welded Structural Steel
Coupler:	Spacer, Jaw Type
Coupler Guard:	ANSI/OSHA Compliant, Fully Enclosed

Pump Options *contact your local rep to configure

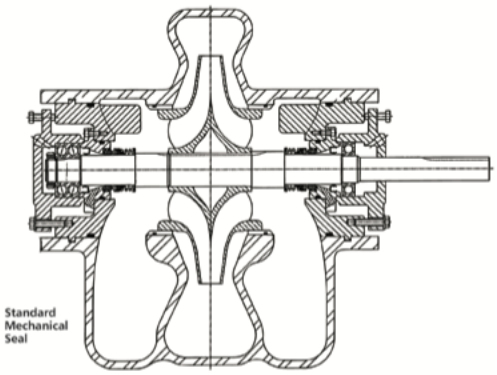
Spacer Coupling	
Galvanized Drip Pan	

Standard Mechanical Seal Assembly

Elastomer:	Buna
Rotating Face:	Carbon
Stationary Face:	Ceramic
Hardware	Stainless Steel/Brass

Maximum Working Pressure

Max Working Pressure (standard)	175 psi (12 bar) W..P.
Max Working Suction Pressure (standard)	100 psi (17 bar) W.P. w 125#FF ANSI flange



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Powermaster WB-A2-3P

Three Pass Wet Back A2 Boilers

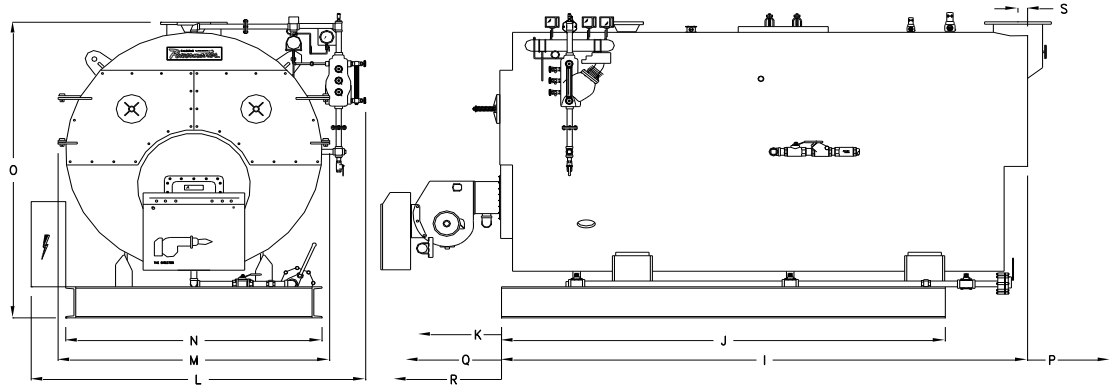
Maximum allowable working pressure 15 psig

Powermaster®

Boiler Data Sheet

MODEL BHP

NOMINAL CAPACITIES		80	100	125	150	200	250	300	350	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
Steam generation from and at 212 °F & 1 atm.	lb/hr	2,760	3,450	4,313	5,175	6,900	8,625	10,350	12,075	13,800	17,250	20,700	24,150	27,600	31,050	34,500	37,950	41,400	44,850	48,300	51,750
Heating Surface	SQFT	400	500	625	750	1,000	1,250	1,500	1,750	2,000	2,500	3,000	3,500	3,792	4,032	4,160	4,477	4,800	5,122	5,474	5,895
Boiler Output	MBH	2,678	3,348	4,185	5,022	6,695	8,369	10,043	11,717	13,391	16,738	20,086	23,434	26,781	30,129	33,477	36,824	40,172	43,520	46,867	50,215
FIRING RATE FOR BURNER SELECTION*																					
No. 2 Oil - Diesel (140,000 BTU/gal)	gal/hr	23.9	29.9	37.4	44.8	59.8	74.7	89.7	104.6	119.6	149.4	179.3	209.2	239.1	269.0	298.9	328.8	358.7	388.6	418.5	448.3
Natural Gas (1,000 BTU/ft3)	ft3/hr	3,348	4,185	5,231	6,277	8,369	10,461	12,554	14,646	16,738	20,923	25,107	29,292	33,476	37,661	41,845	46,030	50,214	54,399	58,583	62,768
LP Gas (91,500 BTU/gal)	gal/hr	36.6	45.7	57.2	68.6	91.5	114.3	137.2	160.1	182.9	228.7	274.4	320.1	365.9	411.6	457.3	503.1	548.8	594.5	640.3	686.0
Heavy Oil (150,000 BTU/gal)	gal/hr	22.3	27.9	34.9	41.8	55.8	69.7	83.7	97.6	111.6	139.5	167.4	195.3	223.2	251.1	279.0	306.9	334.8	362.7	390.6	418.5
WEIGHTS																					
Empty Boiler	lb	11,663	12,918	15,720	17,183	21,099	24,719	27,982	31,342	34,891	40,351	47,657	54,552	58,774	61,068	64,058	67,053	69,289	72,423	75,467	78,730
Flooded Boiler	lb	18,878	20,695	25,389	27,552	34,612	41,905	47,277	53,995	60,240	68,906	82,405	93,674	103,234	106,382	109,619	112,521	115,163	118,356	121,624	125,045



DIMENSIONS			80	100	125	150	200	250	300	350	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
I	Boiler Length	ft	12.50	13.42	14.34	14.50	16.50	17.32	17.75	20.34	20.93	22.44	23.85	26.05	26.12	26.12	26.12	26.21	26.21	26.38	26.54	27.26
J	Base Length	ft	9.84	10.73	11.38	11.58	13.06	13.81	14.14	18.11	18.60	20.05	21.46	23.56	23.56	23.56	23.72	23.72	23.72	23.79	23.88	24.51
K	Burner Platform **	ft				None				3.61	3.61	3.61	4.99	4.99	4.99	4.99	4.99	4.99	4.99	6.56	6.56	6.56
L	Total Width	ft	7.15	7.22	7.55	7.81	8.27	8.83	9.25	9.25	9.65	9.97	10.50	10.79	11.32	11.52	11.58	11.71	11.84	11.98	12.07	12.07
M	Limit Width***	ft	5.97	6.04	6.36	6.63	7.09	7.64	8.07	8.07	8.46	8.79	9.32	9.61	10.14	10.33	10.40	10.53	10.66	10.79	10.89	10.89
N	Base Width	ft	5.31	5.38	5.71	5.97	6.43	6.99	7.41	7.41	7.81	8.14	8.66	8.96	9.48	9.68	9.74	9.88	10.01	10.14	10.24	10.24
O	Total Height (to steam outlet)	ft	6.66	6.75	7.19	7.45	7.91	8.50	8.92	8.92	9.51	9.88	10.37	10.66	11.22	11.38	11.75	11.88	12.01	12.14	12.24	12.24
P	Back access clearance for maintenance	ft	2.66	2.69	2.85	2.99	3.22	3.49	3.71	3.71	3.90	4.07	4.33	4.48	4.74	4.84	4.87	4.94	5.00	5.07	5.12	5.12
Q	Front access clearance for maintenance	ft	2.66	2.69	2.85	2.99	3.22	3.49	3.71	3.71	3.90	4.07	4.33	4.48	4.74	4.84	4.87	4.94	5.00	5.07	5.12	5.12
R	Front flux tubes exchange clearance	ft	10.27	11.18	11.94	12.10	14.01	14.60	14.93	17.52	17.68	19.13	20.54	22.28	22.28	22.28	22.28	22.28	22.28	22.21	22.11	22.57
S	Smoke stack center to back of boiler	ft	0.31	0.31	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.16	0.16	0.16	0.07	0.02	0.03	0.00	0.00	0.03	0.07
CONNECTIONS																						
Smoke Stack Diameter		in	12	12	14	14	16	18	20	20	22	24	26	28	30	32	34	36	37	39	40	41
Main steam outlet diameter		in	6	8	8	8	10	10	12	12	12	12	12	12	12	12	12	12	12	12	14	14
Boiler feedwater diameter		in	1 1/4	1 1/4	1 1/2	1 1/2	1 1/2	2	2	2	2	2	2	2	2.5 ****	2.5 ****	3	3	3	3	3	3
Bottom blowdown diameter		in	1 1/4	1 1/4	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	2	2	2	2	2	2	2	2	2	2	2	2
Level Control blowdown diameter		in	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4
Surface blowdown diameter		in	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4
FOUNDATION BASES																						
Total width of base		ft	6.04	6.10	6.43	6.69	7.15	7.71	8.14	8.14	8.53	8.86	9.38	9.68	10.20	10.40	10.47	10.60	10.73	10.86	10.96	10.96
Distance between bases		ft	4.07	4.13	4.46	4.72	5.18	5.74	6.17	6.17	6.56	6.89	7.41	7.71	8.23	8.43	7.71	7.84	7.97	8.10	8.20	8.20
Width of each bases		ft	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	1.38	1.38	1.38	1.38	1.38	1.38
Length of bases		ft	10.50	11.38	12.04	12.24	13.71	14.47	14.80	18.77	19.26	20.70	22.11	24.21	24.21	24.21	24.38	24.38	24.38	24.44	24.54	25.16
Height of bases		ft	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66

Termodinámica Enica S.A. de C.V. TEN-840430-465
Av. Dr. Jiménez Cantú Lote 2.5 s/n, Plaza Antigua Edif 3 Ofna. 3-16
Atizapán de Zaragoza, Edo. de México, CP. 52937
*T. +52(55) **5393 5711** ¬ F. +52(55) **5393 9607***

*www. **powermasterboiler** .com*

* The actual firing rate depends on fuel quality, burner selection and adjustment, combustion controls, operating pressure, etc. For an estimated calculation of a specific configuration contact your Powermaster salesman.

** Dimensions varies based on burner selection

*** Width for freight clearance

**** The boiler shell has a 2.5 in coupling. If the boiler is acquired with feed-water piping it will be delivered with a reduction and 2 in valves.

Date: **FEB 26, 2016**
Creator: **SZ**
Revision: **LN**

Powermaster WB-A2-3P

Three Pass Wet Back A2 Boilers

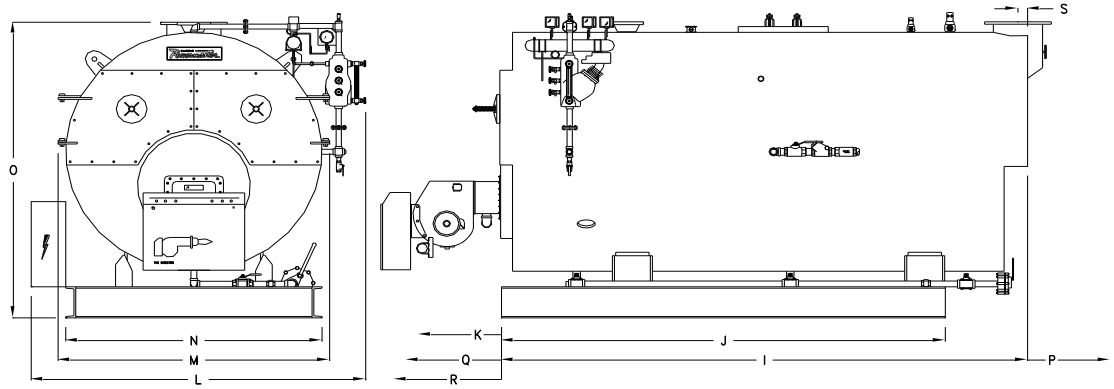
Maximum allowable working pressure 15 psig

Powermaster®

Boiler Data Sheet

MODEL BHP

NOMINAL CAPACITIES		80	100	125	150	200	250	300	350	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
Steam generation from and at 212 °F & 1 atm.	lb/hr	2,760	3,450	4,313	5,175	6,900	8,625	10,350	12,075	13,800	17,250	20,700	24,150	27,600	31,050	34,500	37,950	41,400	44,850	48,300	51,750
Heating Surface	SQFT	400	500	625	750	1,000	1,250	1,500	1,750	2,000	2,500	3,000	3,500	3,792	4,032	4,160	4,477	4,800	5,122	5,474	5,895
Boiler Output	MBH	2,678	3,348	4,185	5,022	6,695	8,369	10,043	11,717	13,391	16,738	20,086	23,434	26,781	30,129	33,477	36,824	40,172	43,520	46,867	50,215
FIRING RATE FOR BURNER SELECTION*																					
No. 2 Oil - Diesel (140,000 BTU/gal)	gal/hr	23.9	29.9	37.4	44.8	59.8	74.7	89.7	104.6	119.6	149.4	179.3	209.2	239.1	269.0	298.9	328.8	358.7	388.6	418.5	448.3
Natural Gas (1,000 BTU/ft3)	ft3/hr	3,348	4,185	5,231	6,277	8,369	10,461	12,554	14,646	16,738	20,923	25,107	29,292	33,476	37,661	41,845	46,030	50,214	54,399	58,583	62,768
LP Gas (91,500 BTU/gal)	gal/hr	36.6	45.7	57.2	68.6	91.5	114.3	137.2	160.1	182.9	228.7	274.4	320.1	365.9	411.6	457.3	503.1	548.8	594.5	640.3	686.0
Heavy Oil (150,000 BTU/gal)	gal/hr	22.3	27.9	34.9	41.8	55.8	69.7	83.7	97.6	111.6	139.5	167.4	195.3	223.2	251.1	279.0	306.9	334.8	362.7	390.6	418.5
WEIGHTS																					
Empty Boiler	lb	11,663	12,918	15,720	17,183	21,099	24,719	27,982	31,342	34,891	40,351	47,657	54,552	58,774	61,068	64,058	67,053	69,289	72,423	75,467	78,730
Flooded Boiler	lb	18,878	20,695	25,389	27,552	34,612	41,905	47,277	53,995	60,240	68,906	82,405	93,674	103,234	106,382	109,619	112,521	115,163	118,356	121,624	125,045



DIMENSIONS			80	100	125	150	200	250	300	350	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
I	Boiler Length	ft	12.50	13.42	14.34	14.50	16.50	17.32	17.75	20.34	20.93	22.44	23.85	26.05	26.12	26.12	26.12	26.21	26.21	26.38	26.54	27.26
J	Base Length	ft	9.84	10.73	11.38	11.58	13.06	13.81	14.14	18.11	18.60	20.05	21.46	23.56	23.56	23.56	23.72	23.72	23.72	23.79	23.88	24.51
K	Burner Platform **	ft				None				3.61	3.61	3.61	4.99	4.99	4.99	4.99	4.99	4.99	4.99	6.56	6.56	6.56
L	Total Width	ft	7.15	7.22	7.55	7.81	8.27	8.83	9.25	9.25	9.65	9.97	10.50	10.79	11.32	11.52	11.58	11.71	11.84	11.98	12.07	12.07
M	Limit Width***	ft	5.97	6.04	6.36	6.63	7.09	7.64	8.07	8.07	8.46	8.79	9.32	9.61	10.14	10.33	10.40	10.53	10.66	10.79	10.89	10.89
N	Base Width	ft	5.31	5.38	5.71	5.97	6.43	6.99	7.41	7.41	7.81	8.14	8.66	8.96	9.48	9.68	9.74	9.88	10.01	10.14	10.24	10.24
O	Total Height (to steam outlet)	ft	6.66	6.75	7.19	7.45	7.91	8.50	8.92	8.92	9.51	9.88	10.37	10.66	11.22	11.38	11.75	11.88	12.01	12.14	12.24	12.24
P	Back access clearance for maintenance	ft	2.66	2.69	2.85	2.99	3.22	3.49	3.71	3.71	3.90	4.07	4.33	4.48	4.74	4.84	4.87	4.94	5.00	5.07	5.12	5.12
Q	Front access clearance for maintenance	ft	2.66	2.69	2.85	2.99	3.22	3.49	3.71	3.71	3.90	4.07	4.33	4.48	4.74	4.84	4.87	4.94	5.00	5.07	5.12	5.12
R	Front flux tubes exchange clearance	ft	10.27	11.18	11.94	12.10	14.01	14.60	14.93	17.52	17.68	19.13	20.54	22.28	22.28	22.28	22.28	22.28	22.28	22.21	22.11	22.57
S	Smoke stack center to back of boiler	ft	0.31	0.31	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.16	0.16	0.16	0.07	0.02	0.03	0.00	0.00	0.03	0.07
CONNECTIONS																						
Smoke Stack Diameter		in	12	12	14	14	16	18	20	20	22	24	26	28	30	32	34	36	37	39	40	41
Main steam outlet diameter		in	6	8	8	8	10	10	12	12	12	12	12	12	12	12	12	12	12	12	14	14
Boiler feedwater diameter		in	1 1/4	1 1/4	1 1/2	1 1/2	1 1/2	2	2	2	2	2	2	2	2.5 ****	2.5 ****	3	3	3	3	3	3
Bottom blowdown diameter		in	1 1/4	1 1/4	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	2	2	2	2	2	2	2	2	2	2	2	2
Level Control blowdown diameter		in	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4
Surface blowdown diameter		in	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4
FOUNDATION BASES																						
Total width of base		ft	6.04	6.10	6.43	6.69	7.15	7.71	8.14	8.14	8.53	8.86	9.38	9.68	10.20	10.40	10.47	10.60	10.73	10.86	10.96	10.96
Distance between bases		ft	4.07	4.13	4.46	4.72	5.18	5.74	6.17	6.17	6.56	6.89	7.41	7.71	8.23	8.43	7.71	7.84	7.97	8.10	8.20	8.20
Width of each bases		ft	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	1.38	1.38	1.38	1.38	1.38	1.38
Length of bases		ft	10.50	11.38	12.04	12.24	13.71	14.47	14.80	18.77	19.26	20.70	22.11	24.21	24.21	24.21	24.38	24.38	24.38	24.44	24.54	25.16
Height of bases		ft	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66

Termodinámica Enica S.A. de C.V. TEN-840430-465
Av. Dr. Jiménez Cantú Lote 2.5 s/n, Plaza Antigua Edif 3 Ofna. 3-16
Atizapán de Zaragoza, Edo. de México, CP. 52937
*T. +52(55) **5393 5711** ¬ F. +52(55) **5393 9607***

*www. **powermasterboiler** .com*

* The actual firing rate depends on fuel quality, burner selection and adjustment, combustion controls, operating pressure, etc. For an estimated calculation of a specific configuration contact your Powermaster salesman.

** Dimensions varies based on burner selection

*** Width for freight clearance

**** The boiler shell has a 2.5 in coupling. If the boiler is acquired with feed-water piping it will be delivered with a reduction and 2 in valves.

Date: **FEB 26, 2016**
Creator: **SZ**
Revision: **LN**

CALDERAS Powermaster®

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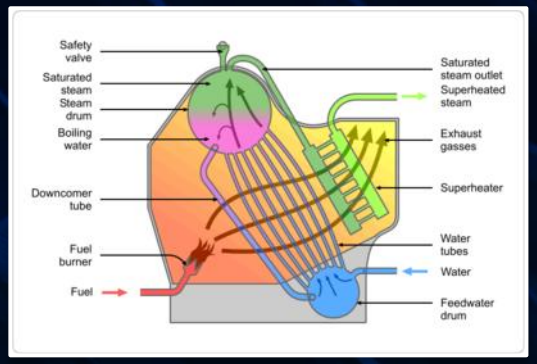
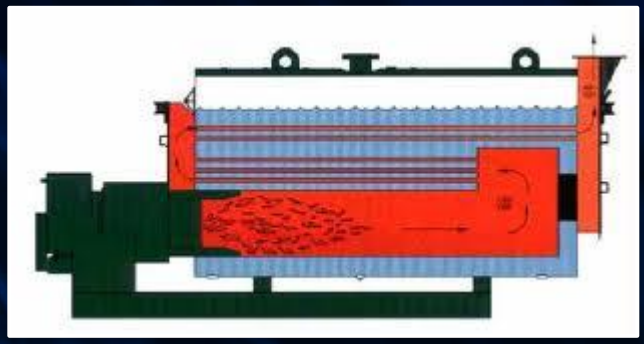
Water tube boilers *vs* *Firetube boilers*

Water and steam travel in the tubes.



