



**VAPORPHASE  
DIVISION**  
KICKHAM BOILER, INC.

# **WASTE HEAT RECOVERY SYSTEMS FOR RECIPROCATING GAS ENGINE COGENERATION SYSTEMS**

Presented by  
Warner H. Bauer

## TYPICAL RECOVERY SYSTEMS

- HOT WATER
  - 180°F - 260°F
- LOW PRESSURE STEAM
  - 15 PSIG
- HIGH PRESSURE STEAM
  - 125 PSIG



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**HOT WATER SYSTEMS**  
**WHAT IS RECOVERABLE?**  
**180-260°F HOT WATER SYSTEM**

- **RECIPROCATING GAS ENGINE**
  - JACKET WATER HEAT: 100%
  - LUBE OIL HEAT: 100% ON SOME APPLICATIONS
  - EXHAUST HEAT: 60-70%



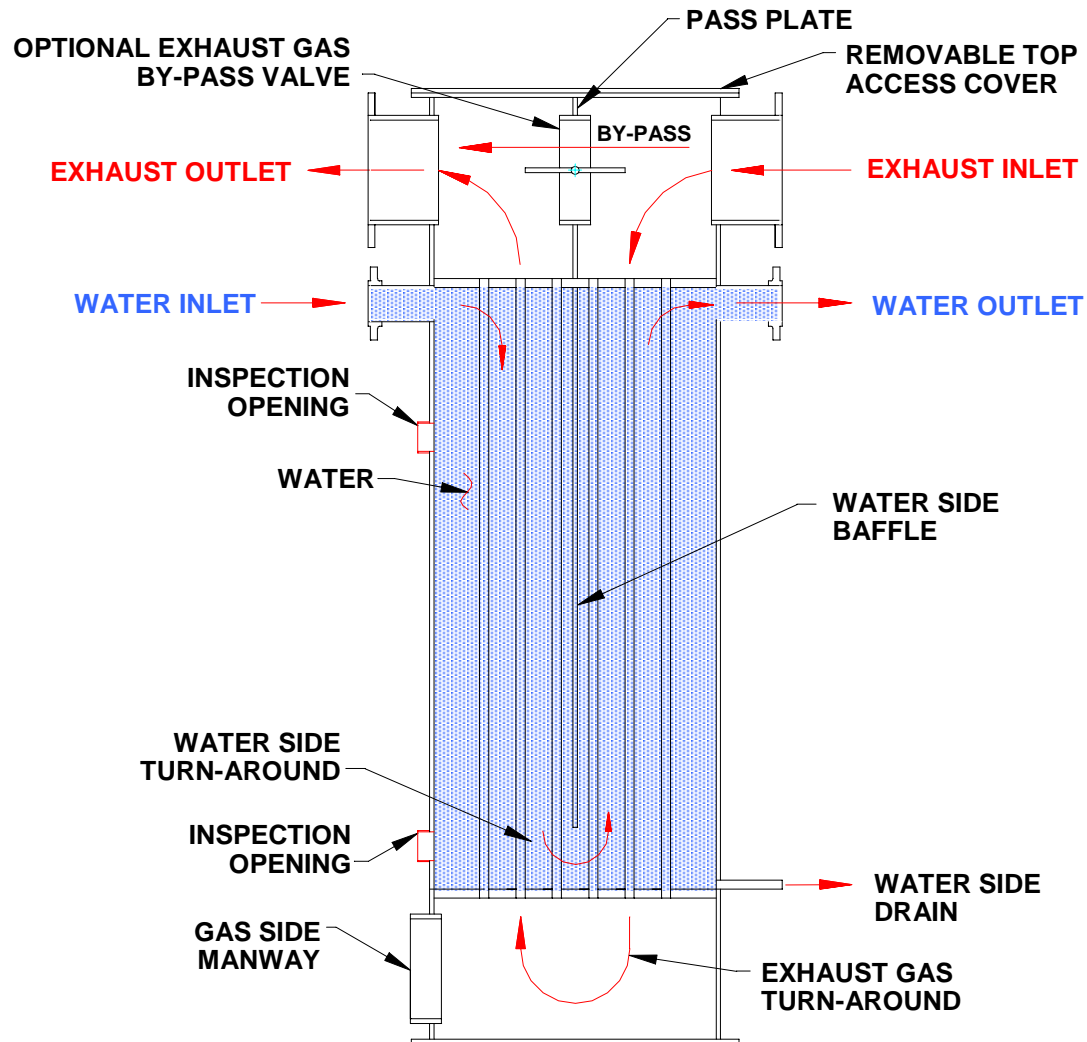
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**HOT WATER SYSTEMS**  
**RECIPROCATING ENGINE HOT WATER**  
**WASTE HEAT RECOVERY SILENCER**



