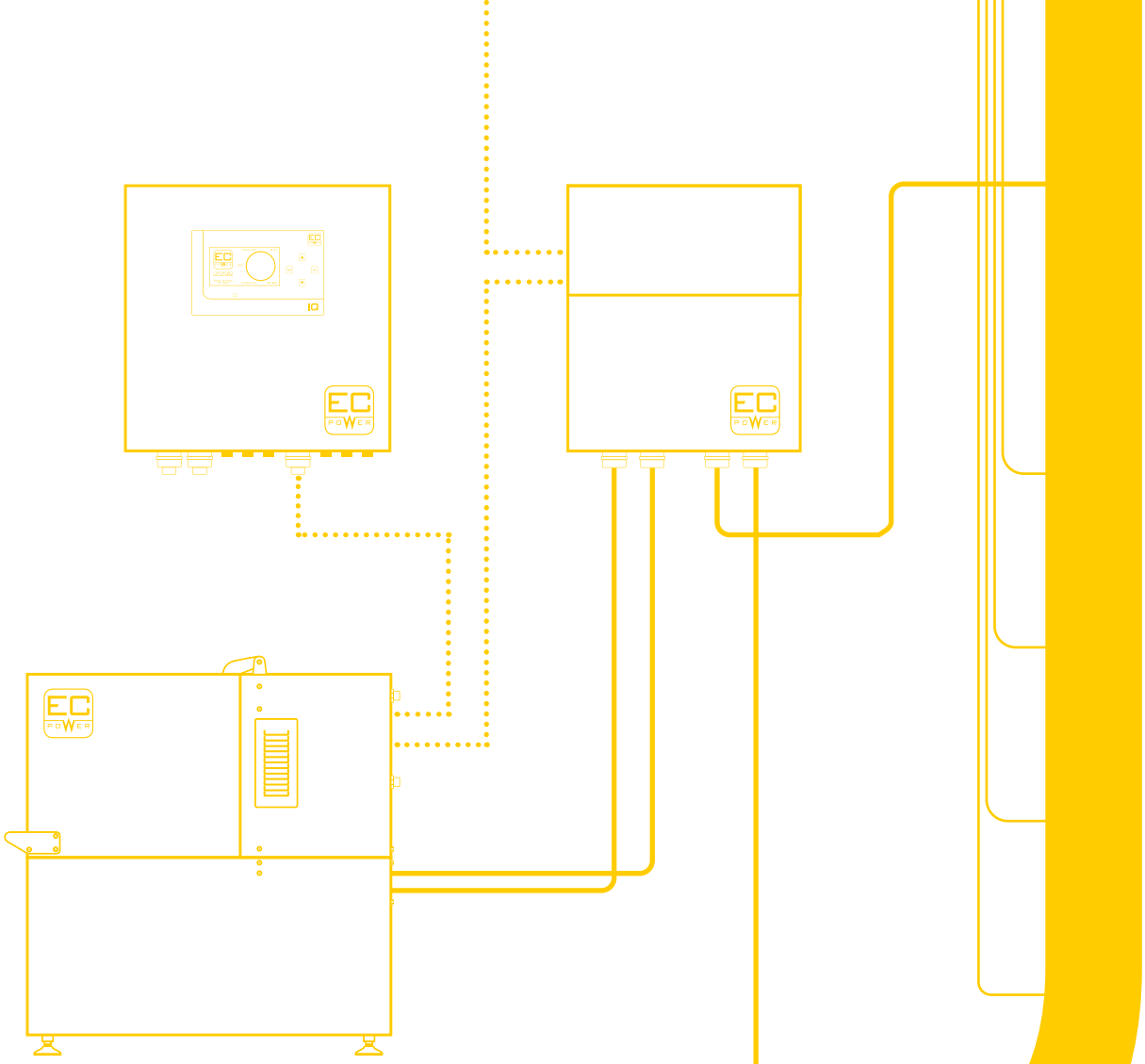


XRGI®

HYDRAULIC SOLUTIONS

01DOC1089-01

VERSION 1.1 2019

TABLE OF CONTENTS

OBJECTIVES AND REQUIREMENTS FOR INSTALLATION

OBJECTIVES:

- Optimum operation and interaction between the XRGI® and boiler system.
- Cost-effective integration of the XRGI® into existing or new central heating systems.
- Use of the manufacturer's standard settings (non-use of higher-level settings).

REQUIREMENTS FOR INSTALLATION:

- The hydraulic circuit diagrams are schematic diagrams. Design and install any necessary hydraulic, safety and control fittings in accordance with DIN standards and local regulations.
- Only install the Storage Tank with two hydraulic connections (apart from the additional cost, additional connections will lead to supply and return water mixing in the Storage Tank and hence to inefficiency and malfunctions).
- High return temperatures can cause malfunctions. Avoid excessive flow in the heating system.
- Operate the heating system at the lowest possible return temperatures.
- Refer to the instructions for information on hydraulic and electrical connections.
- Proper hydraulic integration (and prevention of start/stop operation) is necessary to comply with the warranty conditions.
- Only the current version of this document, which can be found at **www.ecpower.eu**, is applicable.