1. *Critical, relatively fragile design .Preferred when pressures between 300 and 2300 PSIG are required (E.g., thermoelectric plants).*
2. *The small diameter of the tube in which the water travels causes scaling quickly and plugs the tube.*
3. *The quality of the water must be continuously monitored.*
4. *High operating cost.*

Combustion gases travel in the tubes.



1. *Sturdy design. Favored by industry when the required pressure is below 21 bars (300 PSIG).*
2. *With the water outside the tube, the scaling has to be excessive in order to damage the boiler.*
3. *The quality of the water need only be monitored periodically.*
4. *Low operating cost.*

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v0

3-Pass boilers *vs* *4-Pass boilers*

1. *The same Heat Transfer Area is divided into three passes, with a longer body and smaller diameter.*
2. *The pressure drop to be overcome by the burner motor is lower and therefore, the electric motor is smaller.*
3. *Lower electrical operation cost.*

1. *The Heat Transfer Area is divided into four passes, with a shorter body and larger diameter.*
2. *The pressure drop to be overcome by the burner motor is higher; therefore, the electric motor is larger.*
3. *Higher electrical operation cost.*

Aplica para: Calderas horizontales.

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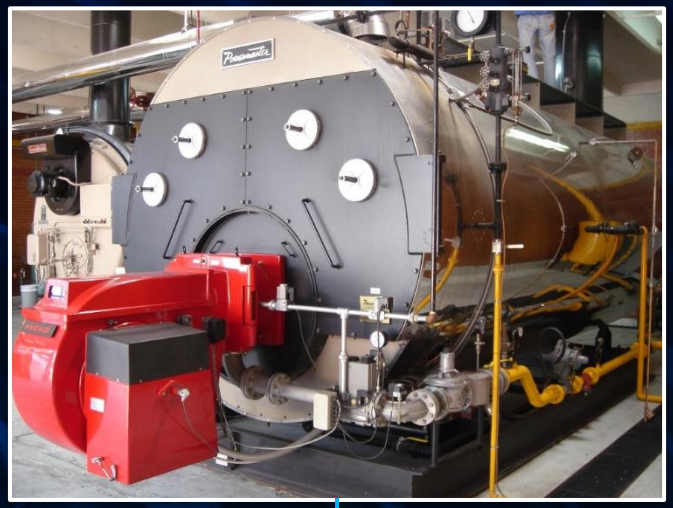
v0

Boilermaker Burner *vs* *Combustion Expert Burner*



1. *Only one supplier is the contact point for the end user.*
2. *Replacement parts may be obtained only from the boiler manufacturer.*
3. *The burner technology is limited to the resources for development assigned by the boiler manufacturer.*

1. *Only one supplier is the contact point for the end user.*
2. *Replacement parts may be obtained from the boiler manufacturer or from other dealers.*
3. *The burner technology is state-of-the-art because all of the resources for development are assigned to the burner.*

Aplica para: Todas las calderas de 5 HP a 1500 HP

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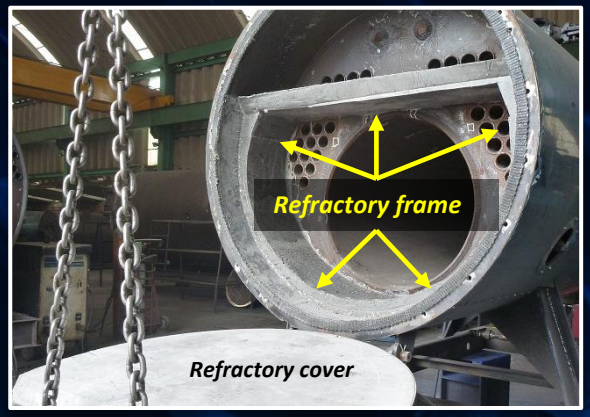
www.powermaster.com.mx

v0

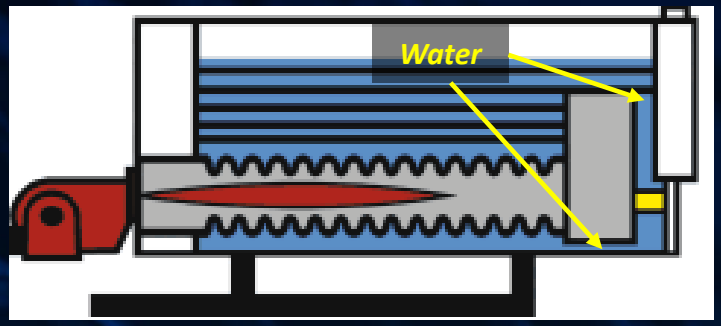
Dry-Back vs *Wet-Back*

Recirculation of gases in a three-piece chamber (cover, refractory frame and steel) adjacent to the water to be evaporated in a boiler.



1. *Heat losses through the refractory cover.*
2. *Losses caused by leaks between passes.*
3. *The boiler operation cycles involve major temperature changes. The useful life of the refractory is limited and unpredictable.*
4. *The repair of a collapsed frame or cover takes two to three days.*

Recirculation of gases inside a one-piece chamber made of steel submerged in the water to be evaporated in a boiler.



1. *Heat losses are limited to the man-way plug: lower losses, greater efficiency, fuel savings.*
2. *No leaks between stages.*
3. *Steel construction, no refractory frames: withstands temperature changes without wear, preventing unpredictable shutdowns.*
4. *Access for changing tubes through the man-way. A person can access the Wet-Back.*

Aplica para: Calderas horizontales de 80 HP a 1500 HP

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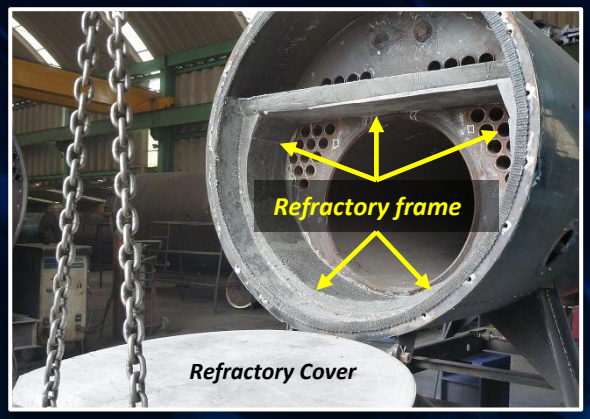
v0

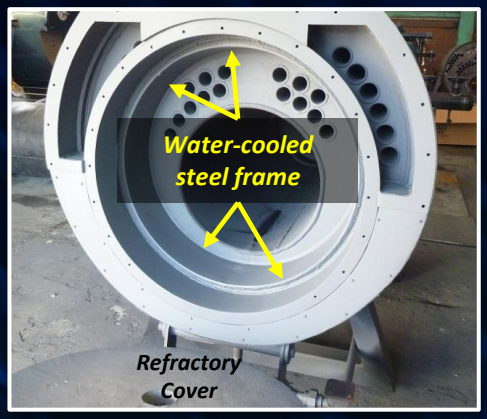
Dry- Back vs Semi Wet-Back

Recirculation of gases in a three-piece chamber (cover, refractory frame and steel) adjacent to the water to be evaporated in a boiler.



1. *Heat leaks through the refractory cover.*
2. *Losses due to leaks between passes.*
3. *The boiler operation cycles involve major temperature changes. The useful life of the refractory is limited and unpredictable.*
4. *Repair of a collapsed cover takes two to three days.*

Recirculation of gases in a two-piece chamber made of steel partially submerged in the water to be evaporated in a boiler, with a small cover made of refractory material.



1. *Smaller cover, generates lower losses and offers greater efficiency.*
2. *No leaks between passes.*
3. *Steel construction, no refractory frames. Withstands temperature changes with no wear, preventing unpredictable shutdowns. Only the flat cover, made of refractory material, can crack. There is no frame that could collapse.*

Aplica para: Calderas horizontales de 10 HP a 60 HP

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v0

Doors without refractories

All Powermaster horizontal boilers have refractory free second, third and fourth passes.

The competition uses doors with refractories.

The Advantages

1. *Lower maintenance costs. No cracking or detaching.*
2. *Easy access: light, easy-to-open doors.*

Aplica para: Calderas horizontales de 10 HP a 1500 HP

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External burners offering easy access and maintenance

All Powermaster boilers are equipped with external burners for easy access and maintenance

The competition equips its boilers with burners which are not state-of-the-art or with difficult access for maintenance..

The Advantages

1. *Accessibility: most of the components are easily accessible*
2. *Quick maintenance: no need to cool off the entire boiler to gain access to the burner.*

Aplica para: Todas las calderas de 5 HP a 1500 HP

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Access for maintenance of wet-back

All Powermaster Wet-Back boilers are equipped with a man-way 16 inches in diameter to facilitate and expedite access for maintenance.

The access for maintenance to the gas recirculation chamber used by the competition is complicated and takes a long time to operate.

The Advantages

1. *Accessibility: easy access to the gas recirculation chamber.*
2. *Quick maintenance: access to the gas recirculation chamber is gained by removing only 16 bolts.*

JN/LN/--

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Aplica para: Calderas horizontales de 80 HP a 1500 HP

v0

Maintenance ladder and walkway

All Powermaster 80 to 1500 HP boilers are standard equipped with an overhead walkway and ladder that offers fast and easy access for maintenance.

The competition does not use walkways and ladders as standard.

The Advantages

1. *Accessibility: easy access to the overhead components of the boiler.*
2. *Lower installation cost: no need to install additional accesses.*
3. *Longer useful life: the lining is not damaged each time an overhead component is manipulated.*

JN/LN/--

Aplica para: Calderas horizontales de 80 HP a 1500 HP

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v0

Stainless steel lining

All Powermaster boilers can be equipped with stainless steel linings.

The competition equips its boilers with a painted layer of carbon steel.

The Advantages

1. *Longer useful life: no need to periodically repaint the lining.*
2. *Longer useful life: no need to replace a lining damaged by corrosion.*

JN/LN/--

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Aplica para: Todas las calderas de 5 HP a 1500 HP

v0

Ample furnace tube

All Powermaster boilers have an ample furnace tube.

The competition equips its boilers with small, compact furnace tubes.

The Advantages

1. *Longer useful life: lower metal fatigue*
2. *Higher quality emissions: no need for burners with recirculation or pre-mixing.*
3. *Greater efficiency: sixty percent of the heat transfer of a boiler takes place in the furnace tube*

JN/LN/--

Aplica para: Todas las calderas de 5 HP a 1500 HP

CALDERAS Powermaster®

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v0

Gas side relief valves

All horizontal Powermaster boilers are fitted standard with gas side relief valves.
The competition does not equip its boilers with these safety devices as standard.

The Advantages

Greater safety: in the event of an explosion on the fire side, the relief valves safely release the pressure without causing any damage.

JN/LN/--

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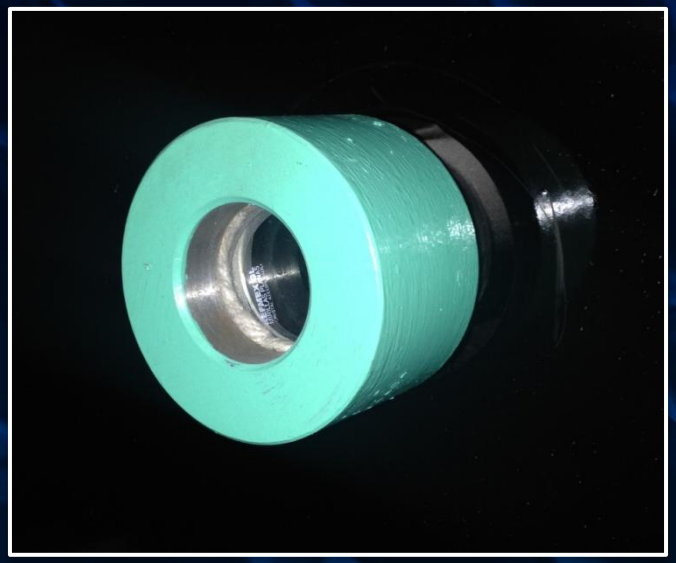
Aplica para: Todas las calderas horizontales de 10 HP a 1500 HP (excluye VAP)

v0

Rear sight glass

All horizontal Powermaster boilers have a reinforced rear sight glass, allowing you to see the flame. They also have a port permitting measurement of the backpressure.



The Advantages

1. *Combustion adjustments: the flame shape and color can be clearly seen.*
2. *Combustion adjustments: backpressure can be easily measured.*
3. *Longer useful life: the part in contact with the user is reinforced.*

Aplica para: Calderas horizontales de 10 HP a 1500 HP

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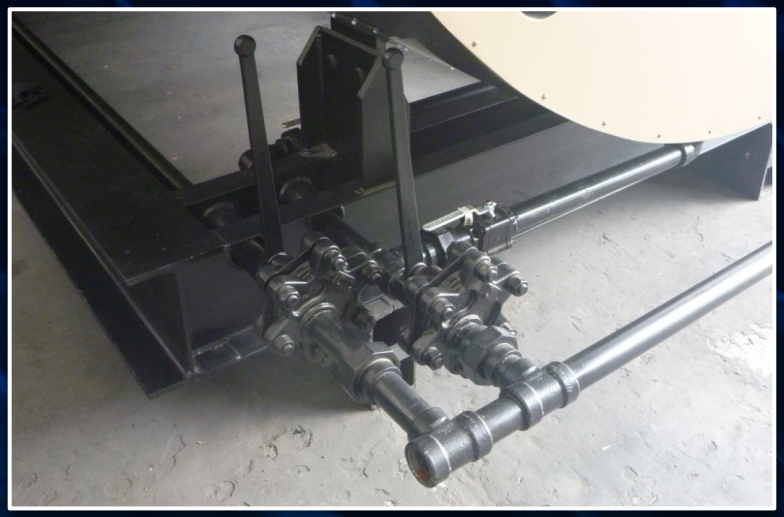
Bottom blowdown valves

The Powermaster steam boilers have from two to six bottom blowdown valves, depending on the capacity of the boiler.



The Advantages

1. *Longer useful life: improved elimination of sediment in the boiler.*
2. *Reliability: lower risk of damage to furnace tube caused by sediment.*

Aplica para: Calderas de vapor de 5 HP a 1500 HP

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v0

Heat Shields

All horizontal Powermaster boilers have heat shields to reduce the surface temperature of the doors.

The competition does not supply this feature.

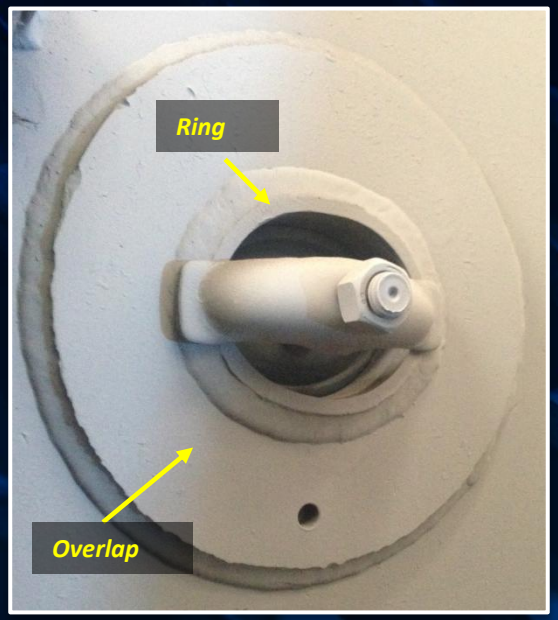
The Advantages

1. *Safety: lower surface temperatures.*
2. *Maintenance: the paint on the heat shields has a longer useful life.*

Reinforced Handholes

All Powermaster boilers with capacity of 150 PSIG and over have handholes reinforced with an overlap and ring.

The competition equips its boilers with handholes that do not have overlap or ring.



The Advantages

1. *Longer useful life: reinforced maintenance area, meaning lower wear.*
2. *Improved seal: the flat ring offers a better seal against leaks.*

JN/LN/--

Aplica para: Calderas de 150 PSIG de diseño y mayores

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v0

Fusible plug

All Powermaster steam boilers with a design pressure of 150 PSIG have a fusible plug as an additional mechanical device for protection against low water levels.

The competition does not equip its boilers with this technology.

The Advantages

1. *Greater safety: An additional safety device for protection against low water levels.*
2. *Greater safety: a physical device that cannot be circumvented.*

JN/LN/--

Aplica para: Calderas de vapor de 150 PSIG de diseño

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Atmospheric Deareator vs *Pressurized Deareator*

Condensate recovery and preheating tank for non-pressurized water

1. *Capable of eliminating 99% of the oxygen in the water, which is adequate for fire tube boilers.*
2. *Sturdy design, ease of operation and maintenance.*
3. *Safety: Not a pressure vessel.*
4. *Cost: Lower initial investment.*
5. *Design pressure: Atmospheric.*
6. *Does not require additional pumps or tanks*

Condensate recovery tank and pressurized water preheater

1. *Capable of eliminating 99.9% of the oxygen in the water, which is adequate for water tube boilers.*
2. *Complicated design, difficult to operate and maintain*
3. *Safety: Pressure vessel*
4. *Cost: High initial investment*
5. *Typical design pressure: 15 psig*
6. *Requires pump and additional tank*

JN/LN/--

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Boiler tubes

All Powermaster Wet-Back boilers are fitted standard with seamless 11 gauge boiler tubes.

The competition uses much thinner tubes as standard (typically 13 gague).

The Advantages

1. *Longer tube lifetime due to thicker wall.*
2. *Same efficiency: tube thickness does not significantly affect heat transfer.*
3. *Reliability: More tube material guarantees a better seal between the tube and the tubesheet.*

JN/LN/--

Aplica para: Calderas de 80 a 1500 HP

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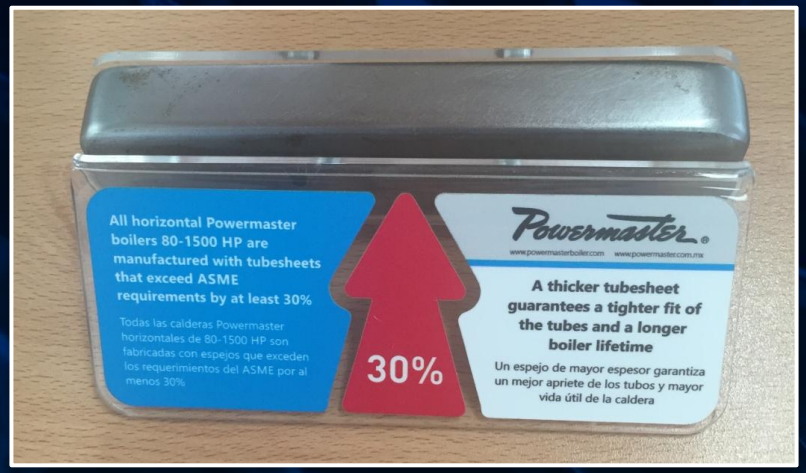
Tubesheet thickness

All Powermaster Wet-Back boilers are fitted with tubesheets which exceed ASME requirements by at least 30%.

The competition typically does not exceed ASME requirements.



The Advantages

1. *More material guarantees a longer lifetime.*
2. *Reliability: More material guarantees a better seal between tube and tubesheet.*

JN/LN/--

Aplica para: Calderas de 80 a 1500 HP

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v0

Control header

All Powermaster Wet-Back steam boilers have a control header.

The competition does not equip its boilers with this technology.

The Advantages

1. *Maintenance: easy access for checking the control plumbing.*
2. *Longer useful life: Condensates do not enter into contact with the controls.*
3. *Greater reliability: the larger diameter is less susceptible to plugging .*

Aplica para: Calderas de vapor de 80 a 1500 HP

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Insulation

All Powermaster boilers are insulated using 2" thick mineral wool with an actual density of 5.8 lb/ft3.

