

Changes shown by ↕

SCOPE

- I 1.1 This practice covers the design and installation of closed cooling water systems for internal combustion engines, integral gas engine compressors, and reciprocating compressors. It **does not apply** to compressor intercooling and aftercooling facilities.
- I 1.2 An asterisk (*) indicates that additional information is required. If a job is contracted, this additional information is furnished in the Job Specification.

SUMMARY OF ADDITIONAL REQUIREMENTS

- I 2.1 **Table 1** lists the standards which shall be used with this practice.

TABLE 1

STANDARDS			
API Standard 661		ASTM Standards (Cont) B 171 / B 171M Copper-Alloy Condenser Tube Plates B 584 Copper Alloy Sand Castings for General Application	
ASTM Standards B 111 / B 111M Copper and Copper-Alloy Seamless Condenser Tubes and Ferrule Stock B 169 / B 169M Aluminum Bronze Plate, Sheet, Strip and Rolled Bar		TEMA Standards Standards of the Tubular Exchanger Manufacturers Association	

MATERIALS

- R * 3.1 **Materials for shell and tube coolers** shall be as follows:
- a. If fresh water cooling is specified, components shall be of carbon steel.
- b. If salt or brackish water cooling is specified, components shall be of the following materials:

SHELL	CHANNELS AND COVERS		TUBESHEETS		TUBES	
	Materials	Specification	Material	Specification	Material	Specification
Carbon Steel	Acid Resisting Bronze or Aluminum Bronze	ASTM B 584 Alloy C92200 ASTM B 169 Alloy C61400	Naval brass	ASTM B 171 Alloy C46400	Inhibited Admiralty	ASTM B 111 Alloy C44300 C44400, or C44500

- R 3.2 **Materials for air-cooled heat exchangers** shall be as follows:
- a. Headers shall be of carbon steel.
- b. Tubes shall be of carbon steel, with aluminum fins.
- R 3.3 **Cooling water system piping** shall be carbon steel, Schd. 40 minimum wall thickness.
- R 3.4 Materials of system components shall be suitable for the cooling water treatment.

DESIGN

COOLING SYSTEM

- C 4.1 **One or two engine installations** shall be furnished with a complete manufacturer's standard cooling system for each engine.
- R,M ↕ * 4.2 **Installations** for reciprocating compressors and three or more engines, when specified, shall have the system shown in **Figure 1**. The system shall be capable of providing the following:
- a. Cooling water for reciprocating compressor cylinder jackets.
- b. Cooling water for engine cylinder jackets.
- c. Cooling water for oil coolers.
- d. Water for cooling compressor packing boxes, or in the case of refrigeration service, water to warm the packing.

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- R 4.3 **Capacity of system.** The system shall be designed to meet the following operating conditions:
- For engines, the inlet water temperature to cylinder jackets shall be maintained at 145°F to 155°F (63°C to 68°C).
 - For reciprocating compressors, the inlet water temperature to cylinder jackets shall be maintained at about 10°F (6°C) above the maximum specified suction temperature.
 - The water temperature rise shall be no more than 15°F (8°C) through the cylinder jackets.
- I 4.4 **Working and test pressures.** The system shall be designed for not less than 100 psig (650 kPa) working pressure, and a hydrostatic test pressure of 150 psig (975 kPa).
- R 4.5 **Vapor phase cooling systems** are not permitted.

COOLERS

- R,M 4.6 **Shell and tube coolers** shall be per the following minimum requirements:
- Design and construction per **TEMA** Class C.
 - Tube diameter 5/8 in. OD (16 mm).
 - Tube wall thickness 0.049 in. (1.24 mm).
 - Tube bundles shall be removable.
- R,M 4.7 **Air cooled heat exchangers** shall be per the following minimum requirements:
- Design and construction per **API 661**.
 - Tube diameter 3/4 in. OD (19 mm).
 - Tube wall thickness 0.083 in. (2.1 mm)

COOLING WATER RESERVOIR

- O 4.8 **Location of cooling water reservoir.** The system reservoir should be located above the highest point in the system.
- O 4.9 **The working capacity of the reservoir** shall be at least equal to the normal capacity of the pump per minute.
- O 4.10 **A gage glass** shall be provided for the **reservoir**, and shall be of sufficient length to cover the following:
- Working range of the reservoir.
 - Normal expansion and contraction within the system.
 - The rundown from the system when all engines are idle.
- O 4.11 **A reservoir vent** shall be provided, and shall have a diameter of not less than 1/2 the diameter of the pump suction line.
- O 4.12 **A continuous slope** shall be provided **from the reservoir** down to the suction connection of the pump.

CIRCULATING PUMPS

- I,R * 4.13 **Two pumps shall be provided.** The **main pump** shall be motor driven; the **spare pump** shall be steam turbine driven if a secondary selective electric system is not provided.
- O,R 4.14 **The spare pump shall start automatically** on loss of pressure in the discharge line of the main pump.
- R 4.15 **Both pumps** shall have **mechanical seals**.

Revision Memo

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Par. 4.2 revised to cover any number of reciprocating compressors. **Par. 4.4** revised to reflect design pressures required for API cooling systems.

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