EFFICIENCY LABEL FOR HEATING SYSTEMS

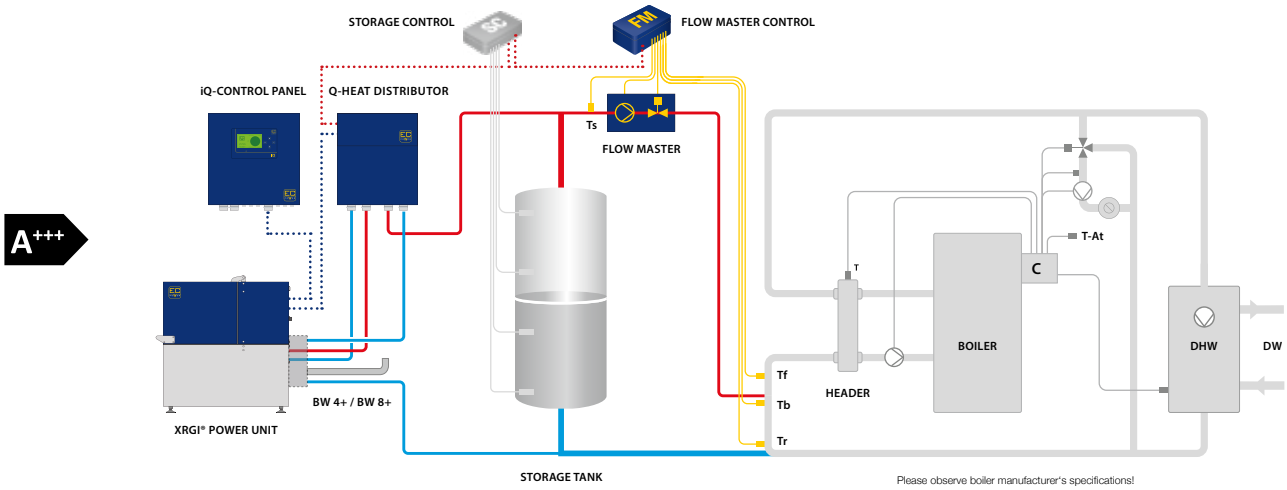
PRODUCT LABEL AND PACKAGE LABEL:

Refrigerators, televisions and washing machines have carried an energy efficiency label for several years now – appliances that we can't imagine being without. This now also includes the XRGI®.

This label has been mandatory on space heaters since 26 September 2015. The individual components of a heating system carry a product label. The XRGI® carries the highest efficiency class label: A^{+++}.

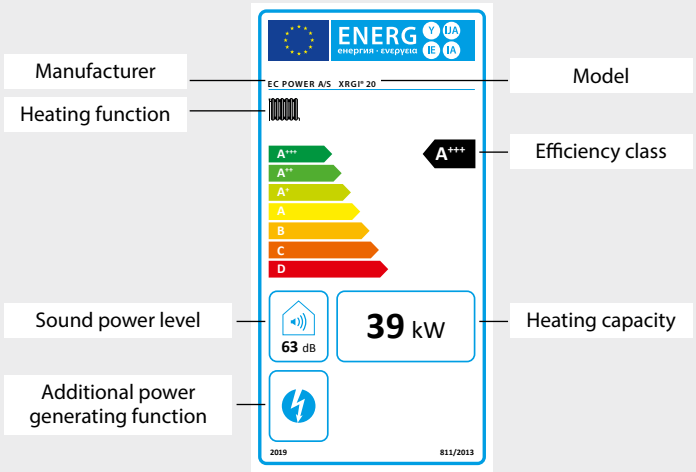
As heating systems consist of several components and all components affect the efficiency of the overall system, package labels are now being added to product labels.

Example: SERIES CIRCUIT WITH INJECTION – BOILER WITH HEADER

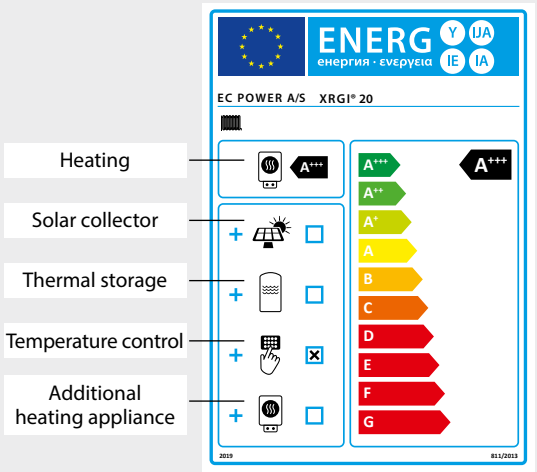


Example:

PRODUCT LABEL
XRGI® 20



PACKAGE LABEL
XRGI® 20 with Flow Master



IMPORTANT:

If products from other companies are used in systems in addition to products from EC POWER, EC POWER excludes all liability for the correct calculation of the energy efficiency class for the overall system.

The calculations are prescribed by the European Commission (Delegated Regulation (EU) no. 811/2013)

OVERVIEW OF HYDRAULIC SOLUTIONS

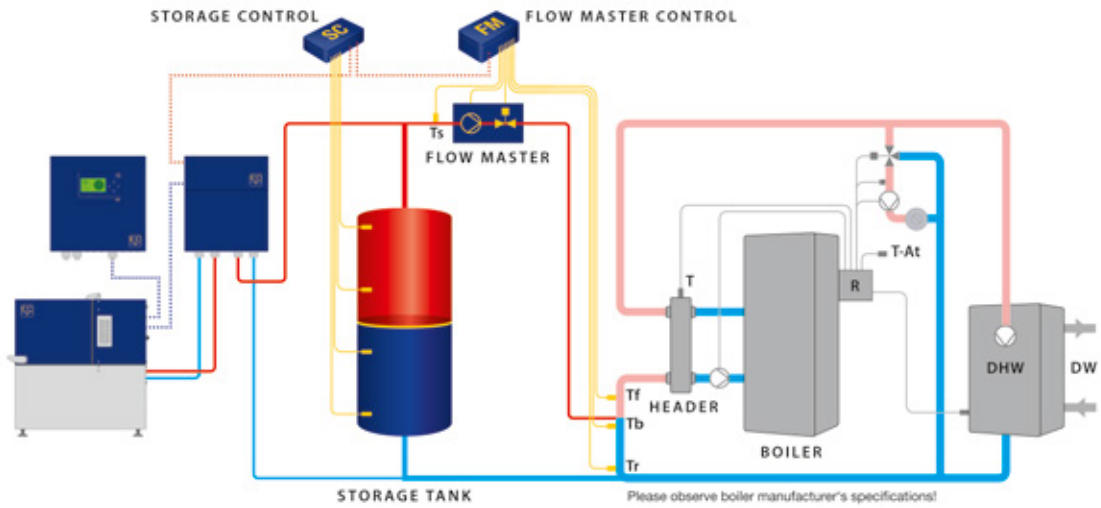
HYDRAULIC	TYPE OF CIRCUIT	FLOW MASTER INJECTION	BOILER TYPE	NUMBER OF XRGI®	PAGE
1HO	SERIES	YES	WITH HEADER	1	6
1HM	SERIES	YES	WITH HEADER	>1	6
2HO	SERIES	NO	WITH HEADER	1	7
2HM	SERIES	NO	WITH HEADER	>1	7