The competition insulates their boilers using lower actual density mineral wool.

Density	Actual Density = 5.8 lb/ft³ - (93 kg/m³) Nominal Density = 8.0 lb/ft³	ASTM C303

The Advantages

1. *Greater efficiency: less losses from radiation.*
2. *Longer useful life: greater density offers greater rigidity to the lining; therefore, it is less susceptible to deformation.*

Aplica para: Todas las calderas de 5 HP a 1500 HP

CALDERAS Powermaster®

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v0

Connections and fittings

All Powermaster boilers are equipped with class 2000 or 3000 fittings.

The competition uses class 150 or 300 fittings.

The Advantages

1. *Longer useful life since it incorporates more material.*
2. *Greater reliability: better sealing of tubes and fittings.*
3. *Greater reliability: the fittings are rated at a higher pressure.*

Aplica para: Todas las calderas de 5 HP a 1500 HP

CALDERAS Powermaster®

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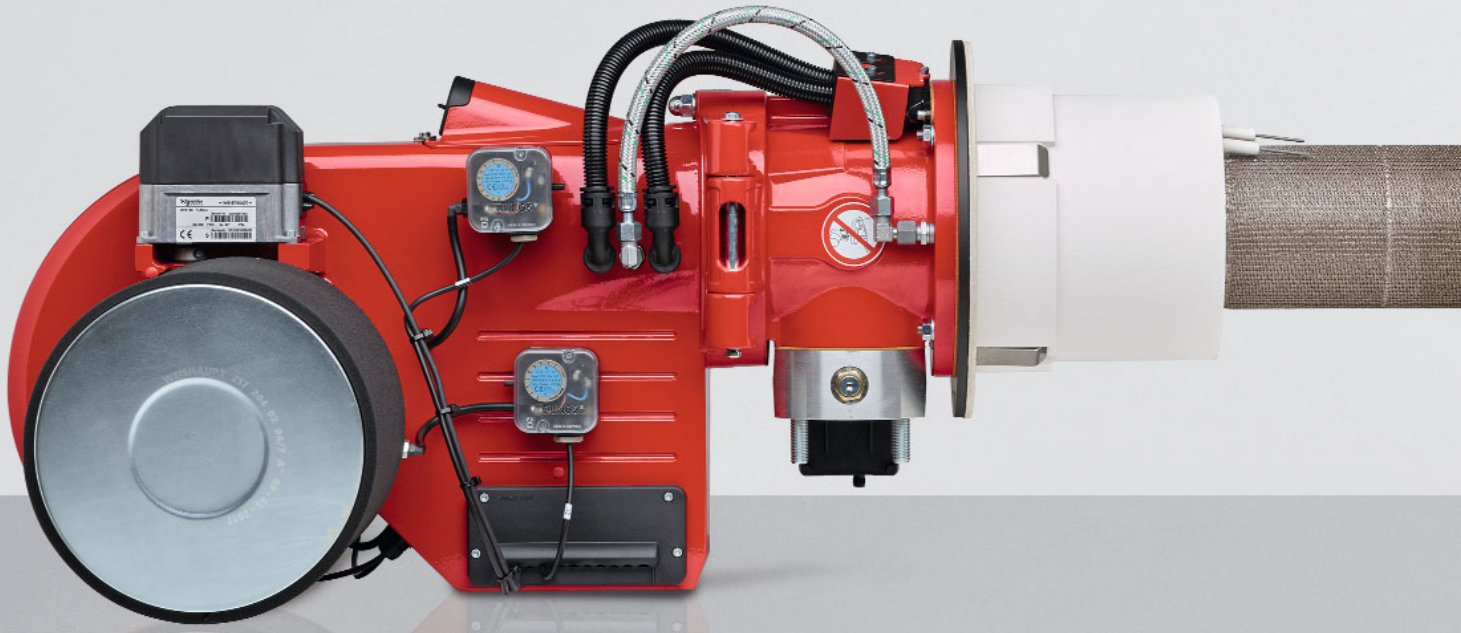
v0

–weishaupt–

product

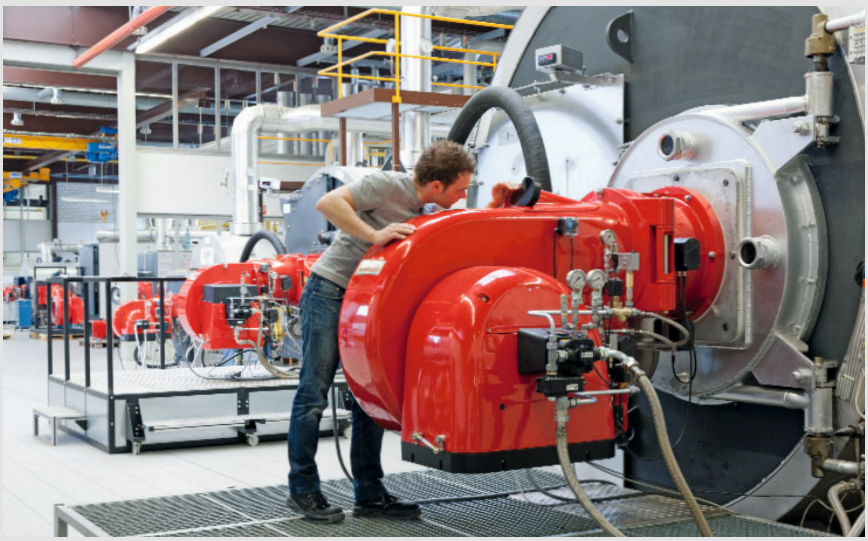
Information on Ultra-Low-NO_x gas burners



NO_x emissions < 30 mg/kWh

WM-G10 ZM-PLN and WM-G20 ZM-PLN monarch® burners (85–3000 kW)

A new class of emissions: Ultra-Low NO_x



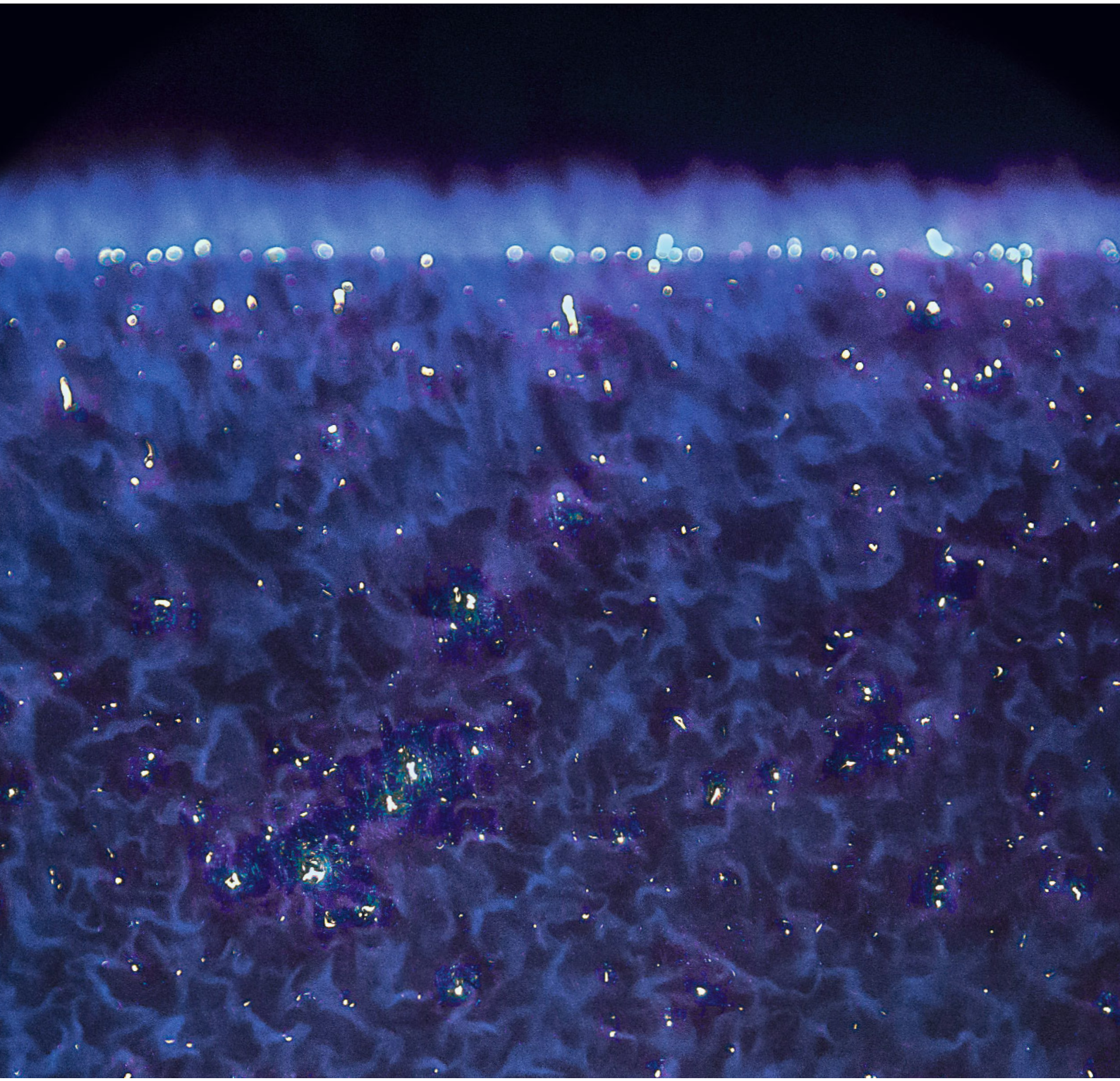
Test-firing chambers for medium and large-sized burners at the Weishaupt Research & Development Centre

For more than six decades, Weishaupt's monarch® series burners have been used on a wide variety of heat generators and industrial plant, and their success has helped underpin Weishaupt's outstanding reputation.

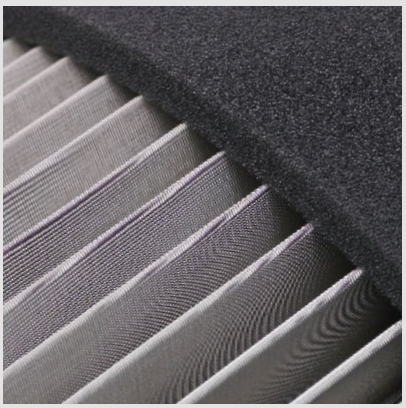
Their PLN-version burners stand ready for use in situations where the very lowest of emission levels are being demanded. PLN stands for Premix Low NO_x – a system that combines premixing with surface-stabilised combustion.

A further advantage of this type of combustion system is that it can be used on appliances with particularly small combustion chambers, as well as with more typical boilers.

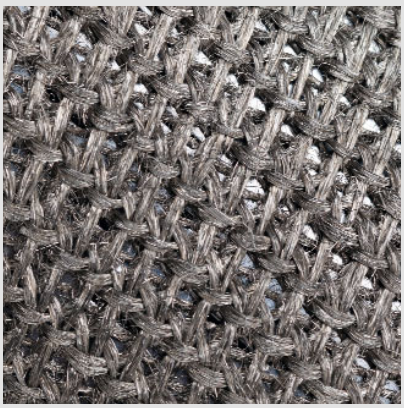
Homogeneous, surface-stabilised combustion



Weishaupt premix technology for extremely low NO_x emission limits



The metal gauze air filter is protected from dust by an additional pre-filter sleeve



A microweave mat made from a high-quality alloy permits the right amount of gas / air mix to pass

Weishaupt PLN-version burners can also be used in very small combustion chambers

Everywhere in the world, emission limits are becoming ever tighter, with a focus on NO_x emissions in particular. Weishaupt has therefore developed a new generation of burners designed to fulfil these demands.

Weishaupt burners have always been particularly efficient and environmentally friendly. Premix engineering is used to achieve NO_x emissions below 30 mg/kWh.

Premixing followed by surface-stabilised combustion has been state of the art for many years in small condensing boilers. It is environmentally friendly, reliable, and efficient. Extending these benefits to typical heat generators with larger outputs was the developmental goal for the PLN-version burners.

Special gas / air mix

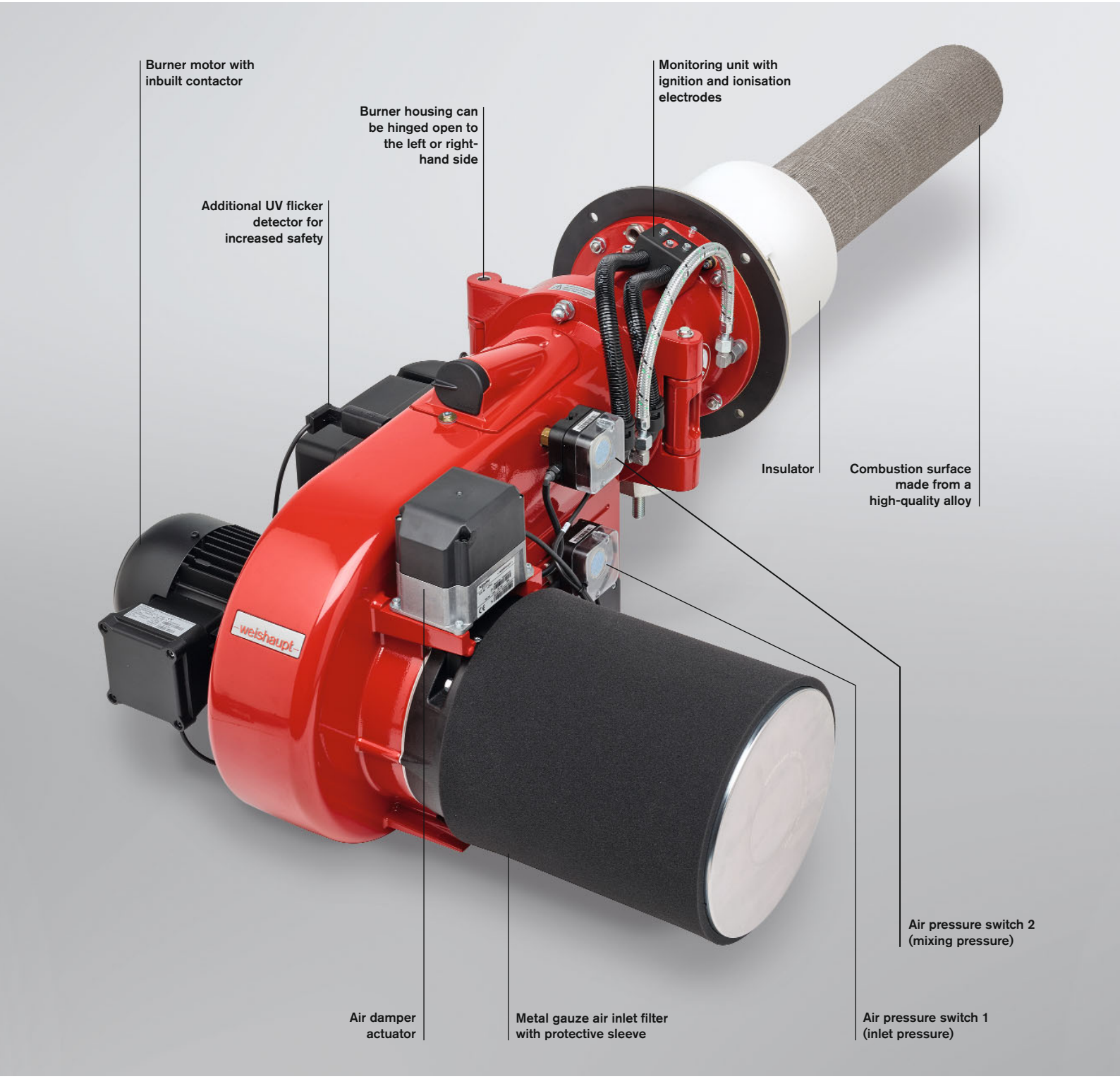
Stabilised surface combustion relies on an homogeneous gas / air mixture. For that reason, a completely new mixing assembly was developed for the PLN-version burners. A key feature is the separated gas and air feeds, with the two media not being brought together before the burner tube. There, a uniform mix is produced from the gas flowing out through the distributor and the combustion air that has been set in rotation by the swirl plate.

Stabilised surface combustion

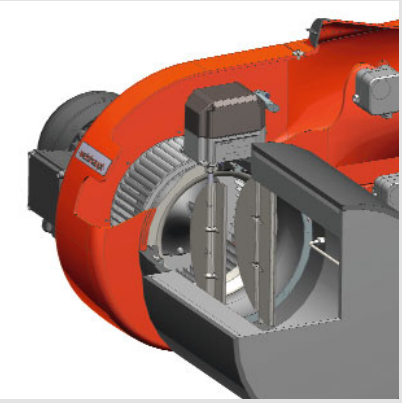
The gas / air mix, which is under pressure, permeates the microweave alloy mat and combusts at its surface. The flame carpet thereby created has flame temperatures below 1200 °C and so the formation of thermal NO_x is inhibited. NO_x emission levels below 30 mg/kWh are now also a reality for medium-capacity burners.

One substantial benefit of this technology is to be found in the combustion chamber requirements. These can be considerably smaller than those found in typical boilers.

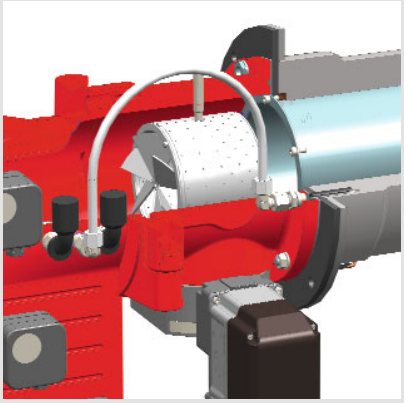
Weishaupt's PLN-version premix burners also have similar turndowns to their forced-draught stablemates. The electronic compound regulation provided by the W-FM 50, W-FM 100 and W-FM 200 combustion managers can achieve turn-down ratios of 7:1 with these burners.


Burner motor with inbuilt contactor
Burner housing can be hinged open to the left or right-hand side
Additional UV flicker detector for increased safety
Monitoring unit with ignition and ionisation electrodes
Insulator
Combustion surface made from a high-quality alloy
Air pressure switch 2 (mixing pressure)
Air damper actuator
Metal gauze air inlet filter with protective sleeve
Air pressure switch 1 (inlet pressure)

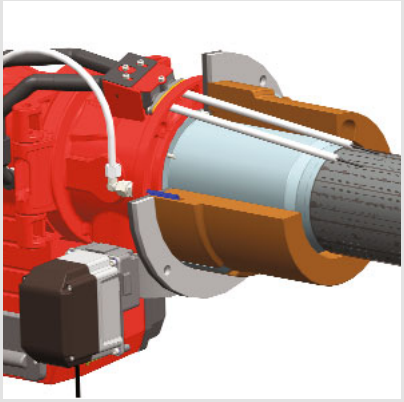
Safety first



The air damper control has been designed to be particularly aerodynamic



The special mixing of gas and air is conducive to reliable ignition behaviour



A ceramic insulator provides optimal heat shielding to the mixing assembly and electrode unit

Clean combustion air
The combustion surface's alloy microweave mat is only able to distribute the gas / air mixture evenly if its pores are not blocked by particles. Weishaupt therefore employs a special metal gauze air filter. An additional pre-filter sleeve is used to keep larger dust particles at bay. This sleeve can be washed or replaced as required.

Ignition and monitoring
The ignition electrode and the ionisation electrode are brought together as a monitoring unit. The electrodes are fed through the insulator to protect them from the heat and are also air cooled.

Optimal safety and reliability
The PLN-version burners are especially equipped with two monitoring systems. An ionisation electrode monitors the combustion surface, while an infra-red flicker detector secures the premix chamber and the burner tube.

Uninterrupted monitoring
The air volume, and thus the cleanliness of the air filter, is continuously monitored during burner operation by an additional air pressure switch. The necessary air volume is thereby always guaranteed.

