

SCOPE

- I 1.1 This practice covers the design, fabrication, and inspection of mechanical agitators.
- I 1.2 **An asterisk (*)** indicates that a decision by the Purchaser is required or that additional information is furnished by the Purchaser.

SUMMARY OF ADDITIONAL REQUIREMENTS

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

↗ *

TABLE 1

PRACTICES	
IP 2-1-1	Plant Noise Design Criteria
IP 3-16-1	Flanged Joints, Gaskets, and Bolting
IP 18-12-1	Positive Material Identification
IP 20-1-1	Inspection of Equipment and Materials
CODES AND STANDARDS	
AGMA Standard	
420	Enclosed Speed Reducers and Increasers Using Spur, Helical, Herringbone and Spiral Bevel Gears
ASME Codes	
Section VIII	Pressure Vessels, Division 1
Section IX	Welding and Brazing Qualifications
ANSI/ASME Standard	
B1.20.1	Pipe Threads, General Purpose (Inch)
ASTM Standards	
A 395	Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures
B III / B IIIM	Copper and Copper Alloy Seamless Condenser Tubes and Ferrule Stock

- I * 2.2 **Table 2** lists the practices which shall be used with this practice **as specified** by the Purchaser.

↗ *

TABLE 2

PRACTICES	
IP 16-9-1	Low Voltage A-C Motors Up to 200 HP (150 kW)
IP 16-9-2	A-C Motors: Medium Voltage and Low Voltage Over 200 HP (150 kW)
IP 18-10-1	Additional Requirements for Materials

- I * 2.3 The vendor shall comply with any **local rules or regulations** specified by the Purchaser.

DOCUMENTATION

PROPOSAL INFORMATION

- O,R 3.1 Vendor's proposal shall specify any **requirements for externally supplied lubrication, barrier fluid, or flushing for a mechanical seal or a packed stuffing box**. Proposal shall describe components required for the external supply system, such as reservoirs, instrumentation, pumps, filters, and piping.
- O,R 3.2 Vendor's proposal shall specify the type of **rust preventive** to be applied to the **agitator interior and bearing surfaces**.

MATERIALS

- S * 4.1 **Low temperature materials.** If mixing temperatures are below -20°F (-29°C), ferrous materials used for pressure containing parts shall comply with the requirements of [IP 18-10-1](#).

IP 10-9-1		Mechanical Agitators	
Page 2 of 7			
Rev. 1	March 1998		

(This practice is appropriate for attachment to Inquiry or Purchase Document)

- S,E * 4.2 **Pressure casings** shall be of carbon or alloy steel for **flammable or toxic services**.
- I 4.3 Bolting shall be selected per **IP 3-16-1**.
- I 4.4 Gasket materials shall be per **IP 3-16-1**.
- R 4.5 Gasket and O-Ring materials shall have suitable resistance to chemical and temperature attack.
- R,M * 4.6 Unless otherwise specified, seal sleeves and miscellaneous components such as drive pins, anti rotation pins, internal set screws and the like shall have strength and corrosion resistance of AISI Type 316 stainless steel or better.
- R,M * 4.7 Unless otherwise specified, gland plate material shall be Type 316 stainless steel. Gland plates for alloy agitators shall be of the same alloy as the casing.
- I * 4.8 **Shaft and mixing element** materials will be specified.
- M 4.9 **Sleeve nuts**, if used, shall be made of a material capable of withstanding external corrosion.

DESIGN

- R,M * 5.1 **Agitators** shall be suitable for **outdoor installation** for the **climatic zone** specified.
- S * 5.2 **Pressure containing components**, including mounting flanges, shall be suitable for the design pressure and temperature of the mixing vessel. Flange rating, facing, and finish, will be specified.