IMPORTANT:

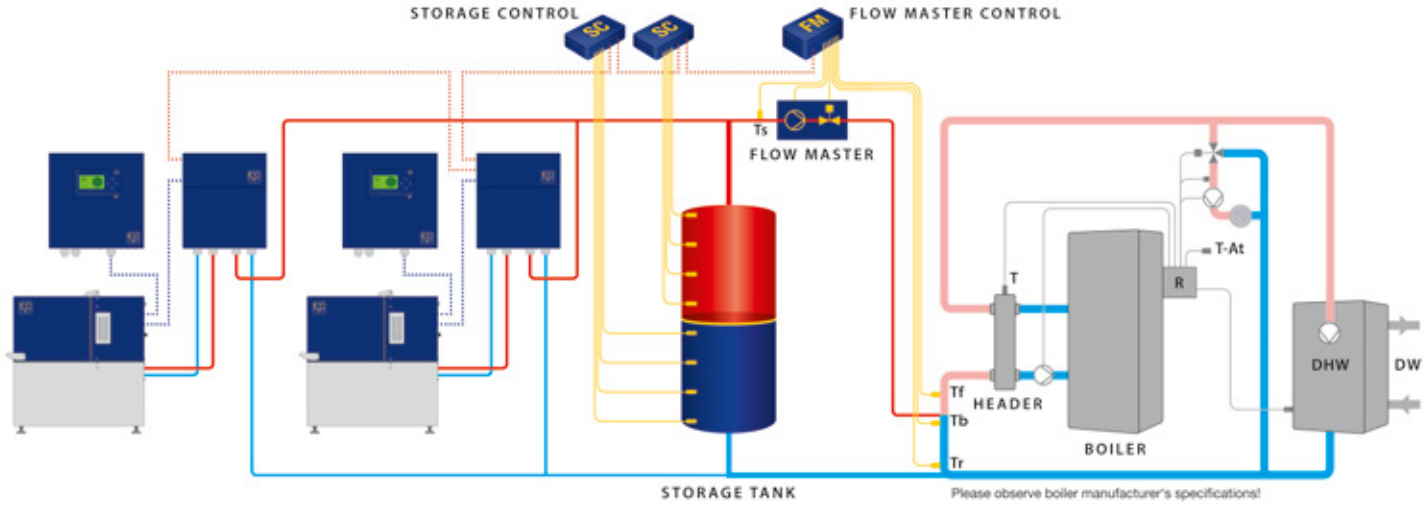
All hydraulic solutions use the boiler functions to control the heating circuits and domestic hot water (DHW) as well as all possible energy-saving measures within the secondary heating system.
This avoids expensive control redundancies and there is not need for higher-level external control.

SERIES CIRCUIT WITH INJECTION – BOILER WITH HEADER

1HO Hydraulic – ONE XRGI®



1HM Hydraulic – MORE THAN ONE XRGI®



IMPORTANT:

- Always set Tf higher than the maximum flow temperature in the control settings to give the XRGI® priority over the boiler, so that the XRGI® always supplies the base load heat (Δ 5 K is sufficient).
- Select the Flow Master type/size based on the discharge capacity you require.
- Use a minimum of 2 Storage Controls (= 8 temperature sensors) with multi-module systems.
- Possible use of condensing technology in the boiler is slightly reduced by raising the return water temperature. However, the achieved efficiency improvement of the XRGI® production more than covers this minor loss.

MAIN COMPONENTS FOR OPERATION OF THE XRGI®:

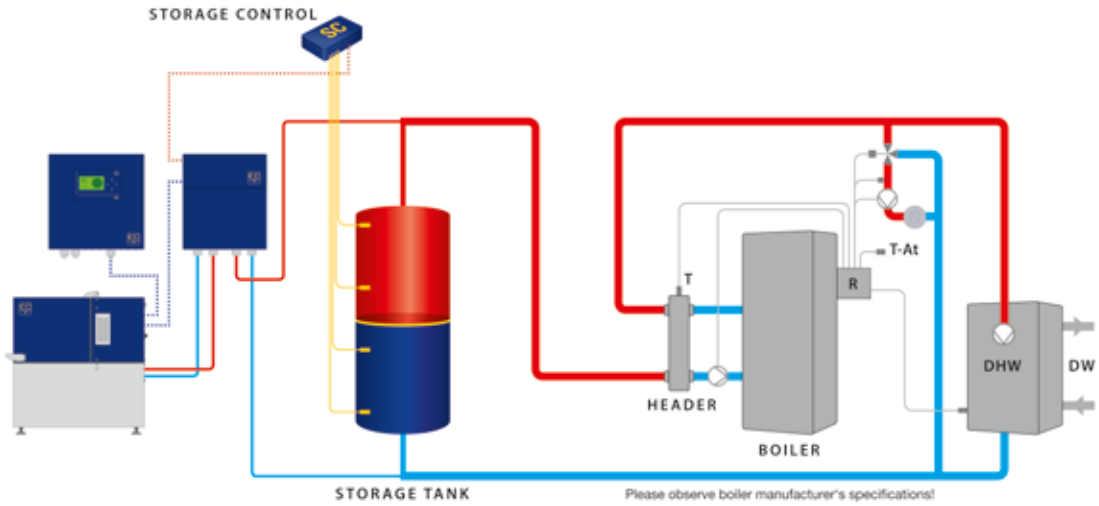
Power Unit, Q-Heat Distributor, iQ-Control Panel, Flow Master, Flow Master Control, Storage Control, Storage Tank