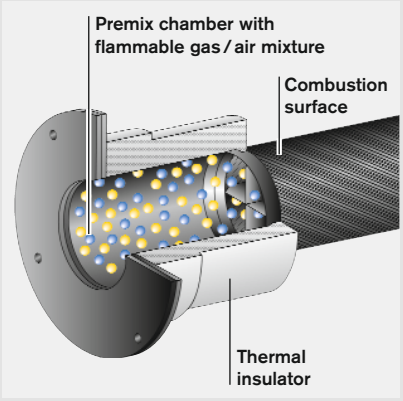
Thermal insulators
Thermal protection of the premix chamber, which contains the flammable gas / air mixture, is a safety-critical aspect of PLN-version burners.

Conscious of their importance, Weishaupt has developed precisely tailored insulators that are suited to the thermal conditions. They provide optimal protection against uncontrolled heat influences in this very sensitive area.

An insulator designed for temperatures up to 850 °C is suitable for burners used on low-temperature hot-water boilers with through-pass or three-pass combustion chambers.

Boilers with a reverse-flame combustion chamber,[1)] steam boilers, and thermal fluid heaters will place a considerably higher demand on the insulator. Weishaupt offers a high-temperature ceramic insulator for such plant, providing optimal protection for temperatures up to 1200 °C.

[1)] The use of PLN-version burners on boilers with reverse-flame chambers requires OEM approval.

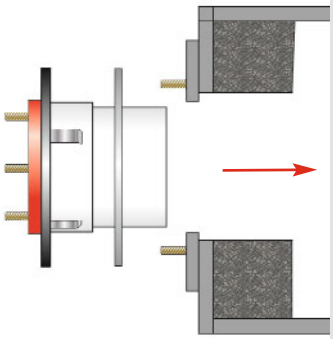


Simple installation, easy servicing

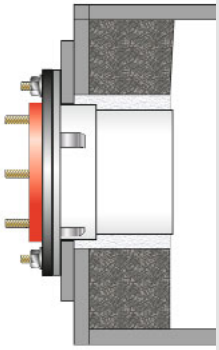
The burner is installed in five easy steps:

1. Installation of the ceramic insulator.
2. Checking of the insertion depth and insulation of the aperture between the burner and the refractory
3. Mounting of the hinged flange.
4. Insertion of the combustion surface (optional installation aid available)
5. Attachment of the burner to the hinged flange.

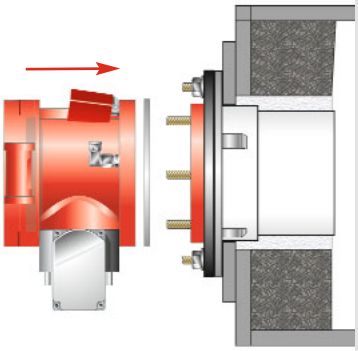
1.



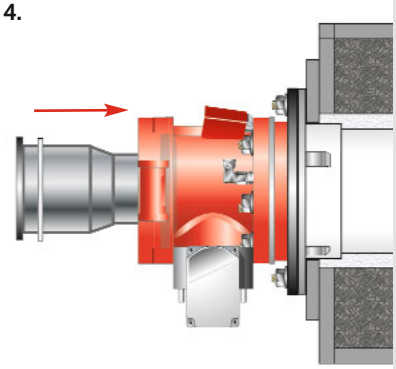
2.



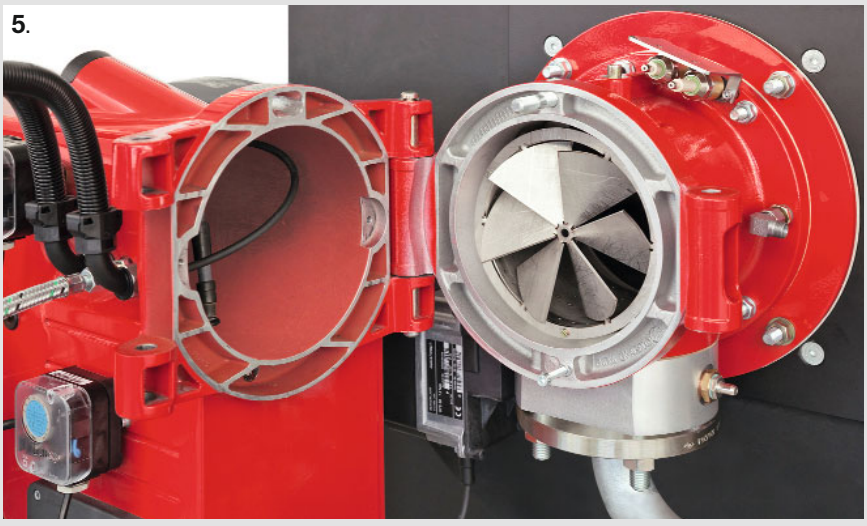
3.



4.



5.



The burner hinges a full 90°, enabling the combustion surface to be withdrawn through the mounted flange

Specification, control, and model designation

Fuels
Natural gas
LPG

The suitability of fuels of differing quality must be confirmed in advance with Weishaupt.

Applications
Weishaupt PLN-version burners are suitable for intermittent firing and continuous firing on:
- EN 303-compliant heat generators
- LTHW boilers
- HTHW boilers < 130 °C
- Steam boilers [1)]
- Air heaters < 100 °C
- Thermal fluid heaters [1)]
- Certain process applications [1)]

Permissible ambient conditions
- Ambient temperature -15 to + 40 °C
- Maximum 80 % relative humidity, no condensation
- The combustion air must be free of aggressive substances (halogens, chlorides, fluorides etc.) and impurities (dust, debris, vapours, etc.)
- Adequate ventilation is required for operation in enclosed spaces
- For plant in unheated areas, certain further measures may be required

Use of the burner for other applications or in ambient conditions not detailed above is not permitted without the prior written agreement of Max Weishaupt GmbH. Service intervals will be reduced in accordance with the more extreme operational conditions.

International Protection rating
IP 54 per EN 60529.

Standards compliance
The burners are tested by an independent body and fulfil the applicable requirements of the following European Union directives and applied standards:

EMC EMC Directive 2014/30/EU
Applied standards:
- EN 61000-6-1 : 2007
- EN 61000-6-2 : 2005
- EN 61000-6-4 : 2007

LVD Low Voltage Directive 2014/35/EU
Applied standards:
- EN 60335-1 : 2010
- EN 60335-2-102 : 2010

MD Machinery Directive 2006/42/EC
Applied standards:
- EN 267 Annex J,
- EN 676 Annex J,

GAR Gas Appliances Regulation 2016/426/EU
Applied standards:
- EN 676 : 2008

PED[2)] Pressure Equipment Directive 2014/68/EU
Applied standards:
- EN 267 Annex K,
- EN 676 Annex K,
- Conformity assessment procedure: Module B

The burners are labelled with
- CE Mark,
- CE-PIN per 2009/142/EC
- Identification No. of the notified body

Control
Weishaupt PLN-version burners are suitable for gas firing, and for sliding-two-stage or modulating operation, depending on the method of load control employed.

The output of a modulating burner is matched – within its operating range – to current heat demand. That makes the burner suitable for a wide range of applications.

Installation position
The burner is suitable for horizontal and vertical mounting on the heat generator. The manufacturer's instructions should be observed.

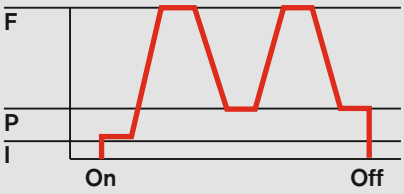
1) Please enquire.
2) With the appropriate choice of equipment.

Gas-fired operation

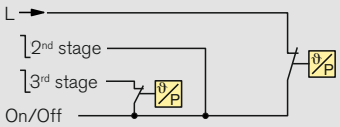
Sliding-two-stage control

- Two-term switching (e.g. temperature or pressure stat) causes actuators to drive the burner to partial load or full load in response to heat demand. Combustion remains CO-free between load points

Sliding-two-stage



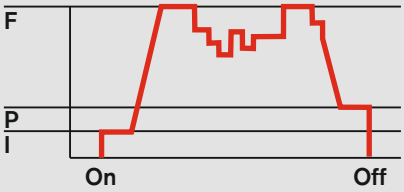
Control [1)]

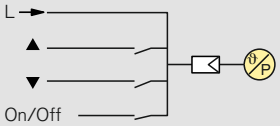


Modulating control

- An electronic load controller causes actuators to make infinitely variable load adjustments in response to heat demand.
- Available modulation control options:
  - W-FM 50 with an optional separate load controller
  - W-FM 100 with an optional integral load controller
  - W-FM 200 with its standard integral load controller
- Alternatively, a PID controller can be fitted into the control panel.

Modulating





F = Full load (nominal load)
P = Partial load (minimum load)
I = Ignition load

[1)] Alternatively, staged load control can also be effected by an electronic PID controller, in which case appropriate temperature sensors or pressure transducers will be required.

Model designation

WM -G 10 / 3 -A ZM-PLN

- Premix Low NO_x
- ZM = Sliding-two-stage / modulating
- Mark
- Capacity
- Size
- G = Gas
- Weishaupt monarch® burner series

Digital combustion management: Efficient and reliable

Digital combustion management means optimal combustion figures, continuously reproducible setpoints, and ease of use.

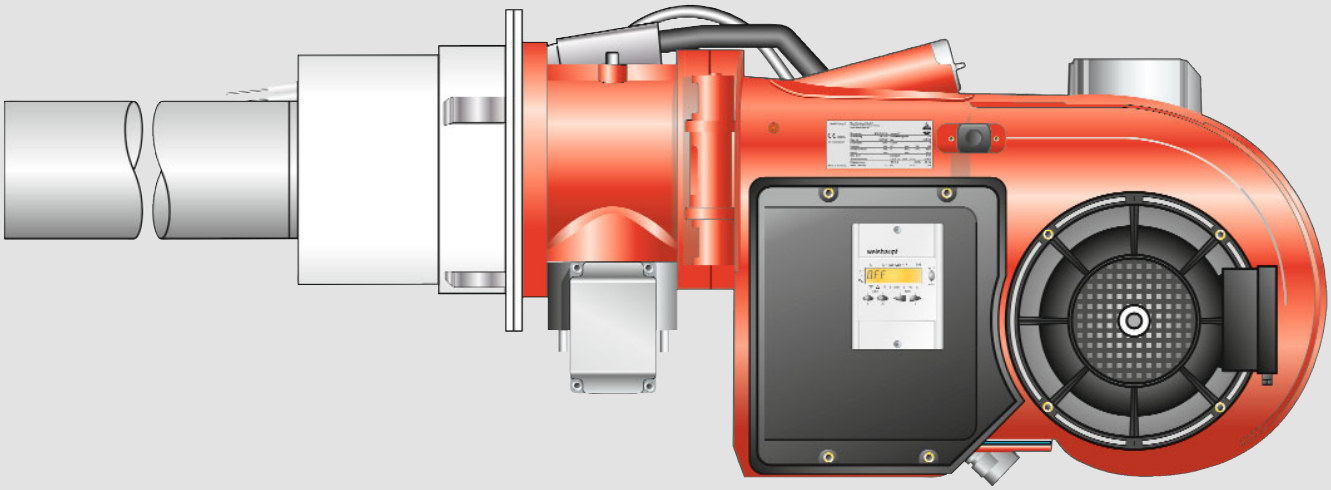
Weishaupt PLN-version gas burners are equipped as standard with electronic compound regulation and digital combustion management. The latest combustion technologies demand a precise and continually reproducible dosing of fuel and combustion air. This optimises combustion efficiency and saves fuel.

Simple operation
Setting and control of the burner is achieved using the control and display unit. This is linked to the combustion manager via a bus system, enabling the user-friendly setting of the burner. The control and display unit has, depending on the type of combustion manager employed, either a language-neutral display or a clear text display with a choice of languages. An English / Chinese dual-screen version is available as an option with the latter should a Chinese-character display be desired.

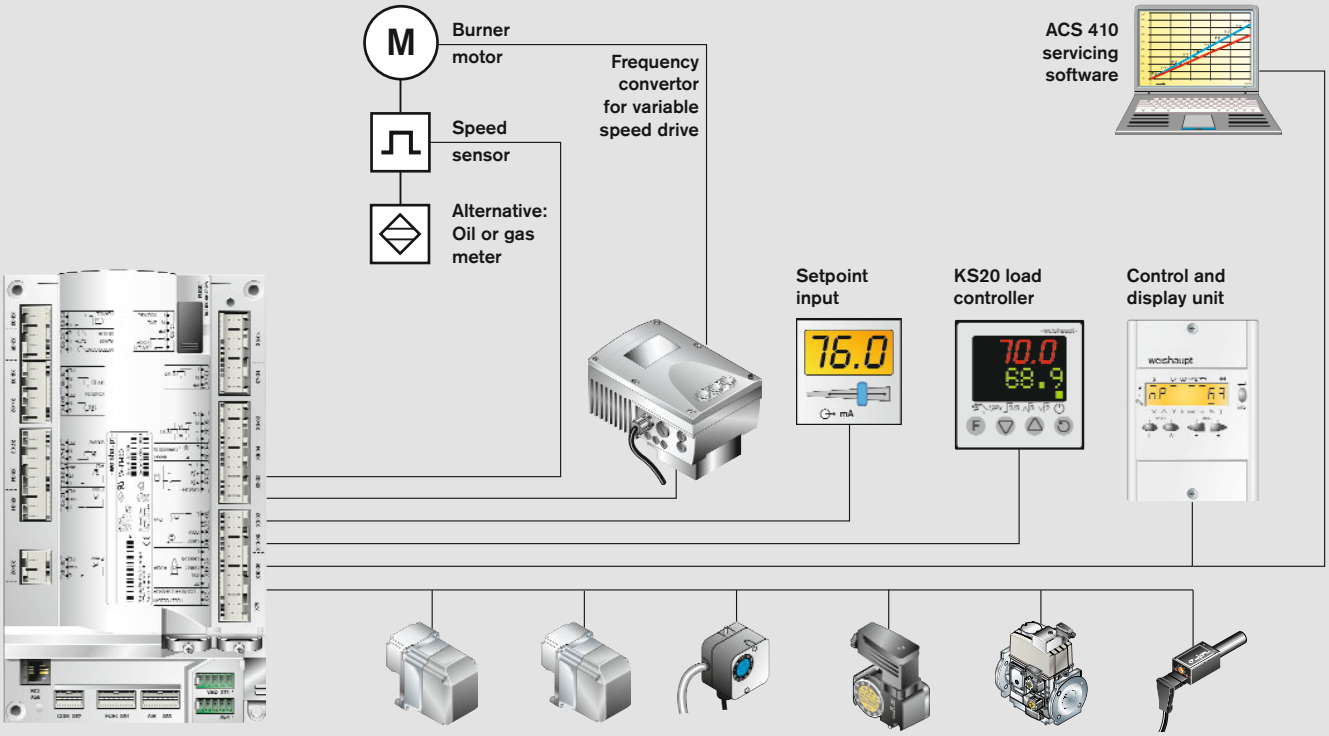
Variable speed drive reduces electrical consumption and facilitates a soft start of the combustion air fan. The use of VSD will also reduce noise emissions by a considerable amount.

Features – digital combustion management	W-FM 50	W-FM 100	W-FM 200
Single-fuel operation	●	●	●
Dual-fuel operation	–	●	●
Intermittent firing	●	●	●
Continuous firing >24 h	●	●	●
Variable speed drive	●	–	●
O_2 trim	–	–	●
CO monitoring	–	–	O
Combined O_2/CO control	–	–	O
ION/LFW flame sensor for continuous firing	●	●	●
Maximum number of actuators	2	4	6
Gas valve proving	●	●	●
Integrated PID controller with automatic adaption. Pt / Ni temperature sensor, 0/2–10 V, and 0/4–20 mA inputs for temperature / pressure	–	O	●
0/2–10 V and 0/4–20 mA setpoint input for temperature / pressure	–	O	●
Configurable 0/4–20 mA analogue output	–	O	●
Language-neutral ABE control unit	●	–	–
ABE control unit with 20 available languages (any one ABE limited to 6)	–	●	●
Dual-language / script ABE control unit (Chinese / English)	–	O	O
Removable ABE control unit (max. length of connecting line)	20 m	100 m	100 m
Fuel consumption meter (switchable)	● [1)]	–	●
Combustion efficiency display	–	–	●
eBUS / Modbus RTU interface	●	●	●
PC-supported commissioning	●	●	●

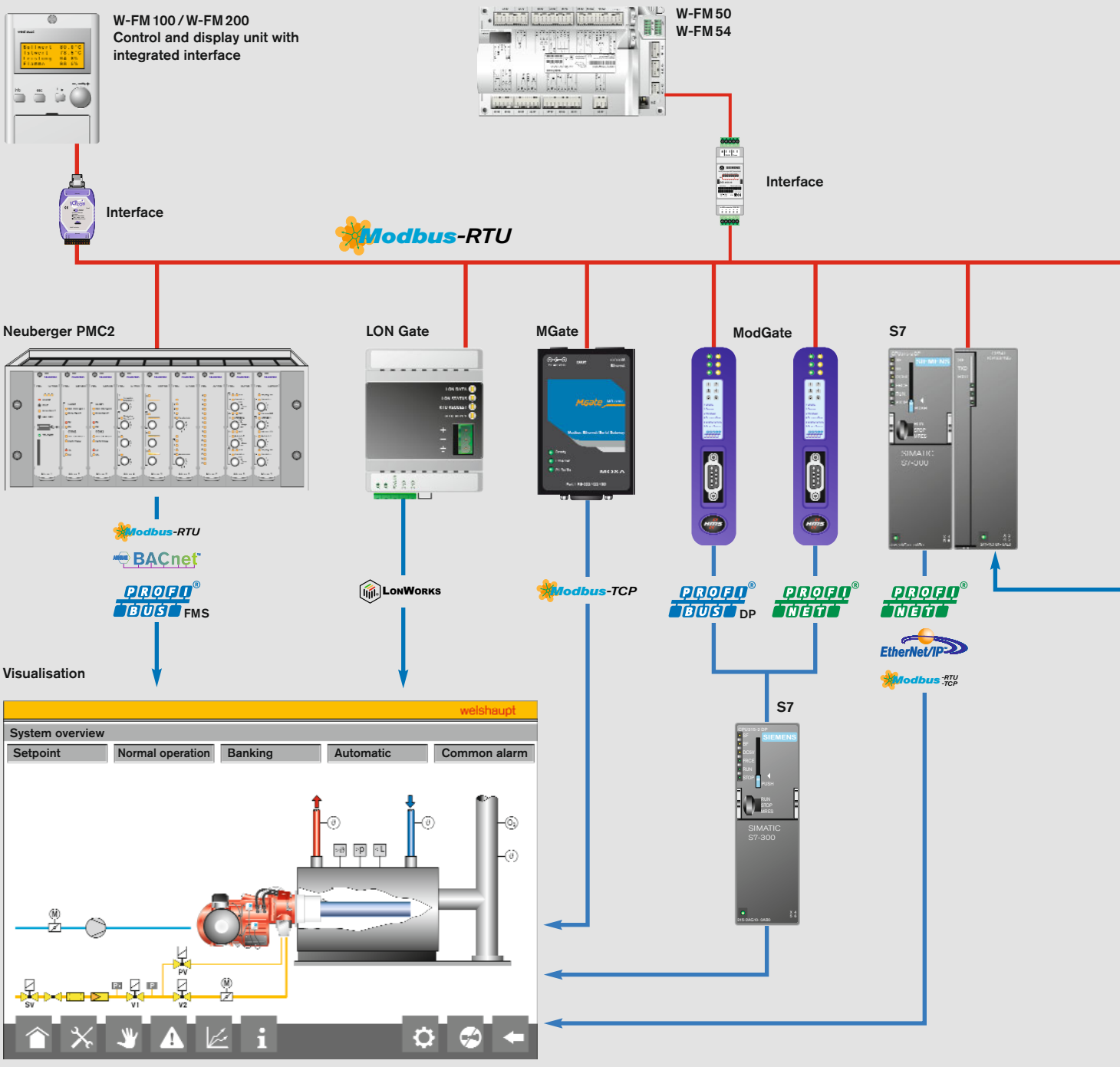
● Standard O Optional [1)] Not in conjunction with VSD