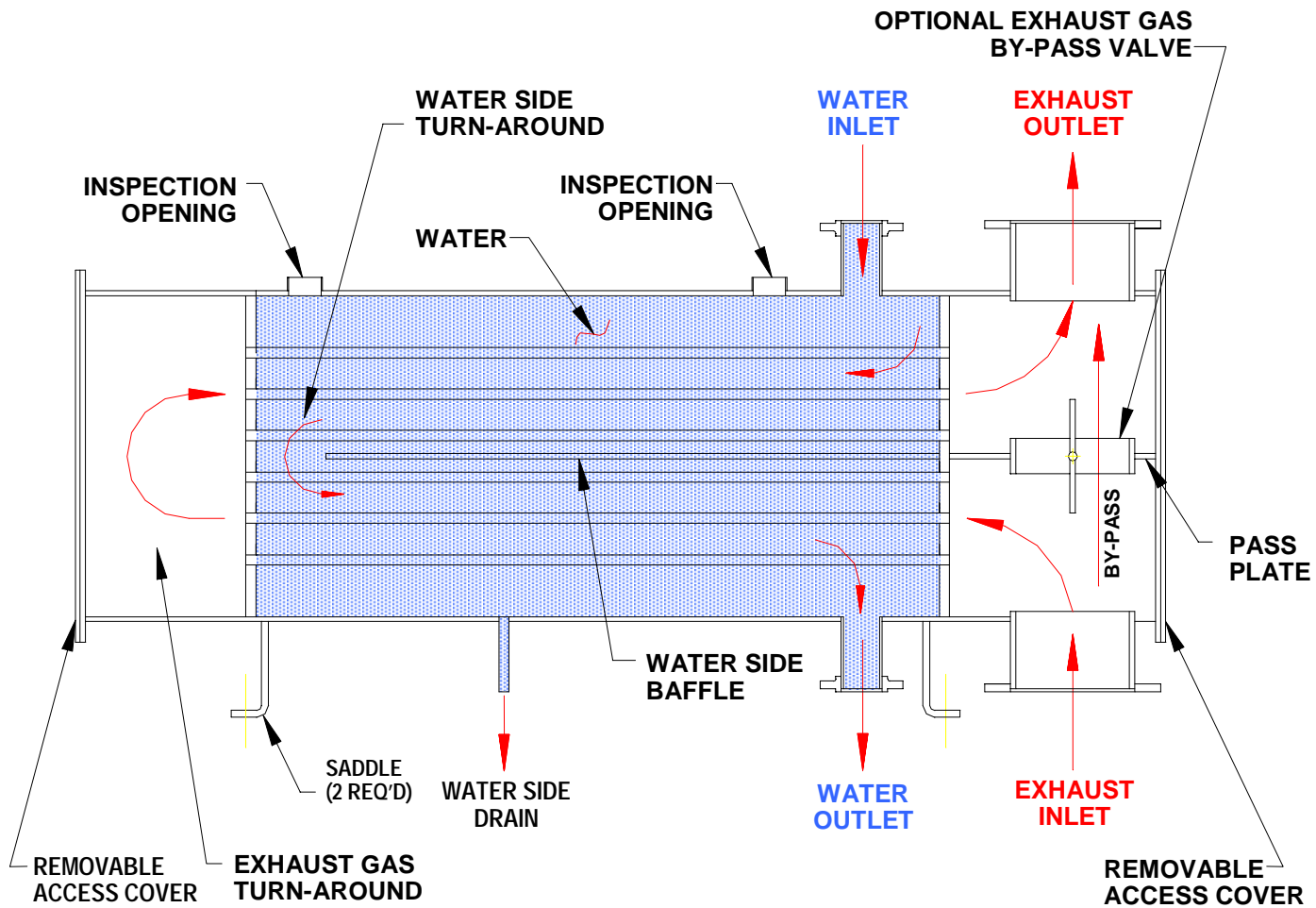
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# CROSS-SECTIONAL VIEW OF 2-PASS ECXWV EXHAUST WASTE HEAT RECOVERY SILENCER FOR HOT WATER SERVICE WITH INTERNAL EXHAUST BY-PASS