LEGEND

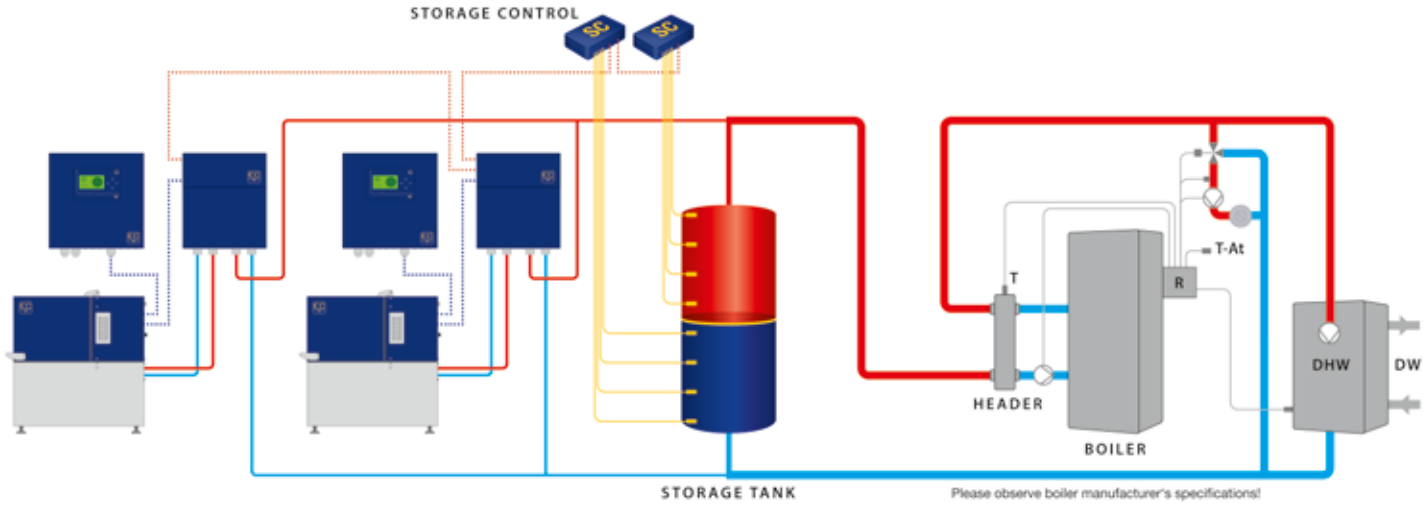
- Temperature sensor
- Signal cable for sensor / controls
- Signal cable for external components
- Flow, return water
- Q-Network cable (heating circuit)
- Q-Network cable (control circuit)
- Pump
- Heat consumer
- 2-way valve
- 3-way valve

SERIES CIRCUIT – BOILER WITH HEADER

2 HO Hydraulic – ONE XRGI®



2 HM Hydraulic – MORE THAN ONE XRGI®



IMPORTANT:

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- Flow, return water
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- Pump
- Heat consumer
- 2-way valve
- 3-way valve

INSTALLATION

(P. 9 – 11)

KEY XRGI®-COMPONENT
FUNCTIONS

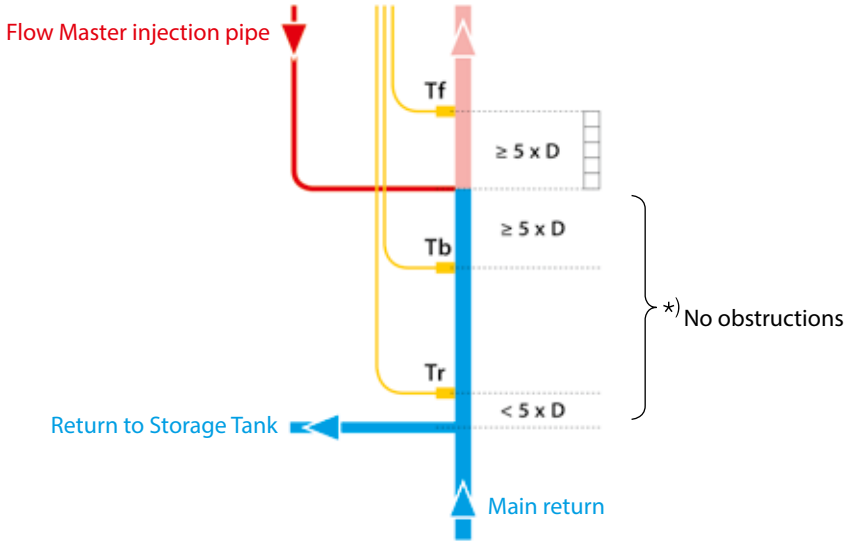
(P. 12 – 17)