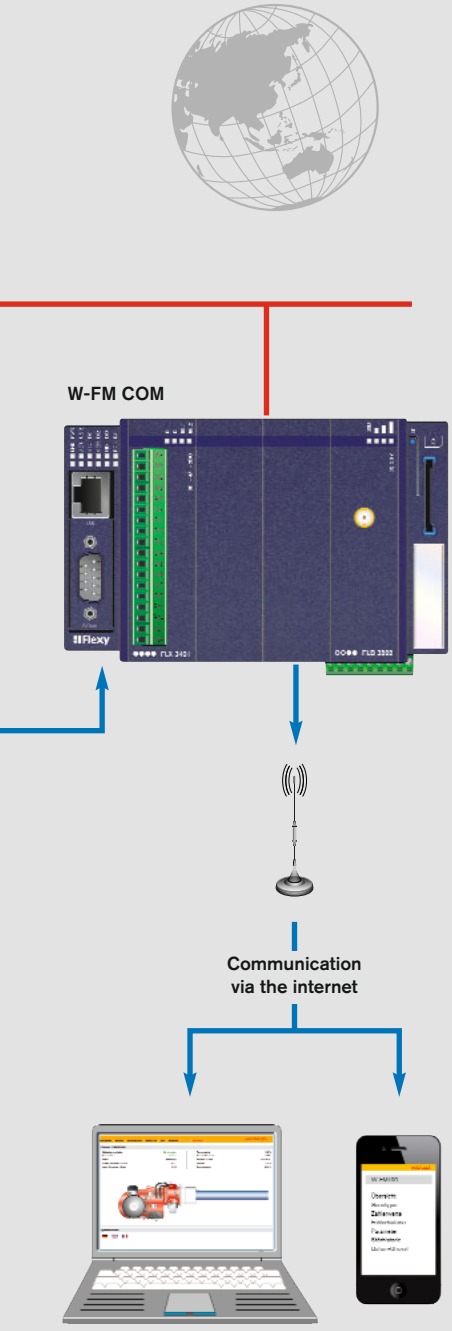


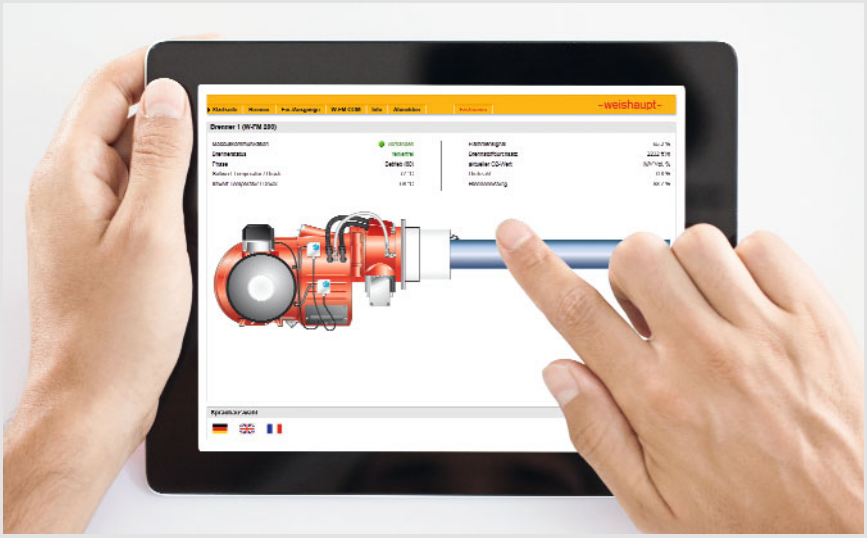
Burner with digital combustion management



Flexible communications:
Compatible with building management systems







Remote monitoring made easy via tablet or laptop

The digital combustion manager is the basis of communications with other superordinate systems. This is generally achieved using the eBus or Modbus protocols.

All the usual burner and boiler functions can be monitored and controlled through a direct connection with a building management system.

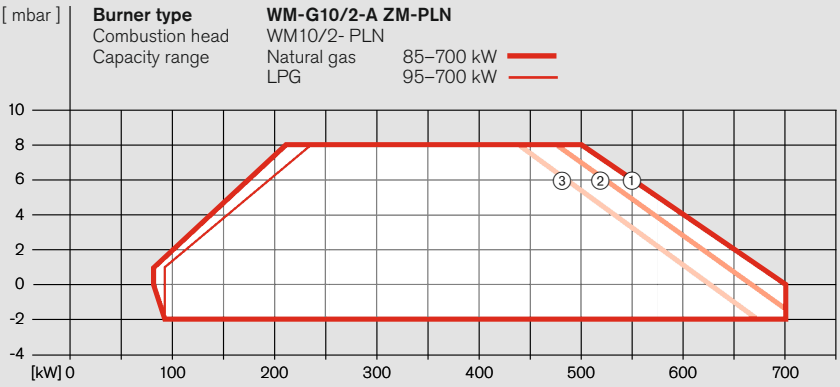
A graphical HMI is available as an option to provide a user-friendly overview of the boiler. The touchscreen display allows numerous functions to be adjusted and monitored, such as system parameters and setpoints of individual and multi-boiler plant and ancilliary equipment.

The controls specialists, Neuberger, who are a part of the Weishaupt Group, are able to design and implement complex control solutions.

Further optional components enable connections to be made to systems using commonplace industrial standards, such as Profibus-DP, LON-Bus, and Modbus RTU, and network protocols such as Profinet I/O, Modbus TCP, BacNet, etc.

A recent addition to Weishaupt's portfolio is the W-FM COM communications module. It transmits data securely over the internet so that it can be called up and displayed in a browser window on a computer, tablet, or smartphone, facilitating accurate service planning for example. Even away from the internet you can be kept up to date with the operation of the burner: In the event of a safety shutdown or other predefined trigger, an SMS text message is sent automatically.

Burner selection / gas valve train sizing
WM-G10, version ZM-PLN



WM-G10/2-A, version ZM-PLN

Burner rating [kW]	Low-pressure supply p_i Min. flow pressure before the gas ball valve Nominal valve train diameter ¾"	1"	1½"	2"	65	High-pressure supply p_o = 140 / 100 / 50 mbar Min. flow pressure before the FRS regulator Nominal valve train diameter ¾"	1"	1½"	p_r Setting pressure at the FRS regulator Nominal valve train diameter ¾"	1"	1½"	2"	65
Natural gas E LHV = 10.35 kWh/m³; d = 0.606													
300	33	–	–	–	–	36	25	21	11	–	–	–	–
350	42	21	–	–	–	43	27	22	14	8	–	–	–
400	52	25	–	–	–	50	30	24	18	9	–	–	–
450	64	30	16	–	–	59	33	25	22	10	8	–	–
500	78	36	19	–	–	69	37	28	26	12	10	–	–
550	93	43	22	15	–	81	42	31	32	15	13	9	–
600	110	50	26	17	15	94	47	34	39	18	15	10	10
700	149	66	33	22	19	122	59	41	53	25	21	14	13
Natural gas LL LHV = 8.83 kWh/m³; d = 0.641													
300	44	22	–	–	–	44	27	22	15	7	–	–	–
350	57	27	15	–	–	54	31	24	19	9	8	–	–
400	72	33	18	–	–	65	35	26	24	11	9	–	–
450	89	40	20	–	–	78	40	29	30	13	11	–	–
500	109	48	24	–	–	92	45	32	37	16	13	–	–
550	131	57	28	17	–	109	52	36	45	20	16	10	–
600	155	68	32	20	17	127	59	40	53	24	19	12	11
700	210	90	42	25	21	–	75	49	72	32	26	17	15
LPG* LHV = 25.89 kWh/m³; d = 1.555													
300	18	–					26	21	7	–			
350	22	–					28	22	8	–			
400	26	–					31	23	9	–			
450	31	–					35	24	11	–			
500	37	20					39	26	13	7			
550	44	23					44	28	16	9			
600	51	26					50	31	19	11			
700	68	34					63	37	26	14			

The LHV is referenced to 0 °C and 1013 mbar atmospheric pressure. All pressures are in mbar.
* The LPG charts are based on propane, but may also be used for butane.

Determining load point dependent on excess air
(See example on page 20)

	NO_x [mg/kWh] N. Gas	LPG	Setting* O_2	λ	P_F factor [1]
①	80	150	5 %	1.28	1.24
②	30	60	7 %	1.46	1.61
③	20	–	8 %	1.56	1.84

[1] The correction factor is based on the combustion chamber resistance (P_F) at 3 % O_2.
* Site-specific setting conditions may vary.

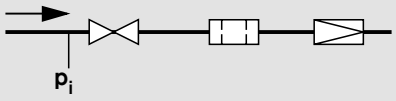
NO_x reference conditions:

Air temperature	= 20 °C
Air humidity	= 10 g/kg
LHV, natural gas E	= 10.35 kWh/m³
LHV, propane	= 25.89 kWh/m³

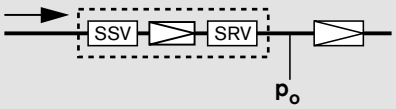
LHV referenced to 0 °C and 1013 mbar atmospheric

- Measurement at every load point
- No averaging
- No measurement uncertainty/tolerance
- Three-pass combustion chamber

Low-pressure supply

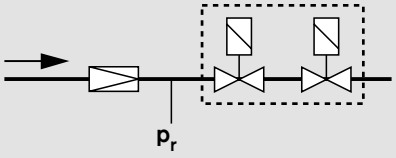


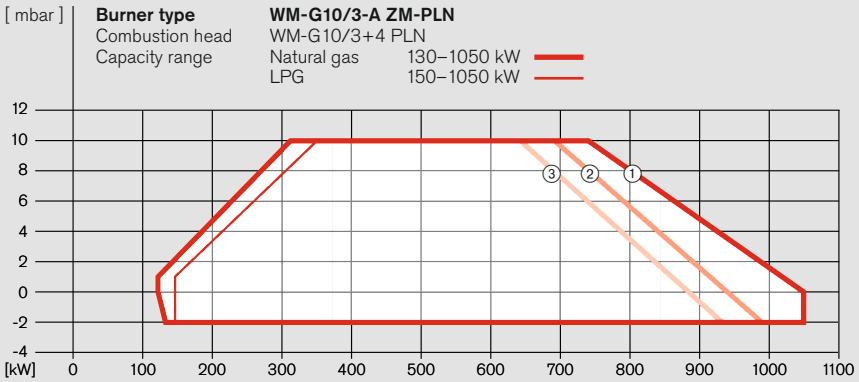
High-pressure supply



The high-pressure regulator should have a spring selected that enables the available outlet pressure (P_o = 140 / 100 / 50 mbar) to be adjusted.

Setting pressure at the FRS regulator





Capacity graphs for gas burners certified in accordance with EN 676.

Stated ratings are based on an air temperature of 20 °C and an installation at sea level. For installations at higher altitudes, a reduction in capacity of 1 % per 100 m above sea level should be taken into account.

Stated flow pressures are based on a combustion chamber resistance of 0 mbar. The combustion chamber pressure of the heat generator must be added to the figure determined from the above chart when sizing the gas valve train.

WM-G10/3-A, version ZM-PLN

Burner rating [kW]	Low-pressure supply p_i Min. flow pressure before the gas ball valve Nominal valve train diameter ¾"	1"	1 ½"	2"	65	80	High-pressure supply p_o = 140 / 100 / 50 mbar Min. flow pressure before the FRS regulator Nominal valve train diameter ¾"	1"	1 ½"	p_r Setting pressure at the FRS regulator Nominal valve train diameter ¾"	1"	1 ½"	2"	65	80
Natural gas E LHV = 10.35 kWh/m³; d = 0.606															
500	76	34	17	–	–	–	68	35	26	25	11	9	–	–	–
550	91	40	20	–	–	–	79	40	28	30	13	10	–	–	–
600	107	47	23	–	–	–	91	44	31	35	15	12	–	–	–
650	125	54	26	16	–	–	104	49	33	42	18	14	8	–	–
700	145	62	29	18	–	–	119	55	37	49	21	17	10	–	–
800	188	81	38	22	18	17	–	68	44	64	28	22	14	12	12
900	237	101	46	27	22	20	–	83	52	81	35	28	18	16	15
1000	291	123	56	32	26	24	–	98	61	100	43	34	22	19	18
1050	–	135	61	35	28	26	–	107	65	–	47	38	24	21	20
Natural gas LL LHV = 8.83 kWh/m³; d = 0.641															
500	107	46	21	–	–	–	90	43	29	34	14	11	–	–	–
550	128	55	25	–	–	–	106	49	33	42	17	13	–	–	–
600	152	64	29	17	–	–	123	56	36	50	20	16	9	–	–
650	178	75	33	19	–	–	–	63	40	59	24	18	11	–	–
700	206	86	39	22	17	16	–	72	45	68	28	22	13	11	10
800	268	112	50	27	22	20	–	90	55	90	37	29	17	15	14
900	–	141	61	33	26	24	–	110	65	–	47	37	22	19	18
1000	–	172	74	40	31	28	–	131	77	–	58	45	26	23	21
1050	–	189	81	43	33	30	–	–	83	–	63	50	29	25	23
LPG* LHV = 25.89 kWh/m³; d = 1.555															
500	36	–	–				39	25	22	13	–	–			
550	42	–	–				43	27	22	14	–	–			
600	48	–	–				48	29	23	16	–	–			
650	55	26	–				53	30	24	19	9	–			
700	64	30	17				59	33	26	22	10	9			
800	83	39	21				73	39	30	29	14	12			
900	104	48	25				89	46	34	37	18	15			
1000	127	58	30				107	54	38	46	22	19			
1050	139	63	33				116	57	40	50	25	21			

The LHV is referenced to 0 °C and 1013 mbar atmospheric pressure. All pressures are in mbar.
* The LPG charts are based on propane, but may also be used for butane.

For low-pressure supplies, EN 88-compliant regulators with safety diaphragms are used.

For high-pressure supplies, an EN 334-compliant high-pressure regulator should be selected from the following technical booklets:
- Regulators up to 4 bar, Print No. 83001202
- Regulators with safety devices, Print No. 83197902

Refer to the burner's rating plate for the maximum connection pressure.

Maximum Operating Pressure (MOP)
The supplier must safeguard the gas flow pressure such that it cannot exceed the MOP of the burner's gas valve train.

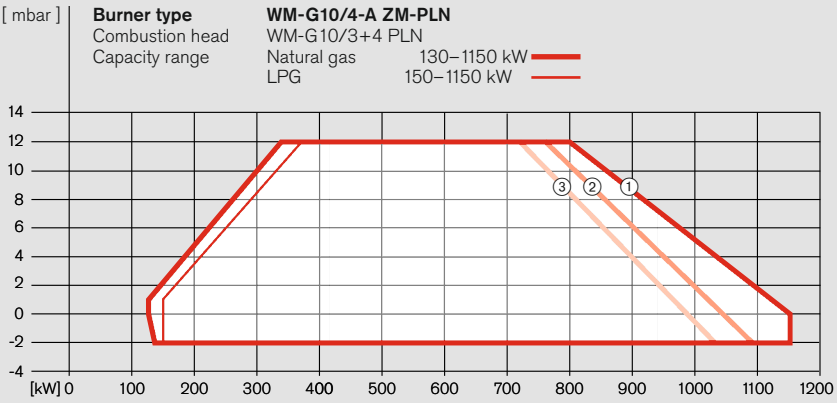
Rating of low-pressure gas valve trains (LP)
Normally, low-pressure valve trains are used for gas flow pressures up to a maximum of 300 mbar. This allows for pressure losses between the transfer station and the valve train. Furthermore, it is assumed that the transfer station utilises components (SSV, SRV, regulator) that are not of the highest class of accuracy. In individual cases, following consideration and approval by Weishaupt's headquarters, a gas flow pressure of up to 360 mbar can be approved if the appropriate conditions exist.

Rating of high-pressure gas valve trains (LP)
Normally, high-pressure valve trains are used for gas flow pressures above 300 mbar.

Double gas valve assemblies

Screwed	
R ¾	W-MF507
R 1	W-MF512
R 1½	W-MF512
R 2	DMV525/12
Flanged	
DN 65	DMV5065/12
DN 80	DMV5080/12
DN 100	DMV5100/12

Burner selection / gas valve train sizing
WM-G10, version ZM-PLN



WM-G10/4-A, version ZM-PLN

Burner rating [kW]	Low-pressure supply p_i Min. flow pressure before the gas ball valve Nominal valve train diameter 1"	1½"	2"	65	80	100	High-pressure supply p_o = 140 / 100 / 50 mbar Min. flow pressure before the FRS regulator Nominal valve train diameter 1"	1½"	p_r Setting pressure at the FRS regulator Nominal valve train diameter 1"	1½"	2"	65	80	100
Natural gas E LHV = 10.35 kWh/m³; d = 0.606														
500	34	17	–	–	–	–	35	26	11	9	–	–	–	–
550	40	20	–	–	–	–	40	28	13	10	–	–	–	–
600	47	23	–	–	–	–	44	31	15	12	–	–	–	–
650	54	26	16	–	–	–	49	34	18	14	9	–	–	–
700	62	29	18	–	–	–	55	37	21	17	10	–	–	–
800	81	38	23	19	17	16	68	44	28	22	14	12	12	12
900	101	47	28	23	21	20	83	53	36	29	18	16	15	15
1000	124	57	33	27	24	23	99	61	44	35	22	19	19	18
1100	148	67	38	31	28	27	116	71	52	42	26	23	22	21
Natural gas LL LHV = 8.83 kWh/m³; d = 0.641														
500	46	21	–	–	–	–	43	29	14	11	–	–	–	–
550	54	25	–	–	–	–	49	33	17	13	–	–	–	–
600	64	29	16	–	–	–	56	36	20	15	9	–	–	–
650	74	33	18	–	–	–	63	40	23	18	10	–	–	–
700	85	37	20	16	–	–	70	43	27	21	11	9	–	–
800	111	48	26	21	18	17	88	53	36	28	16	14	13	12
900	140	61	33	25	23	21	109	64	46	36	21	18	17	16
1000	172	74	39	30	27	25	131	76	57	45	26	22	21	20
1100	206	88	46	36	31	29	–	89	69	54	31	26	25	24
LPG* LHV = 25.89 kWh/m³; d = 1.555														
500	19	–					25	22	7	–				
550	21	–					27	22	7	–				
600	24	–					29	23	8	–				
650	27	15					31	24	9	8				
700	29	16					32	24	9	8				
800	37	20					38	28	13	11				
900	47	24					45	33	17	14				
1000	57	29					53	37	21	18				
1100	68	34					60	42	26	21				

The LHV is referenced to 0 °C and 1013 mbar atmospheric pressure. All pressures are in mbar.
* The LPG charts are based on propane, but may also be used for butane.

Determining load point dependent on excess air
(See example on page 20)

	NO_x [mg/kWh] N. Gas	LPG	Setting* O_2	λ	P_F factor [1]
①	80	150	5 %	1.28	1.24
②	30	60	7 %	1.46	1.61
③	20	–	8 %	1.56	1.84

[1] The correction factor is based on the combustion chamber resistance (P_F) at 3 % O_2.
* Site-specific setting conditions may vary.