**MODEL ECXWV**

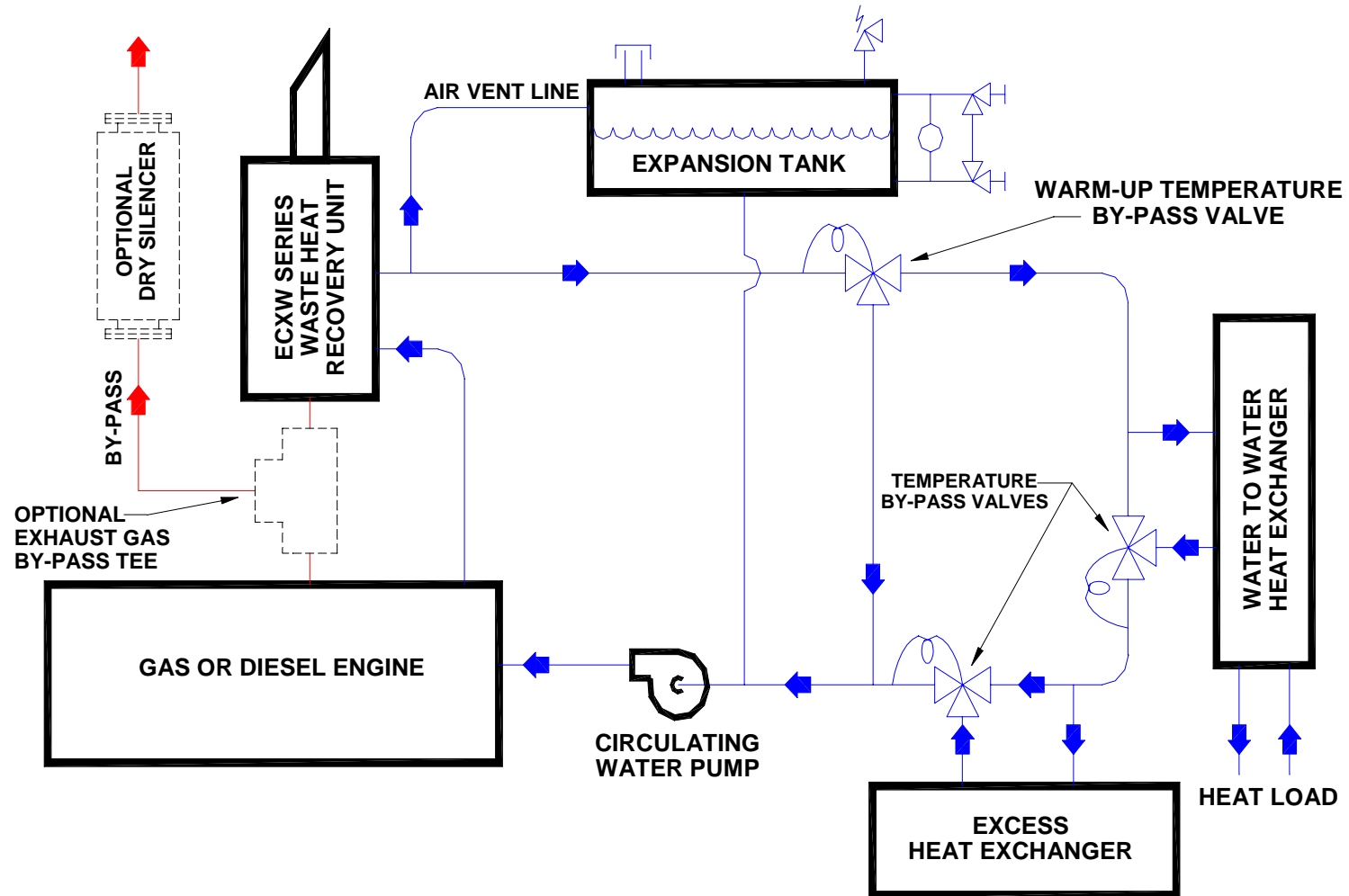
# CROSS-SECTIONAL VIEW OF 2-PASS ECXWH EXHAUST WASTE HEAT RECOVERY SILENCER FOR HOT WATER SERVICE WITH INTERNAL EXHAUST BY-PASS