HYDRAULIC PLANNING
CHECKLIST

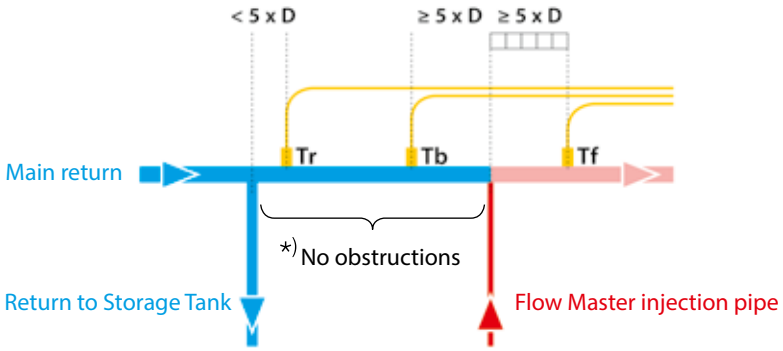
(P. 18)

INSTALLATION OF THE TEMPERATURE SENSOR AND INJECTION LINE FROM FLOW MASTER

INSTALLATION IN VERTICAL PIPEWORK (UPWARD FLOW):



INSTALLATION IN HORIZONTAL PIPEWORK (CONNECT TO UNDERSIDE OF MAIN):



*) Ensure that there are absolutely no obstructions to the flow (e.g. check valve) on the main pipe between the Flow Master and Storage Tank. The Flow Master will automatically maintain the correct direction of flow between these connections.

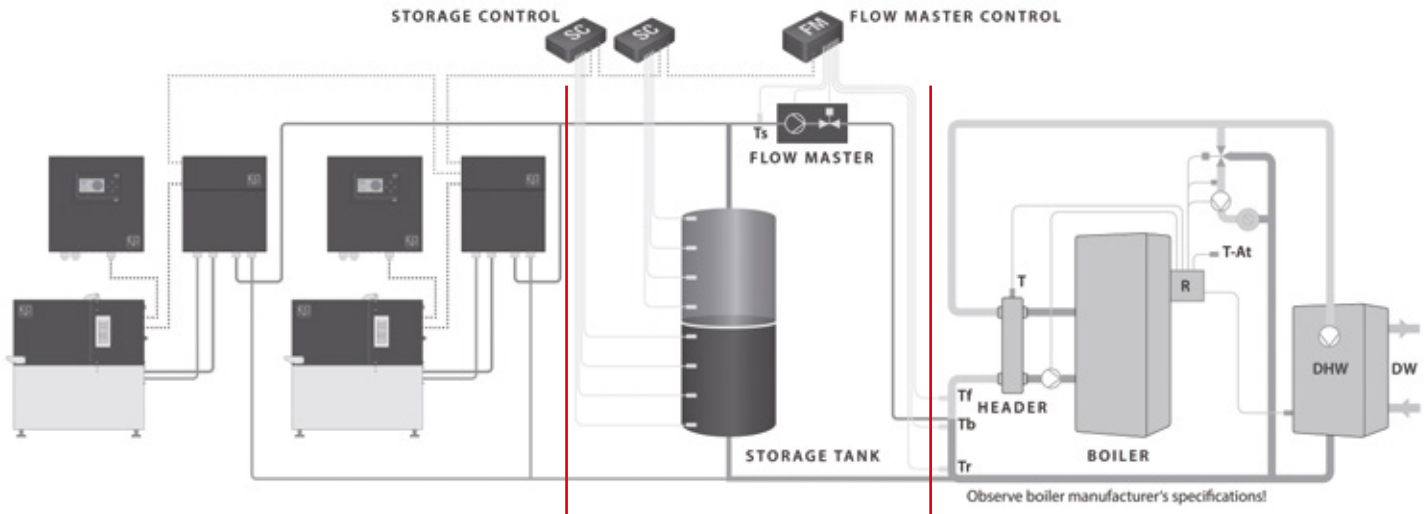
Note the following when installing the (Pt100) temperature sensor:

- Install temperature sensors in immersion sleeves to obtain better and faster results.
- Ensure that the heating water in vertical pipework flows upwards (ascending).
- Ensure that the temperature sensors (in immersion sleeves) in horizontal pipework are fitted from above and "flow" and "return" connections from below.
- Distance from Tf to the injection line of the XRGI®/Storage Tank: minimum 5 x D (pipe diameter)
- Distance from Tb to the injection line of the XRGI®/Storage Tank: minimum 5 x D (pipe diameter)
- Distance from Tr to the return line of the XRGI®/Storage Tank: maximum 5 x D (pipe diameter)

When installing in horizontal pipework, ensure that the 85 °C hot water injected from the XRGI® is well mixed with the main flow of heating water and that there is no temperature stratification in the pipe (particularly at low flow rates).

EC POWER RECOMMENDS INSTALLING THE TEMPERATURE SENSOR AND INJECTION LINE FROM THE FLOW MASTER IN VERTICAL PIPEWORK (UPWARD FLOW).

HEATING PIPE DIMENSIONS



XRGI® SECTION

Pipe diameter sized according to type and number of XRGI®

FM SECTION

Pipe diameter according to type of Flow Master

BUILDING SECTION

Pipe diameter sized according to heat requirements in the building to be heated

RECOMMENDED DIAMETER (FOR 10M AND 5 x 90° BENDS)

XRGI® SECTION

XRGI® type	Number of XRGI®			
	1	2	3	4
XRGI® 6	DN 25	DN 32	DN 32	DN 40
XRGI® 9	DN 25	DN 32	DN 40	DN 50
XRGI® 15	DN 32	DN 40	DN 50	DN 65
XRGI® 20	DN 32	DN 50	DN 65	DN 65