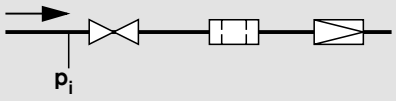
NO_x reference conditions:

Air temperature	= 20 °C
Air humidity	= 10 g/kg
LHV, natural gas E	= 10.35 kWh/m³
LHV, propane	= 25.89 kWh/m³

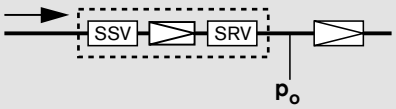
LHV referenced to 0 °C and 1013 mbar atmospheric

- Measurement at every load point
- No averaging
- No measurement uncertainty/tolerance
- Three-pass combustion chamber

Low-pressure supply

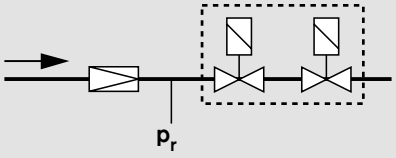


High-pressure supply

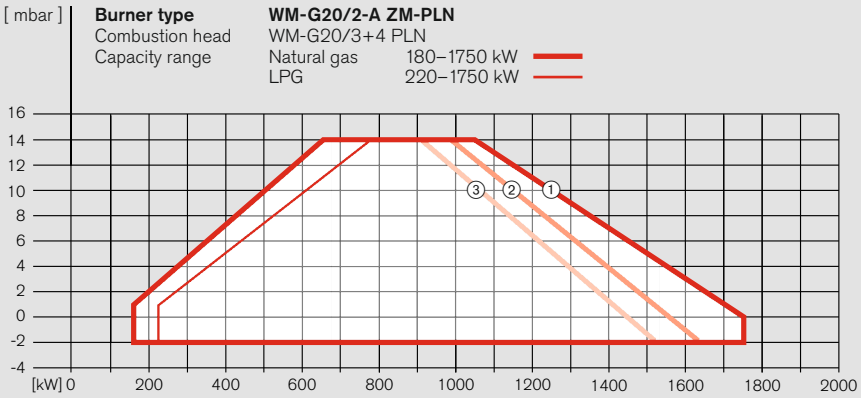


The high-pressure regulator should have a spring selected that enables the available outlet pressure (P_o = 140 / 100 / 50 mbar) to be adjusted.

Setting pressure at the FRS regulator



Burner selection / gas valve train sizing WM-G20, version ZM-PLN



Capacity graphs for gas burners certified in accordance with EN 676.

Stated ratings are based on an air temperature of 20 °C and an installation at sea level. For installations at higher altitudes, a reduction in capacity of 1 % per 100 m above sea level should be taken into account.

Stated flow pressures are based on a combustion chamber resistance of 0 mbar. The combustion chamber pressure of the heat generator must be added to the figure determined from the above chart when sizing the gas valve train.

WM-G20/2-A, version ZM-PLN

Burner rating [kW]	Low-pressure supply p_i Min. flow pressure before the gas ball valve — Nominal valve train diameter 1"	1 1/2"	2"	65	80	100	High-pressure supply p_o = 140 / 100 / 50 mbar Min. flow pressure before the FRS regulator — Nominal valve train diameter 1"	1 1/2"	2"	p_r Setting pressure at the FRS regulator — Nominal valve train diameter 1"	1 1/2"	2"	65	80	100
Natural gas E LHV = 10.35 kWh/m³; d = 0.606															
800	71	28	–	–	–	–	59	35	18	18	12	–	–	–	–
900	89	35	–	–	–	–	71	40	19	23	16	–	–	–	–
1000	109	42	–	–	–	–	84	47	21	29	20	–	–	–	–
1100	131	50	21	–	–	–	99	54	22	35	25	9	–	–	–
1200	156	59	25	–	–	–	115	61	24	42	30	11	–	–	–
1300	182	68	28	18	–	–	133	69	25	50	35	13	9	–	–
1400	210	79	32	20	15	–	–	78	27	58	41	15	10	9	–
1500	241	89	36	22	17	–	–	88	29	66	47	17	12	10	–
1600	273	101	40	24	18	15	–	97	31	75	53	20	13	11	9
1750	–	119	46	28	21	17	–	113	33	–	63	23	15	13	11
Natural gas LL LHV = 8.83 kWh/m³; d = 0.641															
800	101	39	–	–	–	–	79	44	20	27	19	–	–	–	–
900	128	49	21	–	–	–	97	52	22	34	24	9	–	–	–
1000	157	59	25	–	–	–	116	62	24	43	30	11	–	–	–
1100	189	71	29	18	–	–	138	72	26	52	36	14	9	–	–
1200	224	84	34	21	16	–	–	83	28	61	43	16	11	9	–
1300	262	97	39	24	18	15	–	94	30	72	51	19	13	11	9
1400	–	112	44	27	20	17	–	107	33	–	59	22	14	12	11
1500	–	128	50	30	22	18	–	120	35	–	67	25	16	14	12
1600	–	144	56	33	24	20	–	135	38	–	76	28	18	15	13
1750	–	170	64	38	28	22	–	–	42	–	91	33	21	18	15
LPG* LHV = 25.89 kWh/m³; d = 1.555															
800	33	–	–				33	24	17	8	–	–			
900	40	–	–				39	26	18	11	–	–			
1000	49	22	–				45	30	19	14	10	–			
1100	59	26	–				52	33	20	17	13	–			
1200	69	30	–				59	37	21	20	15	–			
1300	81	34	18				66	40	22	24	18	9			
1400	93	39	20				75	44	23	27	21	10			
1500	106	44	22				83	49	25	31	23	12			
1600	120	49	24				93	53	26	36	27	13			
1750	142	57	27				108	61	28	42	31	15			

The LHV is referenced to 0 °C and 1013 mbar atmospheric pressure. All pressures are in mbar.
* The LPG charts are based on propane, but may also be used for butane.

For low-pressure supplies, EN 88-compliant regulators with safety diaphragms are used.

For high-pressure supplies, an EN 334-compliant high-pressure regulator should be selected from the following technical booklets:
- Regulators up to 4 bar, Print No. 83001202
- Regulators with safety devices, Print No. 83197902

Refer to the burner's rating plate for the maximum connection pressure.

Maximum Operating Pressure (MOP)
The supplier must safeguard the gas flow pressure such that it cannot exceed the MOP of the burner's gas valve train.

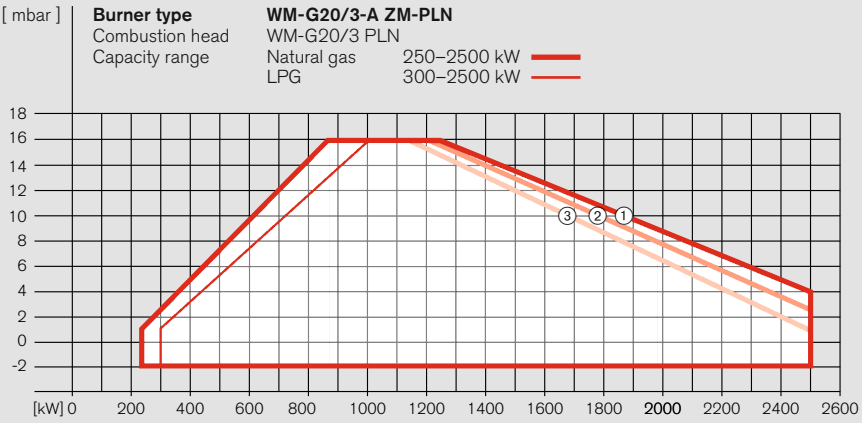
Rating of low-pressure gas valve trains (LP)
Normally, low-pressure valve trains are used for gas flow pressures up to a maximum of 300 mbar. This allows for pressure losses between the transfer station and the valve train. Furthermore, it is assumed that the transfer station utilises components (SSV, SRV, regulator) that are not of the highest class of accuracy. In individual cases, following consideration and approval by Weishaupt's headquarters, a gas flow pressure of up to 360 mbar can be approved if the appropriate conditions exist.

Rating of high-pressure gas valve trains (LP)
Normally, high-pressure valve trains are used for gas flow pressures above 300 mbar.

Double gas valve assemblies

Screwed	
R ¾	W-MF507
R 1	W-MF512
R 1 ½	W-MF512
R 2	DMV525/12
Flanged	
DN 65	DMV5065/12
DN 80	DMV5080/12
DN 100	DMV5100/12

Burner selection / gas valve train sizing WM-G20, version ZM-PLN



WM-G20/3-A, version ZM-PLN

Burner rating [kW]	Low-pressure supply p_i Min. flow pressure before the gas ball valve Nominal valve train diameter 1"	1½"	2"	65	80	100	High-pressure supply p_o = 140 / 100 / 50 mbar Min. flow pressure before the FRS regulator Nominal valve train diameter 1"	1½"	2"	p_r Setting pressure at the FRS regulator Nominal valve train diameter 1"	1½"	2"	65	80	100
Natural gas E LHV = 10.35 kWh/m³; d = 0.606															
1050	120	46	20	–	–	–	92	50	22	32	23	9	–	–	–
1200	156	59	25	–	–	–	115	61	24	42	30	11	–	–	–
1350	196	73	30	19	–	–	–	74	26	53	38	14	9	–	–
1500	240	89	36	22	17	–	–	87	29	66	46	17	11	9	–
1700	–	113	44	27	20	16	–	108	32	–	59	22	14	12	10
1900	–	140	54	32	24	19	–	131	37	–	74	27	18	15	13
2100	–	170	65	38	28	22	–	–	42	–	90	33	22	18	16
2300	–	203	77	45	33	26	–	–	47	–	108	40	26	22	19
2500	–	239	90	52	38	30	–	–	53	–	128	47	31	26	22
Natural gas LL LHV = 8.83 kWh/m³; d = 0.641															
1050	173	65	27	18	–	–	127	67	25	47	34	13	9	–	–
1200	225	84	34	21	17	–	–	83	28	62	44	17	11	9	–
1350	283	105	42	26	20	16	–	101	32	78	55	21	14	12	10
1500	–	128	51	31	23	19	–	121	36	–	68	26	17	15	13
1700	–	164	64	38	28	23	–	–	42	–	87	33	22	19	16
1900	–	203	78	46	34	27	–	–	48	–	109	41	27	23	20
2100	–	247	94	56	41	32	–	–	56	–	133	50	33	28	25
2300	–	–	112	66	48	38	–	–	64	–	–	60	40	34	30
2500	–	–	132	77	56	44	–	–	73	–	–	71	47	40	35
LPG* LHV = 25.89 kWh/m³; d = 1.555															
1050	53	23	–	–			48	31	19	15	11	–	–		
1200	68	29	–	–			58	35	20	19	14	–	–		
1350	85	35	–	–			69	41	21	24	18	–	–		
1500	104	42	20	–			82	47	23	29	21	10	–		
1700	132	52	24	17			100	56	25	38	27	12	9		
1900	163	64	29	20			122	66	27	47	34	15	11		
2100	198	77	34	23			–	77	30	57	41	18	13		
2300	237	91	39	26			–	90	33	68	49	21	16		
2500	279	107	45	30			–	103	36	80	58	25	18		

The LHV is referenced to 0 °C and 1013 mbar atmospheric pressure. All pressures are in mbar.
* The LPG charts are based on propane, but may also be used for butane.

Determining load point dependent on excess air
(See example on page 20)

	NO_x [mg/kWh] N. Gas	LPG	Setting* O_2	λ	P_F factor [1]
①	80	150	5 %	1.28	1.24
②	30	60	7 %	1.46	1.61
③	20	–	8 %	1.56	1.84

[1] The correction factor is based on the combustion chamber resistance (P_F) at 3 % O_2.
* Site-specific setting conditions may vary.

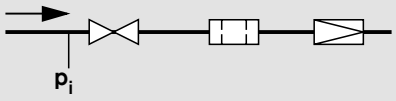
NO_x reference conditions:

Air temperature	= 20 °C
Air humidity	= 10 g/kg
LHV, natural gas E	= 10.35 kWh/m³
LHV, propane	= 25.89 kWh/m³

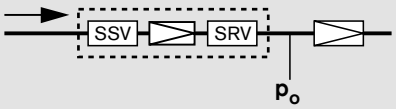
LHV referenced to 0 °C and 1013 mbar atmospheric

- Measurement at every load point
- No averaging
- No measurement uncertainty/tolerance
- Three-pass combustion chamber

Low-pressure supply

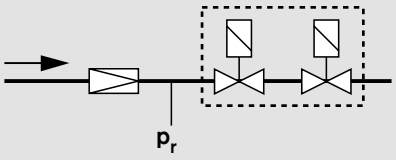


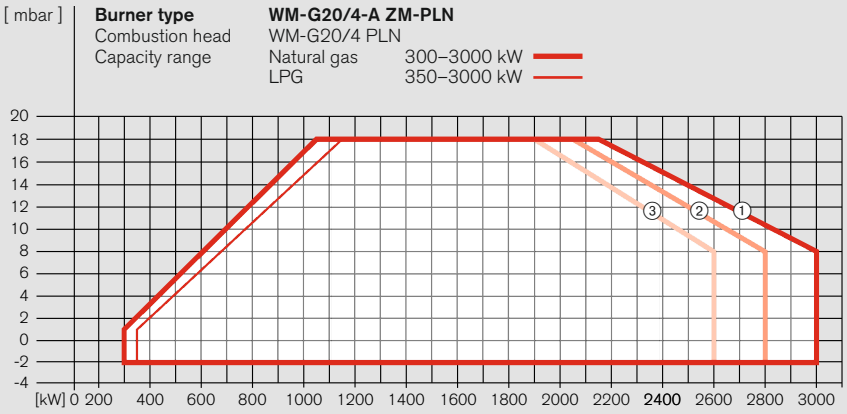
High-pressure supply



The high-pressure regulator should have a spring selected that enables the available outlet pressure (P_o = 140 / 100 / 50 mbar) to be adjusted.

Setting pressure at the FRS regulator





WM-G20/4-A, version ZM-PLN

Burner rating [kW]	Low-pressure supply p_i Min. flow pressure before the gas ball valve – Nominal valve train diameter 1"	1 1/2"	2"	65	80	100	125	High-pressure supply p_o = 140 / 100 / 50 mbar Min. flow pressure before the FRS regulator – Nominal valve train diameter 1"	1 1/2"	2"	p_r Setting pressure at the FRS regulator – Nominal valve train diameter 1"	1 1/2"	2"	65	80	100	125
Natural gas E LHV = 10.35 kWh/m³; d = 0.606																	
1250	169	64	26	17	–	–	–	124	65	25	46	32	12	8	–	–	–
1450	225	84	34	21	16	–	–	–	83	28	62	44	16	11	9	–	–
1650	290	107	42	26	19	16	–	–	103	32	80	56	21	14	12	10	–
1850	–	133	52	31	23	19	17	–	125	36	–	71	26	17	15	13	12
2050	–	163	63	37	27	22	20	–	–	41	–	87	32	21	18	15	15
2250	–	195	74	44	32	25	23	–	–	46	–	104	39	25	21	18	18
2500	–	239	91	53	38	30	28	–	–	53	–	128	48	31	26	22	22
2750	–	–	108	63	45	35	32	–	–	61	–	–	57	37	31	27	26
3000	–	–	128	74	52	41	37	–	–	70	–	–	68	44	37	32	31
Natural gas LL LHV = 8.83 kWh/m³; d = 0.641																	
1250	243	90	36	22	17	–	–	–	78	29	66	47	17	11	9	–	–
1450	–	119	47	28	21	17	16	–	103	34	–	63	23	15	13	11	11
1650	–	153	59	35	26	21	19	–	132	39	–	81	30	19	16	14	14
1850	–	191	73	43	31	25	23	–	–	45	–	102	38	24	20	18	17
2050	–	233	88	51	37	29	26	–	–	52	–	125	46	30	25	21	20
2250	–	–	105	60	43	34	31	–	–	59	–	–	55	35	29	25	24
2500	–	–	128	73	52	40	36	–	–	69	–	–	67	43	36	31	30
2750	–	–	153	87	61	47	43	–	–	80	–	–	81	52	43	37	35
3000	–	–	181	102	71	55	50	–	–	92	–	–	96	61	51	44	42
LPG* LHV = 25.89 kWh/m³; d = 1.555																	
1250	73	30	–	–	–			60	36	–	20	14	–	–	–		
1450	96	38	–	–	–			76	43	–	26	19	–	–	–		
1650	123	48	21	–	–			94	52	23	34	24	10	–	–		
1850	153	59	25	17	–			114	61	25	43	30	12	9	–		
2050	187	71	30	20	16			137	72	27	52	37	15	10	9		
2250	–	85	35	23	18			–	84	30	63	45	18	13	11		
2500	–	104	43	27	21			–	100	33	78	55	22	15	13		
2750	–	125	51	32	25			–	118	37	94	67	27	19	16		
3000	–	147	60	37	29			–	138	42	112	80	32	22	19		

The LHV is referenced to 0 °C and 1013 mbar atmospheric pressure. All pressures are in mbar.
* The LPG charts are based on propane, but may also be used for butane.

Capacity graphs for gas burners certified in accordance with EN 676.

Stated ratings are based on an air temperature of 20 °C and an installation at sea level. For installations at higher altitudes, a reduction in capacity of 1 % per 100 m above sea level should be taken into account.

Stated flow pressures are based on a combustion chamber resistance of 0 mbar. The combustion chamber pressure of the heat generator must be added to the figure determined from the above chart when sizing the gas valve train.

For low-pressure supplies, EN 88-compliant regulators with safety diaphragms are used.

For high-pressure supplies, an EN 334-compliant high-pressure regulator should be selected from the following technical booklets:
- Regulators up to 4 bar, Print No. 83001202
- Regulators with safety devices, Print No. 83197902

Refer to the burner's rating plate for the maximum connection pressure.

Maximum Operating Pressure (MOP)
The supplier must safeguard the gas flow pressure such that it cannot exceed the MOP of the burner's gas valve train.

Rating of low-pressure gas valve trains (LP)
Normally, low-pressure valve trains are used for gas flow pressures up to a maximum of 300 mbar. This allows for pressure losses between the transfer station and the valve train. Furthermore, it is assumed that the transfer station utilises components (SSV, SRV, regulator) that are not of the highest class of accuracy. In individual cases, following consideration and approval by Weishaupt's headquarters, a gas flow pressure of up to 360 mbar can be approved if the appropriate conditions exist.

Rating of high-pressure gas valve trains (LP)
Normally, high-pressure valve trains are used for gas flow pressures above 300 mbar.

Double gas valve assemblies

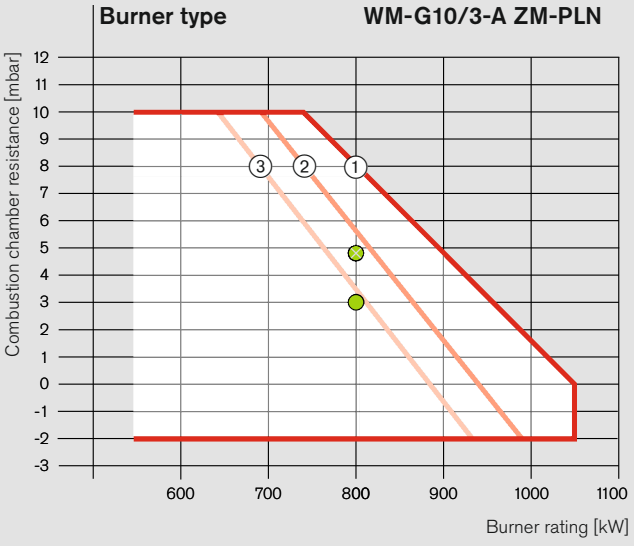
Screwed	
R 1	W-MF512
R 1½	W-MF512
R 2	DMV525/12
Flanged	
DN 65	DMV5065/12
DN 80	DMV5080/12
DN 100	DMV5100/12
DN 125	VGD40.125

Example calculation

Determining load point with regard to the required level of NO_x emissions

Example:

Burner firing rate	800 kW
Combustion chamber resistance:	
● Per manufacturer, with 3 % O_2	3.0 mbar
⊗ For 30 mg/kWh, with 7 % O_2 (3 mbar • 1.61)	4.8 mbar
Installation altitude	0 m asl



Determining load point dependent on excess air

	NO_x [mg/kWh] N. Gas	NO_x [mg/kWh] LPG	Setting* O_2	Setting* λ	P_F factor [1]
①	80	150	5 %	1.28	1.24
②	30	60	7 %	1.46	1.61
③	20	–	8 %	1.56	1.84

[1] The correction factor is based on the combustion chamber resistance (P_F) at 3 % O_2.
* Site-specific stting conditions may vary.