**MODEL ECXWH**

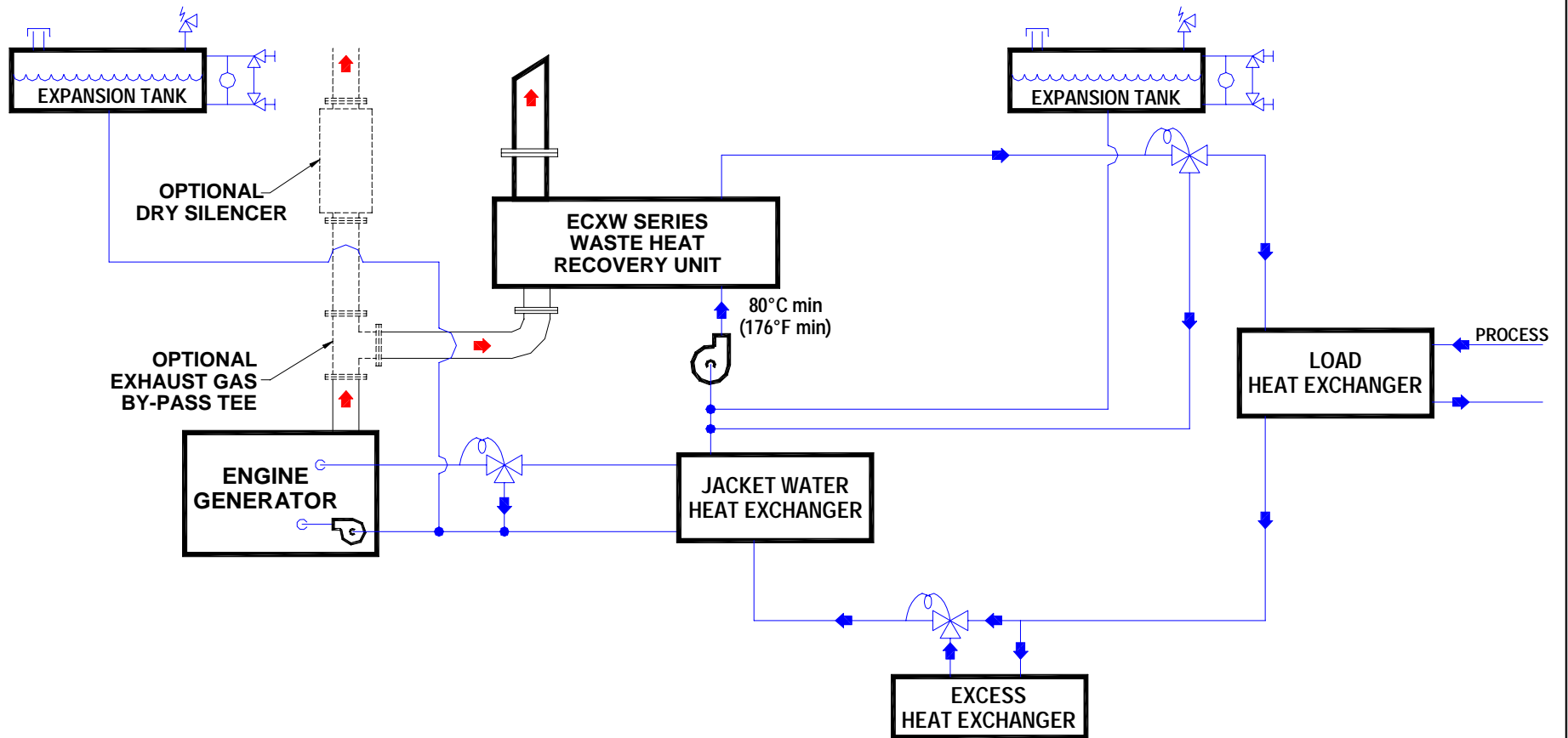
# HOT WATER SYSTEMS

## TYPICAL SCHEMATIC JACKET WATER AND EXHAUST



# HOT WATER SYSTEMS

## TYPICAL SCHEMATIC JACKET WATER AND EXHAUST



**- Model ECXW -**

**Exhaust Waste Heat Recovery Silencers For Hot Water Service**

**Unit Orientation:**    *Vertical*    *Horizontal*

**Engine Data Required For Sizing**

Due to the many options available from current engine models, it is important that you obtain the heat balance information from the engine dealer/manufacturer which includes the data listed below:

<b>Engine Make/Model:</b>			
<b>Rating:</b>	_____ <i>kWe(BHP)</i>	_____ <i>RPM</i>	
<b>Fuel:</b>	<input type="checkbox"/> <i>rich burn</i>	<input type="checkbox"/> <i>diesel</i>	<input type="checkbox"/> <i>low emission gas</i>
	<input type="checkbox"/> <i>dual fuel</i>	<input type="checkbox"/> <i>heavy fuel</i>	<input type="checkbox"/> <i>other</i> _____

	<u>Value</u>	<u>Units</u>
<b>Exhaust gas flow:</b>		#/HR
<b>Exhaust gas temperature:</b>		°F
		°C
<b>Exhaust gas pressure drop limitation for exhaust waste heat recovery silencers:</b>		"H <sub>2</sub> O
<b>Water flow:</b>		GPM
<b>Water inlet temperature:</b>		°F
		°C
<b>Percent (%) of glycol, if any:</b>		%
<b>Water side pressure drop limitation:</b>		PSIG

**Additional Information Required If Bidding to A Specification:** \_\_\_\_\_

All specifications pertaining to the exhaust waste heat recovery silencer including specification on insulation, drawings showing installations of exhaust waste heat recovery silencer.