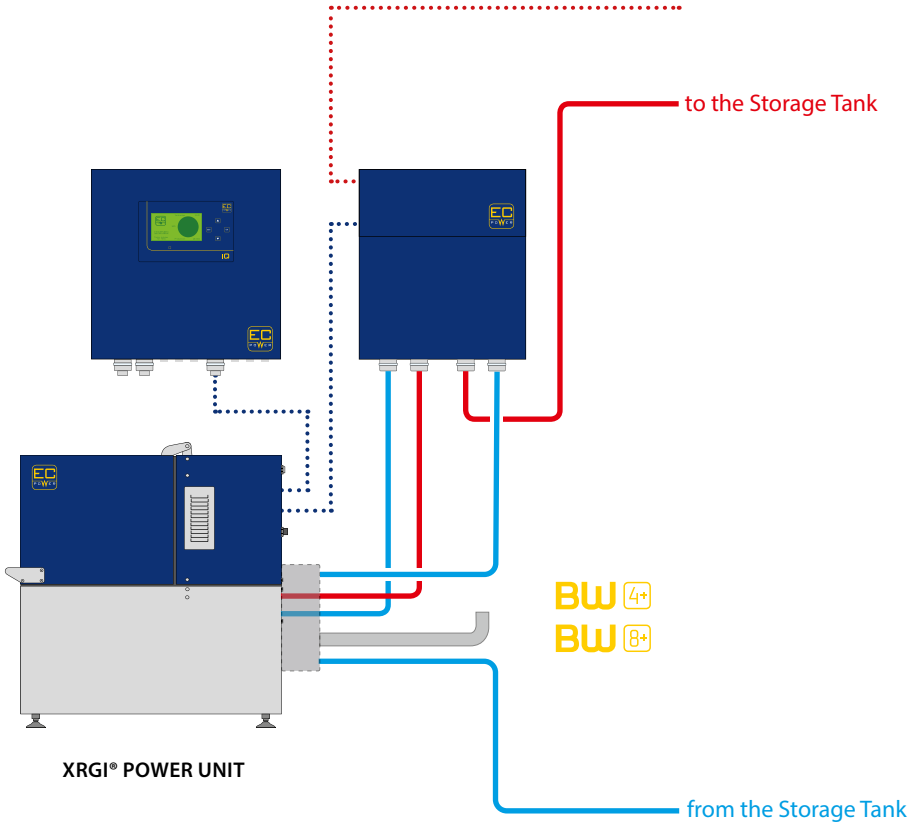
IMPORTANT:

If the entire heating water supply for the building runs through the Storage Tank (cf. Hydraulic solution **2HO** and **2HM** on p. 7), design the pipes to and from the Storage Tank, as well as the Storage Tank connections, according to the heat requirements of the building to be heated.

FM SECTION

FM type	
FM 50	DN 25
FM 150	DN 32
FM 250	DN 40
FM 350	DN 50

INTEGRATION OF BW4+ / BW8+ (CONDENSING EXHAUST GAS HEAT EXCHANGER)



Connect the BW4+ / BW8+ (condensing exhaust gas heat exchanger) to the return line from the consumer network/hot water Storage Tank to the Q-Heat Distributor.

Note the following when connecting:

- Route all return water to the Q-Heat Distributor through the BW4+ / BW8+.
- Only integrate (connect) the BW4+ / BW8+ without causing significant pressure loss.

MAIN COMPONENTS FOR OPERATION OF THE XRGI®:

Power Unit, Q-Heat Distributor, iQ-Control Panel, Flow Master, Flow Master Control, Storage Control, Storage Tank

FLOW MASTER CONTROL

FUNCTIONAL DESCRIPTION

The Flow Master Control regulates the delivery of heat from the XRGI® system to the central heating/site supply system – via the Flow Master valve and variable speed pump – to maintain the required flow temperature (Tf) set on the iQ Control Panel. The Flow Master Control also protects the XRGI® system from excessively high return temperatures, automatically prevents reverse flow between XRGI®/Flow Master connections and ensures minimal consumption of electricity by the pump.

The Flow Master maintains the set temperature at Tf by mixing in 80 - 85°C hot water from the XRGI® system into the supply system water. Variations in heat loads and flow rates are compensated for by the Flow Master valve opening and closing and the pump speed; the supply temperature Tf is therefore maintained regardless of the heat load. The pump will stop if the Flow Master valve closes completely (i.e. no heat load).

The heat store will fill up if the heat load is lower than the heat produced by the XRGI®. The XRGI® will stop production once the heat store is full. During periods of peak demand, it will wait until there is sufficient cooling capacity in the heat store before it restarts, otherwise it will wait until the minimum heat reserve has been reached before starting. None of this affects the steady supply from the Flow Master.

If the heat load is greater than the heat produced by the XRGI®, the heat store will discharge. When the heat store has fully discharged, the supply temperature Ts for the Flow Master will fall and the Flow Master Control accordingly calculates a maximum supply temperature Tf as basis for control.

The Flow Master Control automatically adjusts to actual flow rates and return temperature conditions to achieve stable and precise control. Abrupt changes in supply loads and flow rates are compensated for by special functions to immediately recover and maintain steady control under all circumstances.