NO_x reference conditions:

Air temperature	= 20 °C
Air humidity	= 10 g/kg
LHV, natural gas E	= 10.35 kWh/m^3
LHV, propane	= 25.89 kWh/m^3

LHV referenced to 0 °C and 1013 mbar atmospheric

- Measurement at every load point
- No averaging
- No measurement uncertainty/tolerance
- Three-pass combustion chamber

Note:
Boiler room ventilation must be increased appropriately to take account of the additional air required for low-NO_x combustion.

Scope of delivery

Scope of delivery

Description		WM-G10 ZM-PLN	WM-G20 ZM-PLN
Burner housing, hinged flange, housing cover, Weishaupt burner motor, air inlet housing, fan wheel, combustion head, ignition unit, ignition cable, ignition electrodes, combustion manager with control unit, flame sensor, actuators, flange gasket, limit switch on hinged flange, fixing screws, air filter with sleeve		●	●
Digital combustion manager	W-FM 50	●	●
	W-FM 54 / 100 / /200	○	○
Valve proving via the combustion manager		●	●
Class-A double gas valve assembly		●	●
Gas butterfly valve		●	●
Air pressure switch		●	●
Low gas pressure switch		●	●
Preset, capacity-based mixing assembly		●	●
Actuators for compound regulation of fuel and air via W-FM:			
Air damper actuator		●	●
Gas butterfly valve actuator		●	●
DOL motor contactor fitted to motor [1)]		●	●
IP 54 protection		●	●

EN 676 stipulates that ball valves, gas filters, and gas pressure regulators form part of the burner supply (see Weishaupt accessories list). Please enquire or see the special equipment section of this brochure for further burner executions.

● Standard
○ Optional

Order Numbers

WM-G10 gas burners, version ZM-PLN

Burner type	Version	Valve train size	Order No.
WM-G10/2-A	ZM-PLN	R ¾	217 124 10
		R 1	217 124 11
		R 1½	217 124 12
		R 2	217 124 13
		DN 65	217 221 14
WM-G10/3-A	ZM-PLN	R ¾	217 125 10
		R 1	217 125 11
		R 1½	217 125 12
		DN 65	217 125 13
		DN 80	217 125 14
WM-G10/4-A	ZM-PLN *	R 1	217 126 11
		R 1½	217 126 12
		R 2	217 126 13
		DN 65	217 126 14
		DN 80	217 126 15
		DN 100	217 126 16

CE-PIN: CE 0085BQ0027

* Equipped with VSD as standard

WM-G20 gas burners, version ZM-PLN

Burner type	Version	Valve train size	Order No.
WM-G20/2-A	ZM-PLN	R 1	217 221 11
		R 1½	217 221 12
		R 2	217 221 13
		DN 65	217 221 14
		DN 80	217 221 15
		DN 100	217 221 16
		DN 125	217 221 17
WM-G20/3-A	ZM-PLN	R 1	217 222 11
		R 1½	217 222 12
		R 2	217 222 13
		DN 65	217 222 14
		DN 80	217 222 15
		DN 100	217 222 16
		DN 125	217 222 17
WM-G20/4-A	ZM-PLN *	R 1	217 223 11
		R 1½	217 223 12
		R 2	217 223 13
		DN 65	217 223 14
		DN 80	217 223 15
		DN 100	217 223 16
		DN 125	217 223 17

CE-PIN: CE 0085BQ0027

Special equipment
WM-G10 and WM-G20, version ZM-PLN

Version ZM-PLN		WM-G10 ZM-PLN	WM-G20 ZM-PLN
High gas pressure switch [1] (Screwed W-MF / DMV for low-pressure supplies)	GW 50 A6/1 GW 150 A6/1 GW 500 A6/1	250 033 30 250 033 31 250 033 32	250 033 30 250 033 31 250 033 32
High gas pressure switch [1] (Flanged DMV / VGD for low-pressure supplies)	GW 50 A6/1 GW 150 A6/1 GW 500 A6/1	150 017 49 150 017 50 150 017 51	150 017 49 150 017 50 150 017 51
ST 18/7 and ST 18/4 plug connections (W-FM 50 / 100 / 200)		250 030 22	250 030 22
ST 18/7 plug connection (W-FM 50 with KS20)		250 031 06	250 031 06
Burner-mounted KS20 controller (W-FM 50) [1]		250 033 15	250 033 15
W-FM 100 in lieu of W-FM 50 [1]	burner-mounted	250 030 74	250 030 74
	loose	250 031 45	250 031 43
Integral load controller & analogue signal convertor for W-FM 100		110 017 18	110 017 18
W-FM 200 in lieu of W-FM 50 with integral load controller, analogue signal convertor, and VSD module, with optional fuel metering	burner-mounted	250 030 75	250 030 75
	loose	250 030 48	250 030 48
VSD with integral frequency convertor (W-FM 50 / 200 required) [2] incl. inductive proximity switch and LGW 10 in lieu of LGW 50		210 030 11	210 030 40
VSD with separate frequency convertor (W-FM 200 required) (See accessories list for frequency convertor)		210 030 12	210 030 41
WM-D90 motor with 230 V contactor and overload protection [3]		250 030 86	–
WM-D112 motor with 230 V contactor and overload protection [3]		–	250 030 95
ABE with Chinese-character display, loose (W-FM 100 / 200)		110 018 53	110 018 53
Special voltage (on application only)		250 031 02	250 031 02
110 V control voltage		250 031 72	250 031 72
High-temperature ceramic insulator (up to 1200 °C)		250 035 78	250 035 55
Spacer ring with gasket (72 mm)		250 035 13	250 035 14
Spacer ring with gasket (168 mm)		–	Please enquire

Accessories		
Installation aid	250 104 000 22	–
Installation aid case set for WM 20	–	250 204 000 62
Installation aid case set for WM 10 and WM 20	250 204 000 92	250 204 000 92

Country-specific executions and special voltages on application

[1] Required for PED (2014/68/EU) compliance.

[2] Standard on WM-G10/4 ZM-PLN and WM-G20/4 ZM-PLN.

[3] The necessary motor protection can be provided either by a motor protection switch (supplied and fitted into a panel by others), or with integral motor overload protection (see special equipment).

Technical data

Gas burners		WM-G10/2-A ZM-PLN	WM-G10/3-A ZM-PLN	WM-G10/4-A ZM-PLN
Burner motor	Weishaupt type	WM-D 90/90-2/1K0	WM-D 90/110-2/1K5	WM-D 90/110-2/1K9
Motor power output	kW	0.9	1.5	1.9
Nominal current	A	2.2	3.2	3.7
Nominal frequency	Hz	50	50	50
Motor protection switch or overload protection with motor prefusing [1]	type (e.g.) A minimum	PKE12/XTU - 4 10 A gG / T (by others)	PKE12/XTU - 4 16 A gG / T (by others)	PKE12/XTU - 4 16 A gG / T (by others)
Speed	rpm	2900 at 50 Hz	2900 at 50 Hz	3120 at 55 Hz (with FC)
Combustion manager Prefusing	type A	W-FM 50 / 100 16 A B	W-FM 50 / 100 16 A B	W-FM 50 / 100 16 A B
Flame monitoring	type	ION	ION	ION
Air damper / gas actuator	type	STE 50 / SQM 45	STE 50 / SQM 45	STE 50 / SQM 45
NOx Class per EN 676	ZM-PLN	3	3	3
Mass (excl. double gas valve and fittings)	kg	approx. 74	approx. 75	approx. 75

Gas burners		WM-G20/2-A ZM-PLN	WM-G20/3-A ZM-PLN	WM-G20/4-A ZM-PLN
Burner motor	type Weishaupt	WM-D 112/140-2/3K0	WM-D 112/170-2/4K5	WM-D 112/170-2/7K0
Motor power output	kW	3.0	4.5	7.0
Nominal current	A	6.5	9.2	15.0
Nominal frequency	Hz	50	50	50
Motor protection switch or overload protection with motor prefusing [1]	type (e.g.) A minimum	PKE12/XTU-12 25 A gG/T (by others)	PKE12/XTU-12 35 A gG/T (by others)	PKE32/XTU-32 25 A gG/T (by others)
Speed	rpm	2950 at 50 Hz	2930 at 50 Hz	3520 at 60 Hz (with FC)
Combustion manager Prefusing	type A	W-FM 50 16 AB	W-FM 50 16 AB	W-FM 50 16 AB
Flame monitoring	type	ION	ION	ION
Air damper / gas actuator	type	STE 50/SQM45	STE 50/SQM45	STE 50/SQM45
NOx Class per EN 676	ZM-PLN	3	3	3
Mass (excl. double gas valve and fittings)	kg	approx. 95	approx. 100	approx. 110

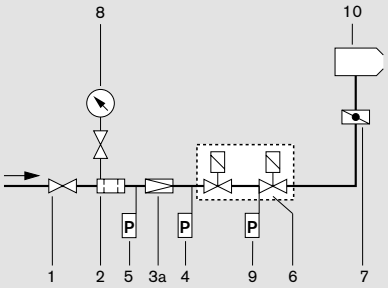
[1] The necessary motor protection can be provided either by a motor protection switch (supplied and fitted into a panel by others) or with integral motor overload protection (see special equipment).

Voltages and frequencies:
The burners are equipped as standard for three-phase alternating current, 400 V, 3 ~, 50 Hz. Other voltages and frequencies are available on application.

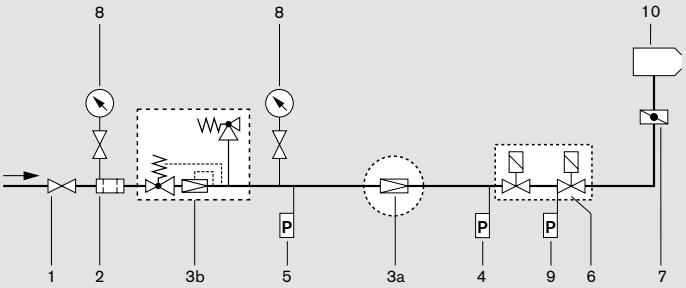
Standard burner motor:
Insulation Class F, IP 55 protection.
IE3 Premium Efficiency.

Fuel systems

Low-pressure gas supply (LP)



High-pressure gas supply (HP)



Layout of the valve train
On boilers with hinged doors, the valve train must be mounted on the opposite side to the boiler-door hinges.

Compensator
To enable a tension free mounting of the valve train, the fitting of a compensator is strongly recommended.

Break points in the valve train
Break points in the valve train should be provided to enable the door of the heat generator to be swung open. The main gas line is best separated at the compensator.

Support of the valve train
The valve train should be properly supported in accordance with the site conditions. Please refer to the Weishaupt accessories list for various valve train support components.

Gas meter
A gas meter must be installed to measure gas consumption during commissioning and servicing.

Optional thermal shutoff (when required by local regulations)
Integrated into the ball valve of screwed valve trains. A separate component with HTB seals fitted before the ball valve on flanged valve trains.

Use of high-pressure regulators
A high-pressure regulator should be selected from the following technical booklets:
- Regulators up to 4 bar, Print No. 83001202
- Regulators with safety devices, Print No. 83197902

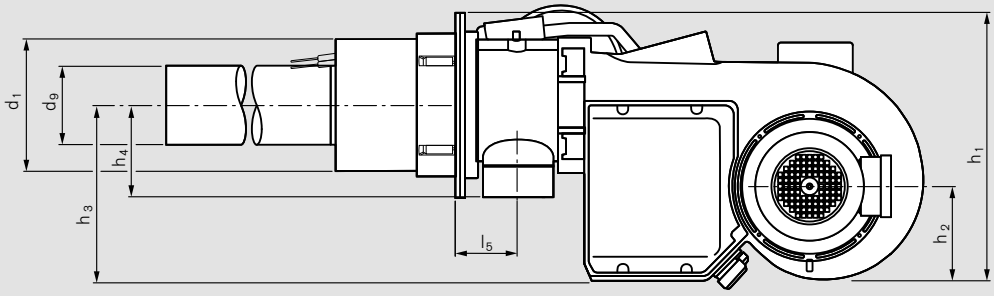
For PLN burners, the high-pressure regulator selected (3b) is used as a pressure reducing station with safety functions. The high-pressure regulator should be set for the maximum outlet pressure calculated, while the load-specific regulated pressure is set on the low-pressure regulator (3a).

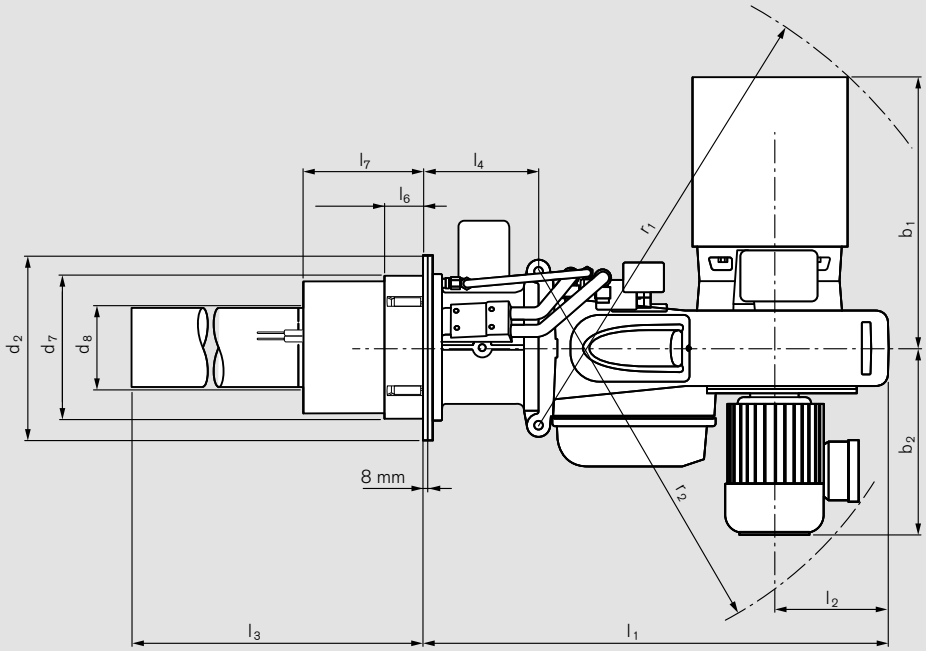
1 Ball valve *
2 Gas filter *
3a Pressure regulator (LP) *
3b Pressure regulator (HP) *
4 High gas pressure switch *
5 Low gas pressure switch
6 Double gas valve assembly
7 Gas butterfly valve
8 Pressure gauge with push-button valve *
9 Valve-proving pressure switch
10 Burner

* Not included in burner price

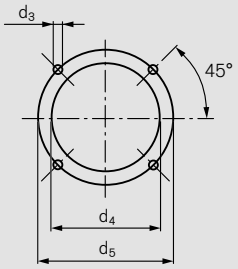
Dimensions

WM-G10 gas burners, version ZM-PLN





Mounting-plate drilling dimensions

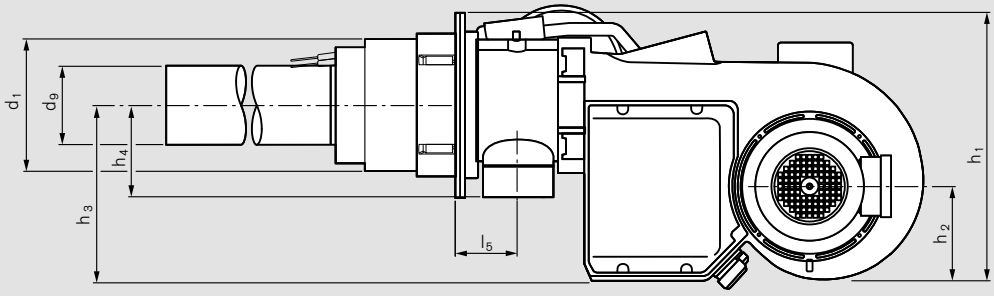


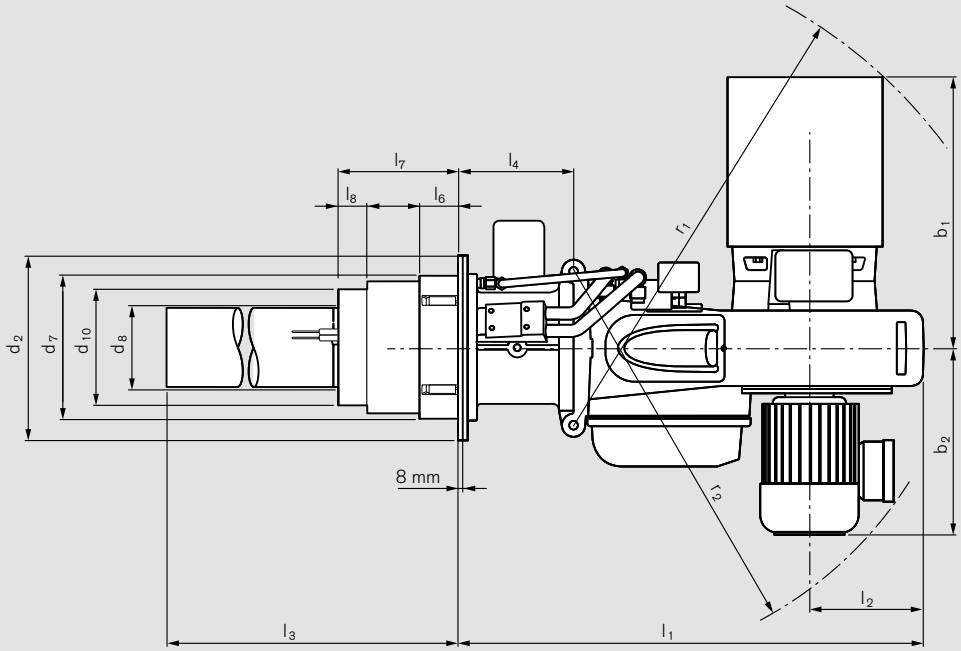
WM-G10 ZM-PLN

Burner type	Dimensions in mm l_1	l_2	l_3	l_4	l_5	l_6	l_7	b_1	b_2	h_1	h_2	h_3	h_4
WM-G10/2-A ZM-PLN	833	205	834	208	108	68	213	481	307*	478	167	313	162
WM-G10/3-A ZM-PLN	833	205	1198	208	108	68	213	481	335*	478	167	313	162
WM-G10/4-A ZM-PLN	833	205	1198	208	108	68	213	481	346	478	167	313	162
	r_1	r_2	d_1	d_2	d_3	d_4	d_5	d_6	d_7	d_8	d_9		
WM-G10/2-A ZM-PLN	826	682	234	330	M12	260	298	255	253	147	145		
WM-G10/3-A ZM-PLN	826	698	234	330	M12	260	298	255	253	147	145		
WM-G10/4-A ZM-PLN	826	698	234	330	M12	260	298	255	253	147	145		

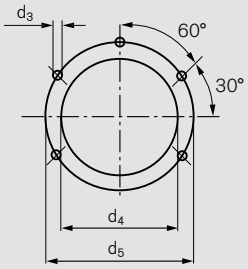
* Projection of frequency convertor approx. 20 mm