**- Model VP -**

**Packaged Jacket Water & Exhaust Waste Heat Recovery Units**

<b>Unit Orientation:</b>	<input type="checkbox"/> Vertical	<input type="checkbox"/> Horizontal
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**Engine Data Required For Sizing**

Due to the many options available from current engine models, it is important that you obtain the heat balance information from the engine dealer/manufacturer which includes the data listed below:

<b>Engine Make/Model:</b>			
<b>Rating:</b>	_____ <i>kWe(BHP)</i>	_____ <i>RPM</i>	
<b>Fuel:</b>	<input type="checkbox"/> rich burn	<input type="checkbox"/> diesel	<input type="checkbox"/> low emission gas
	<input type="checkbox"/> dual fuel	<input type="checkbox"/> heavy fuel	<input type="checkbox"/> other _____

	<u>Value</u>	<u>Units</u>
<b>Exhaust gas flow:</b>		#/HR
<b>Exhaust gas temperature:</b>		°F
		°C
<b>Exhaust gas pressure drop limitation for exhaust waste heat recovery silencers:</b>		"H <sub>2</sub> O
<b>Jacket Water Heat Rejection:</b>		BTU/HR
<b>If system is to be pumped, give max jacket water flow:</b>		GPM
<b>Feed water temperature:</b>		°F
		°C
<b>Engine jacket water outlet temperature limitation (out of the top of the engine) :</b>		°F
		°C
<b>Design pressure (if other than our 20 PSIG standard) :</b>		PSIG

**Additional Information Required If Bidding to A Specification:**

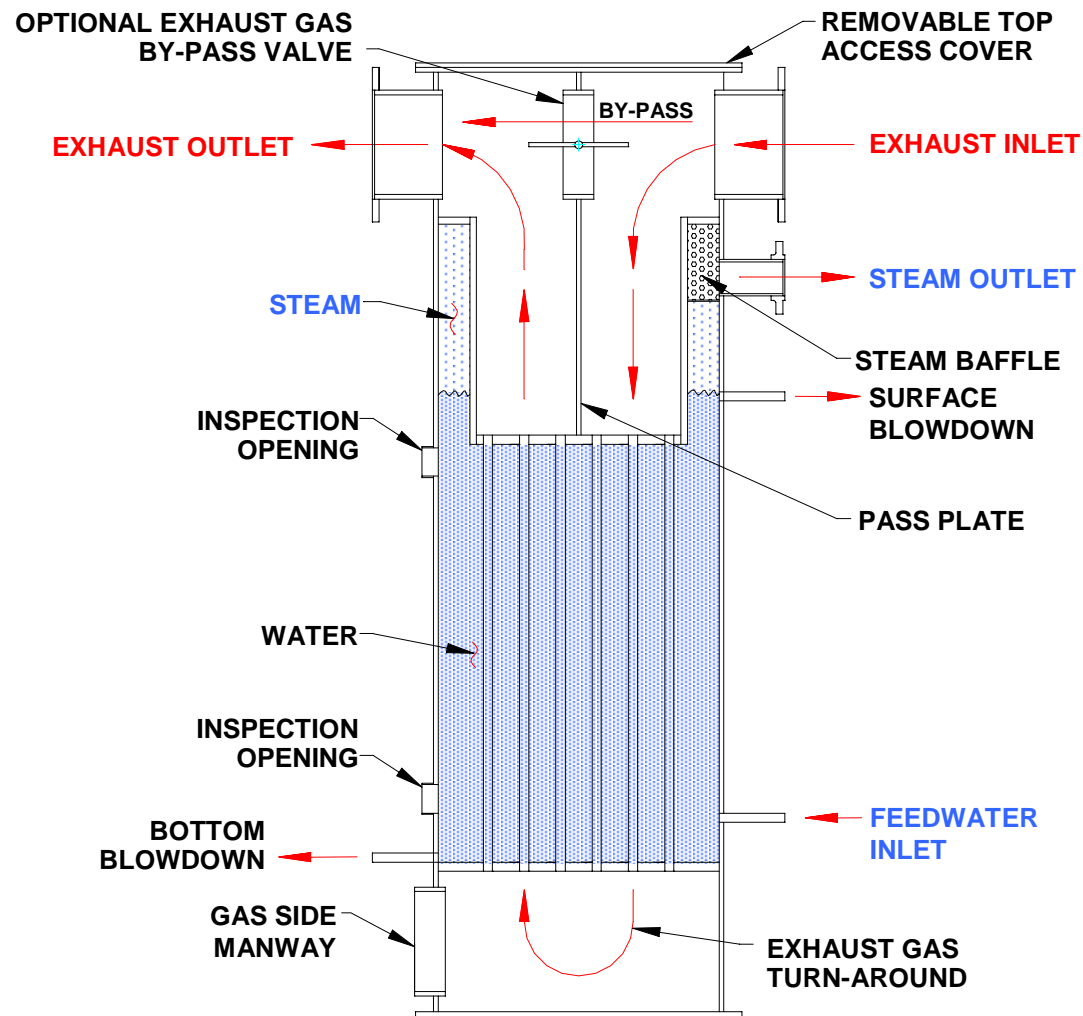
All specifications pertaining to the exhaust waste heat recovery silencer including specification on insulation, water level controls, steam trim & drawings showing installations of exhaust waste heat recovery silencer.