FLOW MASTER

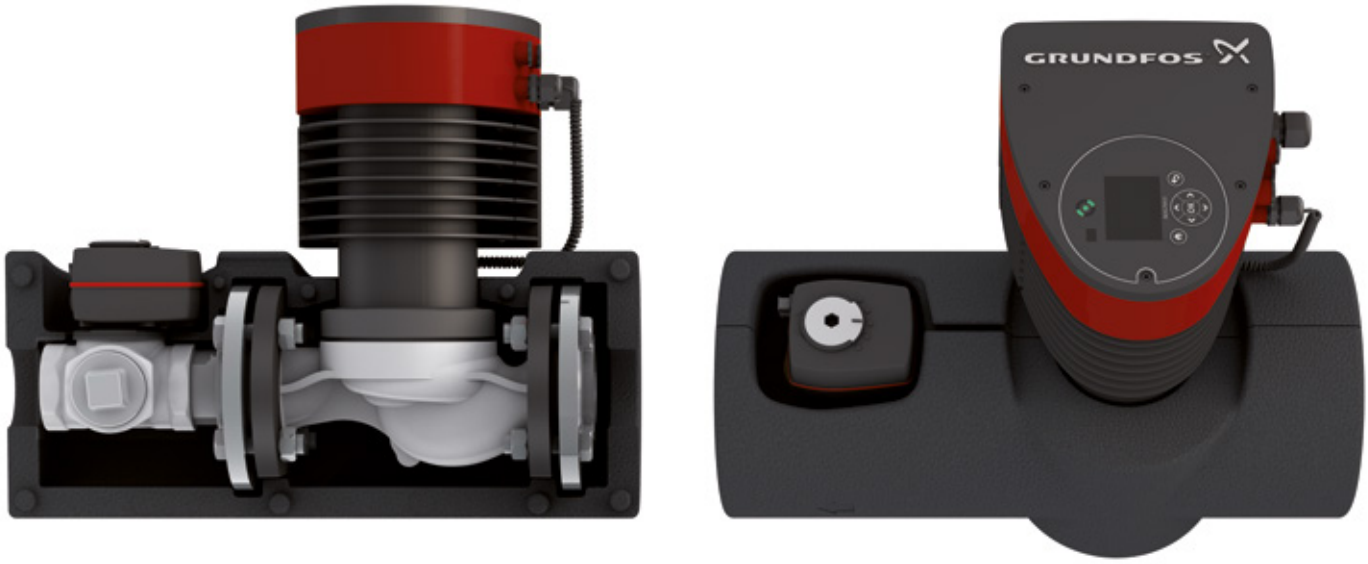


Figure shows FM type 350

FUNCTIONAL DESCRIPTION

The Flow Master is a motorised valve and variable speed pump unit, controlled by the Flow Master Control module. The heat store enables the XRGI® system to service short-term peak loads way beyond the nominal output of the Power Unit. This minimises the need for supplementary heat from back-up boilers and maximises the number of operational hours and electricity production by the Power Unit. The Flow Master should therefore always be able to deliver at least twice the nominal Power Unit heat output, and generally significantly more. Ideally, it should be sized to service all peak loads whenever average loads (e.g. 24 hours) are below the nominal Power Unit output.

The nominal heat outputs are based on a delta T of 20 K between the XRGI® flow and main return, corresponding to a main return temperature of 60 - 65 °C. The Flow Master heat outputs will increase proportionally with lower return temperatures.
Flow Master offers steady regulation down to approx. 2 % of max. load (provided it has been installed correctly).

THE FM-TYPE DEPENDS ON THE CHP'S THERMAL OUTPUT.
SIZING GUIDE SEE QUICK SIZING GUIDE PAGE 15.

FM-Typ	Thermal output	ΔT (at a return of 60 to 65 °C) (Distributor flow - object return)	Maximum flow rate
FM 50	50 kW	20 °C	2,2 m^3/h
FM 150	150 kW	20 °C	6,5 m^3/h
FM 250	250 kW	20 °C	10,8 m^3/h
FM 350	350 kW	20 °C	15,1 m^3/h

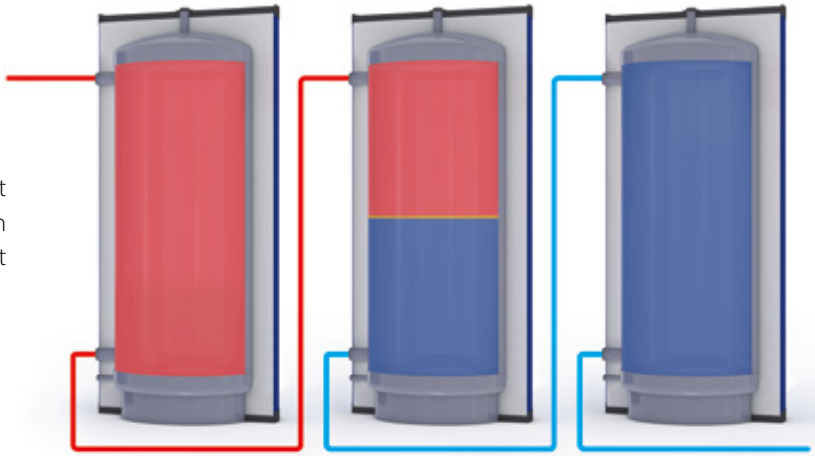
STORAGE TANK

FUNCTIONAL DESCRIPTION

The Storage Tank forms an integral part of the XRGI® system and is required for proper operation of the system. It ensures that any temporary falls in heat loads below the output of the Power Unit do not cause the Power Unit to stop, and enables the XRGI® system to service temporary heat loads way beyond the nominal output of the Power Unit. When the heat load on site is permanently below the output of the Power Unit, the Storage Tank allows the XRGI® system to operate the Power Unit for longer and to schedule operation according to power load patterns on site.

The way in which the Storage Tank is integrated determines its efficiency and effective storage capacity. It must be installed hydraulically with only two connections – regardless of the hydraulic system selected. Installing the Storage Tank with four connections (i.e. as a header) allows the cold return to mix with the hot flow. This reduces storage capacity and, as a result, can cause the control to malfunction, leading to the XRGI® system shutting down and shortening its service life.

If multiple Storage Tanks are used, they must be installed in series. Experience has shown that parallel or reverse return circuits do not operate satisfactorily and must not be used.