WM-G20 gas burners, version ZM-PLN





Mounting-plate drilling dimensions



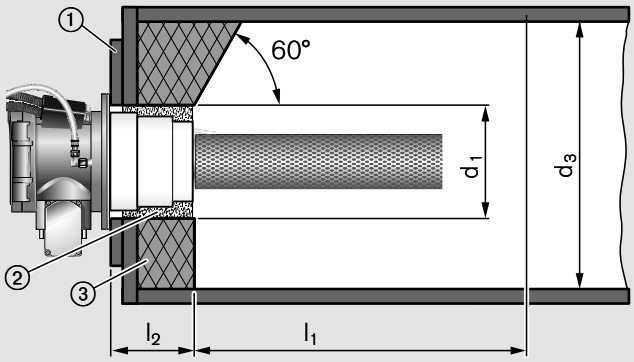
WM-G20 ZM-PLN

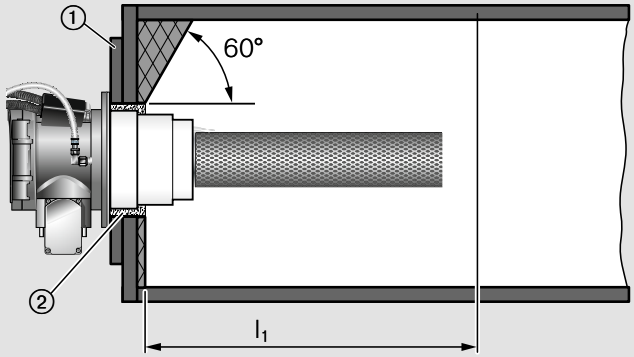
Burner type	Dimensions in mm l_1	l_2	l_3	l_4	l_5	l_6	l_7	l_8	b_1	b_2	h_1	h_2	h_3	h_4
WM-G20/2-A ZM-PLN	1010	254	1023	238	128	78	213	55	545	424*	625	217	400	226
WM-G20/3-A ZM-PLN	1010	254	1423	238	128	78	213	55	545	464*	625	217	400	226
WM-G20/4-A ZM-PLN	1010	254	1623	238	128	78	213	55	545	521	625	217	400	226
	r_1	r_2	d_1	d_2	d_3	d_4	d_5	d_6	d_7	d_8	d_9	d_{10}		
WM-G20/2-A ZM-PLN	1040	869	335	450	M12	370	400	365	360	251	248	315		
WM-G20/3-A ZM-PLN	1040	883	335	450	M12	370	400	365	360	251	248	315		
WM-G20/4-A ZM-PLN	1040	951	335	450	M12	370	400	365	360	251	248	315		

* Projection of frequency convertor approx. 20 mm

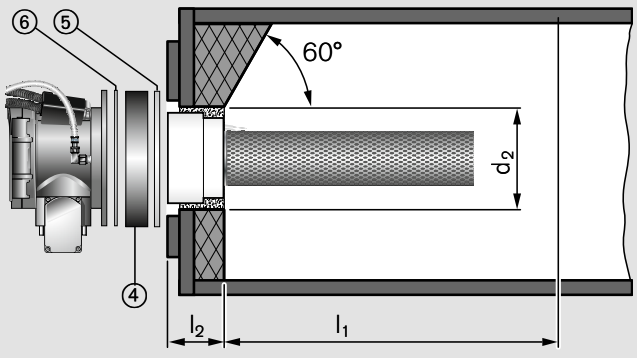
Minimum combustion chamber sizes

Heat generator without spacer ring





Heat generator with spacer ring



Dimensions

WM-G10 ZM-PLN

d_1	Minimum boiler aperture without spacer ring	260 mm
d_2	Minimum boiler aperture with spacer ring	244 mm
d_3	Minimum combustion chamber diameter	350 mm
l_1	Minimum combustion chamber length	
	WM 10/2	840 mm
	WM 10/3	1200 mm
	WM 10/4	1200 mm
l_2	Maximum boiler door depth, including refractory / insulation,	
	without spacer ring	220 mm
	with spacer ring and gasket	145 mm

WM-G20 ZM-PLN

d_1	Minimum boiler aperture without spacer ring	370 mm
d_2	Minimum boiler aperture with 72 mm spacer ring	345 mm
	Minimum boiler aperture with 168 mm spacer ring	320 mm
d_3	Minimum combustion chamber diameter	450 mm
l_1	Minimum combustion chamber length	
	WM 20/2	1230 mm
	WM 20/3	1630 mm
	WM 20/4	1830 mm
l_2	Maximum boiler door depth, including refractory / insulation,	
	without spacer ring	220 mm
	with 72 mm spacer ring and gasket	145 mm
	with 168 mm spacer ring and gasket	55 mm

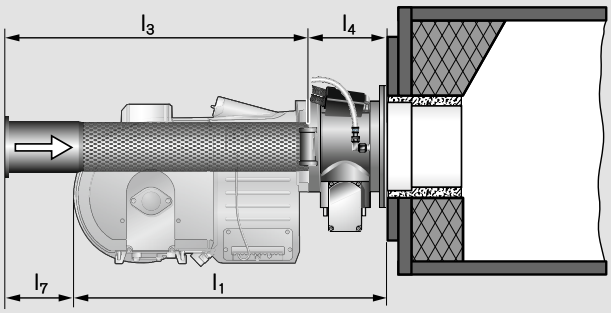
Legend

① Mounting plate
(WM-G20 ZM-PLN: Depth ≥ 8 mm for installations with spacer ring)
② Aperture
③ Refractory / insulation
④ 74 mm spacer ring with gasket, WM-G10 ZM-PLN
72 mm spacer ring with gasket, WM-G20 ZM-PLN
168 mm spacer ring with gasket, WM-G20 ZM-PLN
(Optional for boilers with narrow burner apertures)
⑤ 8 mm flange gasket
⑥ Gasket

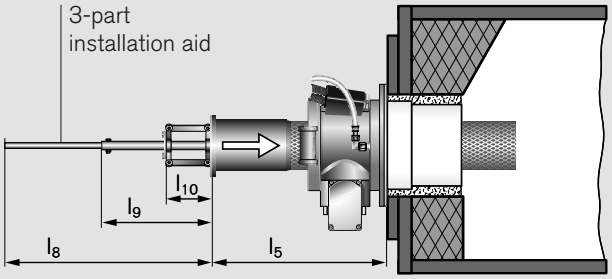
Note:
The boiler door refractory / insulation may be tapered (≥ 60°).

Dimensions for inserting and withdrawing the burner tube

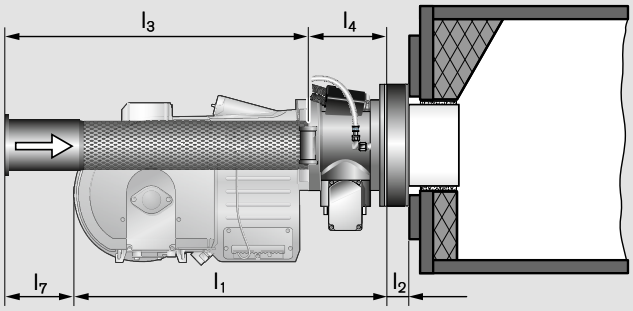
WM-G ZM-PLN without spacer ring



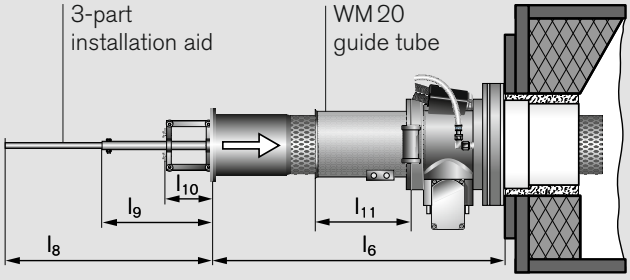
Installation aid – minimum clearance without spacer ring



WM-G ZM-PLN with spacer ring



Installation aid – minimum clearance with spacer ring



Burner type	Dimensions in mm l_1	l_2	l_3	l_4	l_5	l_6	l_7	l_8	l_9	l_{10}	l_{11}
WM-G10/2-A ZM-PLN	833	74	852	208	1060	1134	227	585	305	155	–
WM-G10/3-A ZM-PLN	833	74	1216	208	1424	1498	591	585	305	155	–
WM-G10/4-A ZM-PLN	833	74	1216	208	1424	1498	591	585	305	155	–
WM-G20/2-A ZM-PLN	1010	72	1044	238	1592	1664	582	585	305	155	310
WM-G20/3-A ZM-PLN	1010	72	1444	238	1992	2064	982	585	305	155	310
WM-G20/4-A ZM-PLN	1010	72	1640	238	2188	2260	1178	585	305	155	310

The Weishaupt Group stands for reliability

The Weishaupt Group has over 3400 employees and is a market leader for burners, condensing boilers, heat pumps, solar energy, and building automation.

The business was founded in 1932 and encompasses three companies operating in the fields of energy technology, energy recovery, and energy management.

The core division is Max Weishaupt GmbH (energy technology), which is located in the southwest German town of Schwendi, and which is where all burners are manufactured. It is also the group's administrative headquarters, and home to the group's own Research and Development Institute.

Heating systems are manufactured by Weishaupt's sister company, Pyropac, which is located in the Swiss town of Sennwald. DHW cylinders are made by Power Engineers in Donaueschingen, Germany.

Neuberger building automation (energy management), sited in Rothenburg ob der Tauber in Germany, has been a group subsidiary since 1995.

Germany's Bad Wurzach is home to the geothermal engineering company, BauGrund Süd, which has been part of the Weishaupt Group since 2009.

Facing page, clockwise from top left:
1. Heating system production in Sennwald.
2. Neuberger building automation in Rothenburg.
3. Borehole drilling by BauGrund Süd.
4. Weishaupt Group Headquarters in Schwendi.

–weishaupt–

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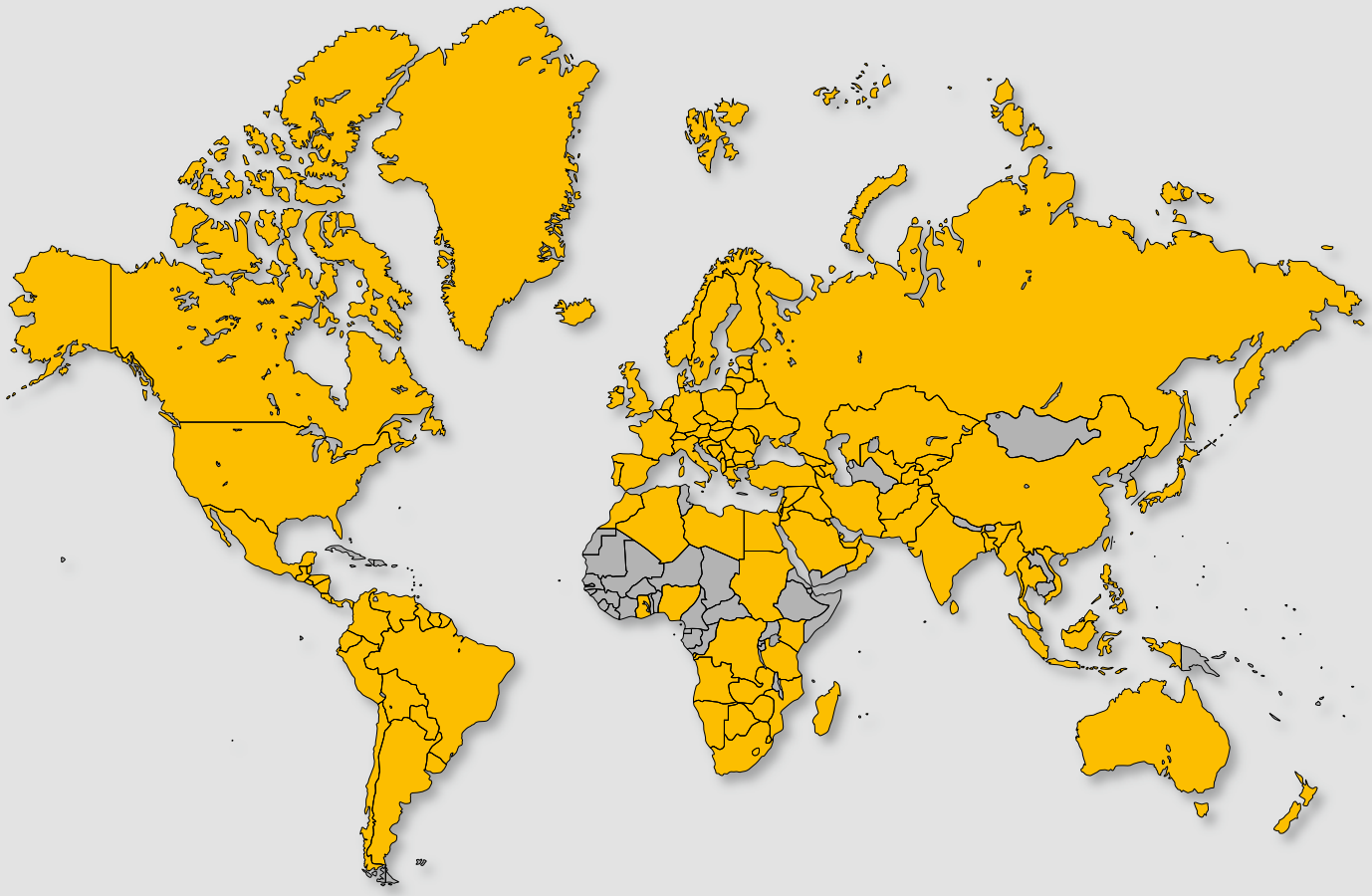

Weishaupt worldwide:

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Algeria
Angola
Argentina
Australia
Austria
Bahrain
Bangladesh
Belarus
Belgium
Belize
Bolivia
Bosnia-Herzegovina
Botswana
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Pakistan
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Uruguay
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Uzbekistan
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Venezuela
Vietnam
Zambia
Zimbabwe

Sample Specifications for Powermaster model WB-A2-3P 300 BHP 15# boiler

The following sample specifications are provided by Powermaster to assist you in providing your customer with the specific needs for that application. The sample specification is normally used as the base template for the boiler specification. Contact your local insurance carrier and state boiler inspector for the current insurance and code requirements. Please contact Powermaster if you need any assistance in completing the specification.

A. Provide Powermaster firetube forced draft, 3 pass wet back scotch type steam boiler model WB-A2-3P. The boiler shall be fully assembled and wired at the factory and ASME rated to 15 psig. The boiler shall be factory wired. The boiler is to be designed, constructed and tested in accordance with the latest edition and addenda of the A.S.M.E. Boiler and Pressure Vessel Code and shall be registered with the National Board of Boiler and Pressure Vessel Inspectors.

B. Standards: Boiler manufacturer shall be authorized by the A.S.M.E. to use its certification mark and stamp the boiler shell with its mark as per the Boiler and Pressure Vessel Code. Boiler shall be constructed to meet the requirements of CSD-1.

C. The boiler capacity shall be 300 BHP equalling 10,350 lb of steam at and from 1 atmosphere and 212°F. Steam quality shall be of at least 99% at all firing rates, based on water quality in boiler of 500 ppm maximum total solids, 15 ppm maximum suspended solids, 440 ppm maximum alkalinity and five grains hardness.

D. The boiler shall have no less than 5 square feet of heating surface per boiler horsepower. The furnace shall be off center and located below the shell centerline to provide for a better heat transfer by being in contact with the coolest boiler water and promote internal recirculation of water.

E. Boiler manufacturer or representative shall provide a factory-trained engineer to inspect, start-up, test and adjust the boiler and related controls.

F. Boiler shall be warranted free of defects in material and workmanship for one (1) year from date of start-up or 18 months drom date of shipment, whichever comes first.

G. Boiler shall be three-pass horizontal firetube wet back design. Pressure vessel shall be constructed, tested and marked in accordance with the ASME Code, and shall be registered with the National Board of Boiler and Pressure Vessel Inspectors.

H. Boiler shall be mounted on a heavy structural steel base, observation ports for the inspection of the flame shall be provided on the burner at the front of the boiler and on the manway to the turnaround chamber on the back of the boiler. Boiler shall include lifting eyes.

I. Boiler shell insulation shall consist of factory installed stainless steel jacket with brushed finish and two inch mineral wool insulation of at least 8.0 lb/ft3 nominal density, covered by a stainless steel sheet with matte finish to guarantee a longer lifetime and ease of maintenance. All fire-side surfaces shall be fully accesible for inspection and cleaning without disturbing or removing the burner equipment.

J. To guarantee a longer lifetime and better seal of the tubes with the tubesheet, boiler tubes shall be 2-1/2" in diameter and at least have a nominal thickness of 0.120" (11 Gauge) and be made of seamless carbon steel boiler tubes for high pressure service, ASTM designation SA-192/A 192M-02.A minimum of 1/2" tangent to tangent ligament spacing shall be provided.

K. To improve heat transfer and reduce stresses, the boiler furnace shall be completely corrugated using the Morrison design. No partial corrugation, Fox design or bowling hoops will be acceptable.

L. All connections and fittings used on the boiler shall be at least class 2000 or 3000. All 90º direction changes in piping shall be fitted with crosses or tees with tapped ends to allow for inspection and cleaning of all straight pipe sections. All piping up to the first valve after the pressure vessel shall be documented on the ASME Data report.

M. Boiler shell shall include a fusible plug above the top tube row and below the lowest water level to provide an additional mechanical safety device to protect against low water levels.

N. Boiler shell shall include gas side relief valves (explosion valves on the gas side) located in the turnaround chamber between the second and third pass to protect the boiler and personnell in case of an explosion in the boiler combustion chamber.

O. Boiler shell doors and maintenance access to wet back shall be fitted with heat shields consisting of a metal sheet on top of the surfaces and offset by studs to create an additional layer of air insulation that decreases the temperatures to the touch and prolongs the life of the paint.

P. Boiler shell shall be fitted with a ladder and catwalk with banister on top of the boiler for safe maintenance access to top valves and controls.

Q. Boiler shell shall be fitted with three bottom blowdown connections, one located on front of boiler, one in the middle of the boiler and one under the wet back to provide better removal of sediments in boiler shell.

R. Boiler doors shall be hinged and shall have ample clearance for access to the tubesheets without being impeded by the burner or fuel lines. Boiler doors shall be insulated on the interior surface with two inches of mineral wool encased in a stainless steel sheet to prevent erosion from the flue gases. A hardener in lieu of the stainless steel sheet will not be permitted. No refractory shall be used on the interior insulation of the doors so as to make them lighter, easier to operate and longer lasting.

S. Boiler shell shall be fitted with at least seven 3" x 4" hand holes and one 12" x 16" manway for access and inspection of water side. All hand holes shall be fitted with a ring to provide a flat surface for the gasket and an overlap on the wear surface of the shell for a longer lifetime of the boiler shell.

T. Limit controls, pressure transducer and main pressure gauge shall be connected to a control manifold 2" in diameter located above the boiler water line to prevent the controls to be in contact with condensate and which shall have taps on the ends for inspection and a drip leg connecting back to the boiler shell to prevent chemical concentration in the manifold and prolong the lifetime of the controls.

U. The tubesheet thickness of the boiler shell shall exceed ASME required stresses by at least 30% to guarantee a better seal with the boiler tubes and a longer lifetime.

V. Trim and controls for steam boiler shall consist of: main steam pressure gauge, safety relief valves as per ASME, combination pump controller and low water cutoff with integral water column and three try-cocks, auxiliary probe type low water cutoff mounted directly on pressure vessel, operating steam pressure control, two redundant limit pressure controls, stack thermometer.

W. Bottom blowdown valves shall consist of three quick opening ball valves (one for each blowdown connection), piped together diverting the flow to one slow opening valve.

X. Steam outlet connection shall consist of a 12" class 150 flange fitted with a 12" class 150 OS&Y gate valve as required by local codes.

Y. Surface blowdown valves shall consist of a skimmer or dip tube inside the boiler shell connected to a needle valve.

Z. Boiler shell shall be fitted with five 1/4" class 150 ball valves to drain any condensate out of the fire-side during cold startups. The drain valves shall be located two in the front doors, two in the back doors and one under the furnace.