**125 PSIG STEAM SYSTEMS**  
**RECIPROCATING ENGINE STEAM GENERATOR EXHAUST  
WASTE HEAT RECOVERY UNIT**



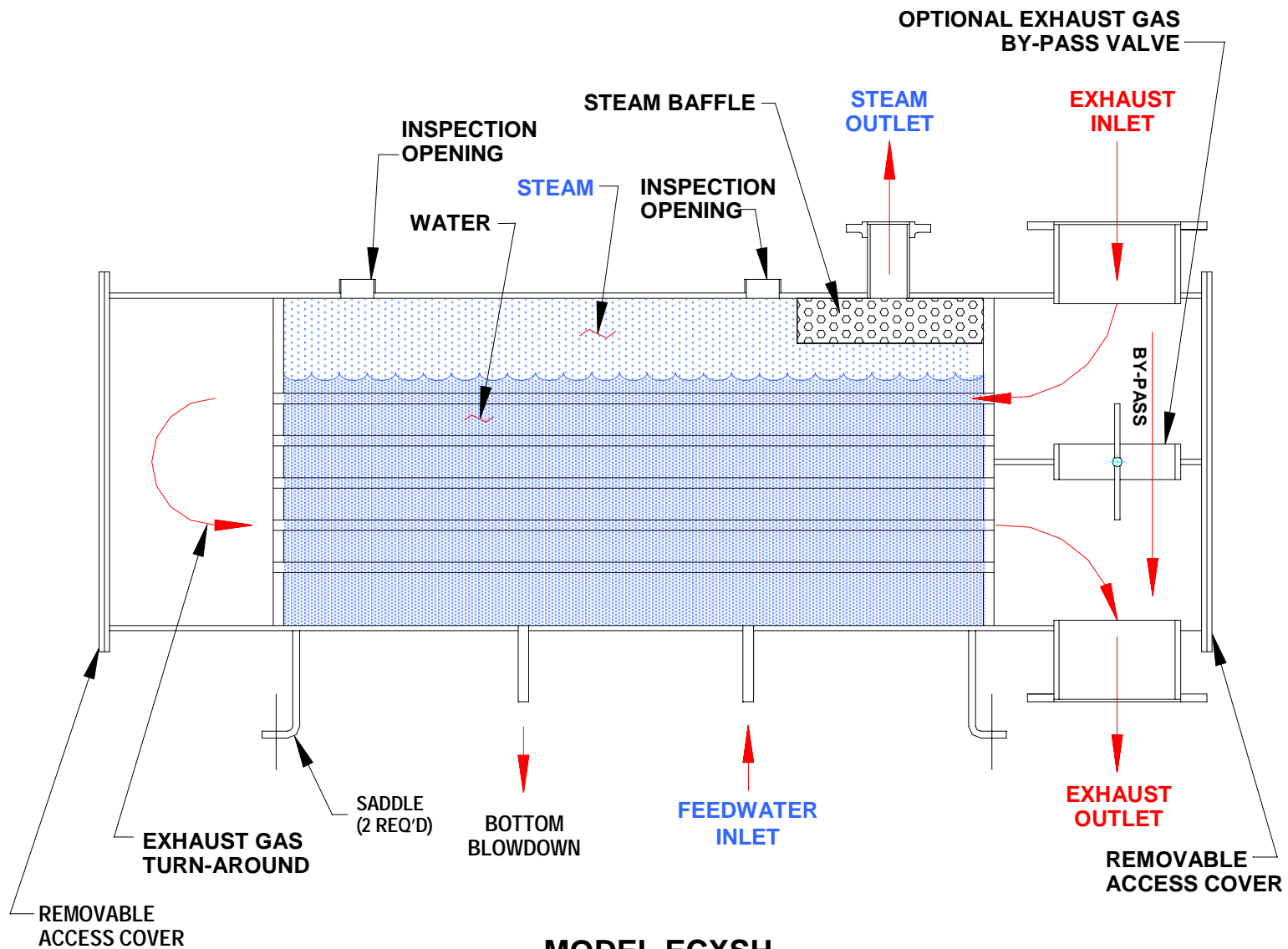
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# CROSS-SECTIONAL VIEW OF 2-PASS ECXSV EXHAUST WASTE HEAT RECOVERY SILENCER FOR STEAM SERVICE WITH INTERNAL EXHAUST BY-PASS