STORAGE TANK AND FLOW MASTER QUICK SIZING GUIDE



XRGI® type	Cascade Units	Nominal Thermal Output, kW)	Storage Capacity Min. Litre	Storage Control Min. Pcs *	Site Return Temperature, Tr 30 °C	40 °C	50 °C	60 °C
XRGI® 6	1	12	500	1	FM 50	FM 50	FM 50	FM 50
XRGI® 9	1	20	500	1	FM 50	FM 50	FM 50	FM 50
XRGI® 15	1	31	800	1	FM 50	FM 50	FM 50	FM 150
XRGI® 20	1	39	1000	2	FM 50	FM 50	FM 150	FM 150
XRGI® 15	2	62	1600	2	FM 50	FM 150	FM 150	FM 150
XRGI® 20	2	77	2000	4	FM 150	FM 150	FM 150	FM 250
XRGI® 20	3	116	3000	6	FM 150	FM 150	FM 250	FM 250
XRGI® 20	4	155	4000	8	FM 150	FM 250	FM 250	FM 350

* EC POWER Storage Tanks include the minimum number of required Storage Controls.

STORAGE TANK AND FLOW MASTER

The above table is a Storage Tank and Flow Master quick sizing guide; the combinations shown cover most applications efficiently. However, if the average thermal load (e.g. 24 hours) mostly is below the nominal XRGI® thermal output, you should size the Storage Tank and Flow Master to cover thermal peak loads.

STORAGE CONTROL

For storage capacities below 1 m^3, use at least one Storage Control with four temperature sensors. Improved operational results can be achieved by using multiple storage controls.

For storage capacities above 1 m^3, you can find the minimum number of Storage Controls in the table above. EC POWER Storage Tanks already contain the minimum number of required Storage Controls.

STORAGE CONTROL

FUNCTIONAL DESCRIPTION

The Storage Control manages the Storage Tank. The temperature sensors detect the stratification layer between hot flow water and cold return water. The clear separation of cold (return) water and hot (flow) water is crucial for optimum operation of the system and thermal storage capacity: the EC POWER Storage Tank ensures this.

THE XRGI® SYSTEM REQUIRES AT LEAST ONE STORAGE CONTROL WITH FOUR TEMPERATURE SENSORS – OTHERWISE IT CANNOT OPERATE! USE A MINIMUM OF TWO STORAGE CONTROLS AND 8 SENSORS FOR OPTIMUM OPERATION.

Fully automated Storage Tank management is based on the following sequence:

1. **Ensure a minimum run-time for each start:**
   Only start the Power Unit when there is sufficient cold water in the Storage Tank.
2. **Maximum servicing of heat demand by the XRGI® system:**
   Start the Power Unit before the Storage Tank is empty. The heat reserve needed is continuously determined based on the actual supply profile.
3. **Ensure power-based operation (e.g. based on electrical demand and/or electricity cost):**
   Storing heat in the Storage Tank for subsequent use enables the Power Unit to operate even when no heat is needed.

The reserve capacities determined by the XRGI® system vary according to season and heat demand profiles. For instance, in the colder months the system will try to maintain a very high heat reserve, whereas the "cold reserve" requirement will be minimal. The situation will be reversed with low heat demand, with the system maintaining a much smaller heat reserve along with a larger "cold reserve" to ensure sufficient periods of operation.

BOILER CONTROL

FUNCTIONAL DESCRIPTION

The Boiler Control ensures optimum operation of the XRGI® and the peak load boiler, when the XRGI® system is operated hydraulically via the Storage Tank parallel to the boiler. A potential-free contact in the Boiler Control activates the boiler to produce heat, when consumption exceeds the heat produced by the XRGI® and the Storage Tank is almost empty. The boiler stops as soon as heat production by the XRGI® exceeds consumption.

THE BOILER CONTROL IS CONTROLLED BY THE TWO TOP STORAGE CONTROL TEMPERATURE SENSORS (INTERNAL EC POWER DESIGNATION S1 AND S2) IN THE STORAGE TANK

If the heat consumption is higher than the heat produced by the XRGI® over the long term, the top Storage Tank sensor S1 becomes cold. Then the boiler control enables the boiler to produce heat until the second Storage Tank sensor from the top (S2) registers a sufficient temperature. When this occurs, the boiler control stops the boiler again.

The additional installation of the Boiler Control ensures that the boiler is only switched on when it is needed in order not to reduce the operating time of the XRGI®. This is particularly important with parallel circuits and domestic hot water (DHW) systems, so that the boiler does not unnecessarily start up although heat production from the XRGI® and the storage volume are sufficient to deliver heat.

HYDRAULIC PLANNING CHECKLIST

		REQUIRED	COMPLETED
SELECT EC POWER STANDARD HYDRAULIC SYSTEM		YES	
SELECT STORAGE CONTROL		YES	
SELECT BOILER CONTROL	AFTER SELECTING HYDRAULIC SYSTEM		
SPECIFY CONNECTING POINTS TO HEATING SYSTEM		YES	
SELECT FLOW MASTER TYPE WITH FLOW MASTER CONTROL	AFTER SELECTING HYDRAULIC SYSTEM		
SELECT XRGI® TYPE AND QUANTITY		YES	
DIMENSION PIPEWORK IN THE XRGI® SECTION		YES	
DIMENSION PIPEWORK IN THE FM SECTION	AFTER SELECTING HYDRAULIC SYSTEM		
INTEGRATE CONDENSING EXHAUST GAS HEAT EXCHANGER		OPTIONAL	
POSITION FLOW MASTER TEMPERATURE SENSOR (TF, TB, TR)	AFTER SELECTING HYDRAULIC SYSTEM		
POSITION INJECTION LINE AND RETURN LINE	AFTER SELECTING HYDRAULIC SYSTEM		
XRGI® AND BOILER SYSTEM CONTROL SETTINGS		YES	
DEFINE TF AND MAXIMUM BOILER TEMPERATURE	AFTER SELECTING HYDRAULIC SYSTEM		
CHECK HEATING CIRCUITS AND HW PRODUCTION AT BOILER SYSTEM		YES	

NOTES

WWW.ECPOWER.EU

XRGI®

HYDRAULIC SOLUTIONS

10/2019

VERSION 1.1 2019