**MODEL ECXSV**

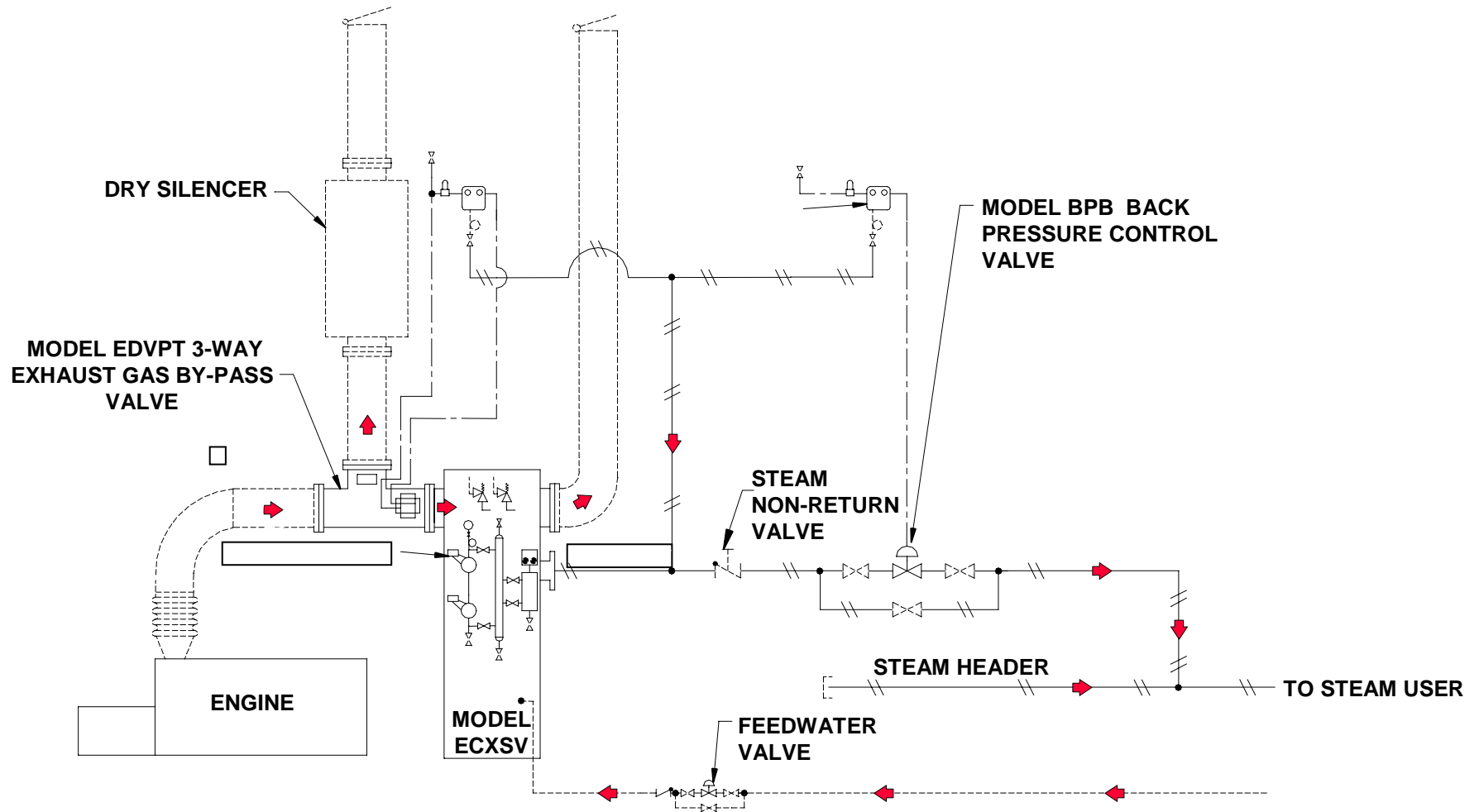
# CROSS-SECTIONAL VIEW OF 2-PASS ECXSH EXHAUST WASTE HEAT RECOVERY SILENCER FOR STEAM SERVICE WITH INTERNAL EXHAUST BY-PASS



**MODEL ECXSH**

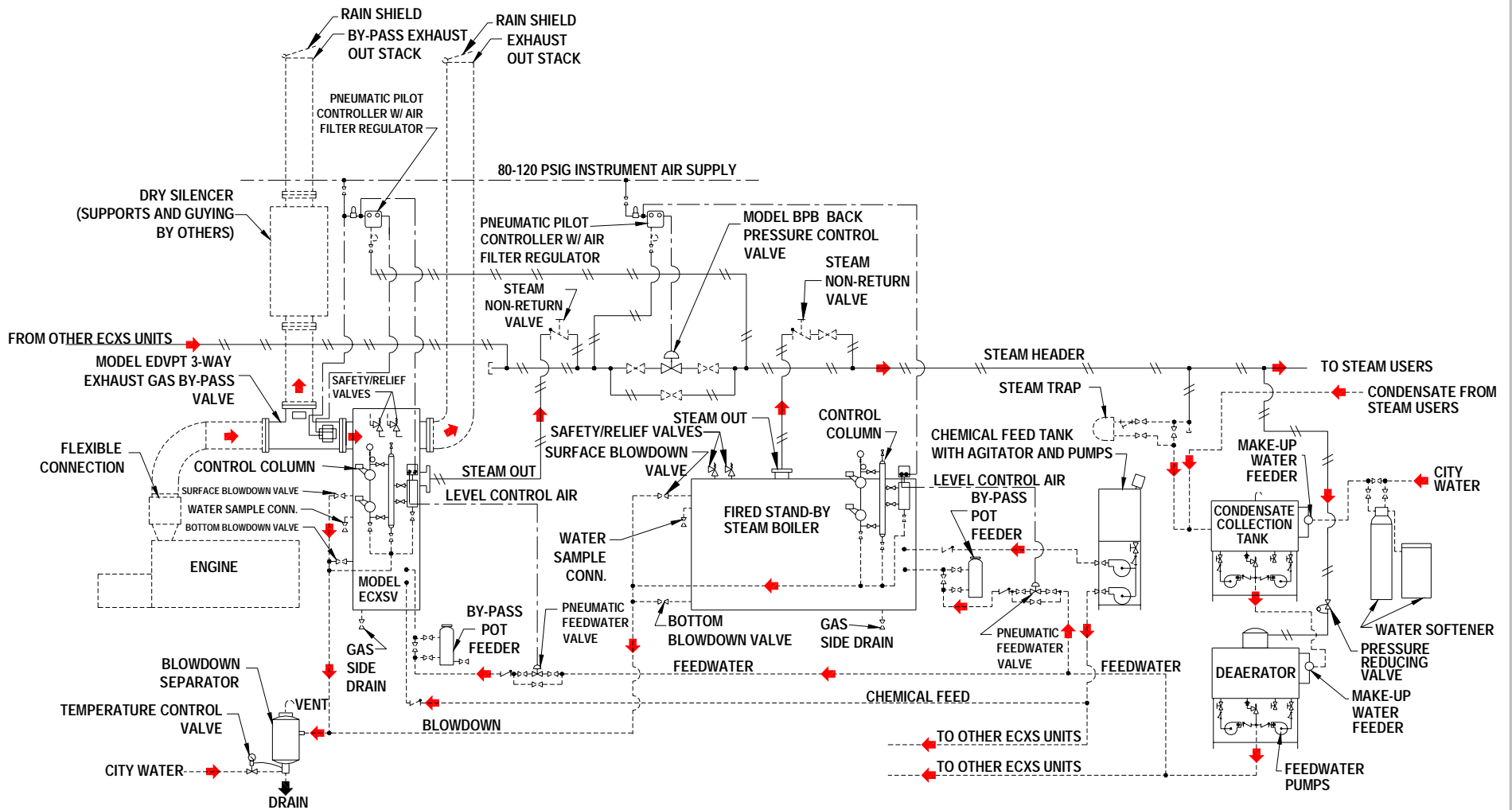
## 125 PSIG STEAM SYSTEMS

### TYPICAL SYSTEM SCHEMATIC FOR RECIPROCATING GAS ENGINE EXHAUST WASTE HEAT RECOVERY SILENCER



# 125 PSIG STEAM SYSTEMS

## TYPICAL SYSTEM SCHEMATIC FOR 2-PASS EXHAUST WASTE HEAT RECOVERY SILENCER FOR STEAM SERVICE WITH STAND-BY BOILER AND ACCESSORIES



**- Model ECXS -**

**Exhaust Waste Heat Recovery Silencers For Steam Service**

<b>Unit Orientation:</b>	<input type="checkbox"/> Vertical	<input type="checkbox"/> Horizontal
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**Engine Data Required For Sizing**

Due to the many options available from current engine models, it is important that you obtain the heat balance information from the engine dealer/manufacturer which includes the data listed below:

<b>Engine Make/Model:</b>			
<b>Rating:</b>	_____ <i>kWe(BHP)</i>	_____ <i>RPM</i>	
<b>Fuel:</b>	<input type="checkbox"/> <i>rich burn</i>	<input type="checkbox"/> <i>diesel</i>	<input type="checkbox"/> <i>low emission gas</i>
	<input type="checkbox"/> <i>dual fuel</i>	<input type="checkbox"/> <i>heavy fuel</i>	<input type="checkbox"/> <i>other</i> _____

	<u>Value</u>	<u>Units</u>
<b>Exhaust gas flow:</b>		#/HR
<b>Exhaust gas temperature:</b>		°F
		°C
<b>Exhaust gas pressure drop limitation for exhaust waste heat recovery silencers:</b>		" H <sub>2</sub> O
<b>Actual operating steam pressure:</b>		PSIG
<b>Feed water temperature:</b>		°F
		°C
<b>*Required design pressure: (Std-15/150/250)</b>		PSIG

\* *Design pressure is the pressure at which the safety valves are set and cannot be operated at that pressure without the safety valves popping:*

- 15 PSIG units can only operate at about 12 PSIG and below.
- 150 PSIG units can only operate at about 140 PSIG and below.
- 250 PSIG units can only operate at about 235 PSIG and below.

**Additional Information Required If Bidding To A Specification:**

All specifications pertaining to the exhaust waste heat recovery silencer including insulation, and drawings showing installations of exhaust waste heat recovery silencer.



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Thank you.