"IN-LINE" BLENDERS

- M * 5.3 **Pressure casings** shall have a **corrosion allowance** equal to the connecting piping, but not less than 1/8 in. (3 mm).
- I 5.4 **Pressure casings** shall be designed per **ASME Code Section VIII** or other pressure vessel code which is accepted where the equipment is to be located.
- M 5.5 **Pipe threads** shall be tapered per **ANSI B1.20.1**.

ASSEMBLY AND DISASSEMBLY

- R,M 5.6 The following **design criteria** shall be observed for **agitators mounted external to tanks or vessels**:
- Replacement of bearings, shaft sealing devices, gear unit, and driver shall be possible without dismantling other major parts of the unit, and without emptying or depressurizing the vessel.
 - Connection of the drive shaft to the agitator shaft shall be outside the pressure vessel.
 - Component parts shall be provided with means to insure accuracy of realignment during reassembly.
 - All support rod turnbuckles shall have locknuts.
 - The shaft/paddle assembly shall be designed to be removed without requiring dismantling. The assembly shall be extractable through its mounting hole.

COOLING FACILITIES

- I * 5.7 **Liquid-cooling jackets** for stuffing boxes, bearings, etc., and oil coolers shall be designed for not less than 100 psig (690 kPa) working pressure or 150 psig (1030 kPa) test pressure.
- R 5.8 **Coils**, if provided for oil cooling, shall be of inhibited admiralty metal, ASTM B III Alloy C 44300, C 44400, or C 44500.
- R 5.9 **Pipe connections** inside the bearing housing are prohibited.
- R,M 5.10 **Oil-lubricated bearings** shall be equipped with constant level oilers and a threaded oil filling connection. Large oil sumps may be fitted with an oil level indicating gage. The recommended oil quantity level shall be marked.
- M 5.11 **Sleeve bearings** shall be renewable insert type.
- R 5.12 **Lubrication**. If pressure type, the furnished system shall include the reservoir, pump, cooler, filter, and necessary controls and instruments.

SHAFTS, SHAFT SLEEVES AND MIXING ELEMENT

- R 5.13 **Shafts and shaft sleeves shall be finished** at the bearing and seal surfaces.
- R,M 5.14 **Shaft sleeves shall be installed** as follows:
- Sleeves shall be locked to the shaft and sealed at one end.
 - The end of the shaft-sleeve assembly (or nut) shall extend beyond the outer face of the packing gland, so that any leakage between the shaft and the sleeve cannot become confused with leakage through stuffing box packing.
- R 5.15 **Antifriction bearings** shall provide a minimum L_{10} **rating life** of 25,000 hours in continuous operation at rated load. L_{10} rating life is defined for this purpose as the number of hours at constant speed that 90% of a group of identical bearings will complete or exceed before the first evidence of failure.

SHAFT SEALING AND LUBRICATION

- O,R 5.16 **External lubrication** shall be provided for any **shaft seal** operating in a gas zone of a vessel, or in the liquid zone of a vessel containing non-lubricating fluids.
- M 5.17 **Lubrication facilities or devices** shall be automatic, and supply lubrication requirements for a minimum of one week without refilling.

MECHANICAL SHAFT SEALS

- R,M 5.18 Mechanical seals shall be furnished unless otherwise specified. Cartridge type is preferred.
- R 5.19 Hydraulically balanced mechanical seal designs shall be used for sealing pressures above 75 psig (517 kPa).
- R 5.20 Face materials shall be premium carbon on SiC unless otherwise specified. If not compatible, seal vendor shall propose an alternate for review and approval by the Owner's Engineer.
- S [5.21](#) **Seal parts**, including non-metallic parts, shall be inert to the fluids being mixed and to any lubricant.
- R * 5.22 **A throttle bushing** shall be provided for single and double seals unless auxiliary packing is specified as the auxiliary containment device. The bushing shall be pressed into the seal plate from the inside against an outside shoulder to prevent blow-out.
- I * 5.23 **Sealing liquid for double mechanical seals** will be provided from one of the following sources, as specified:
- From an external process stream, with piping and instrumentation provided by Purchaser.
 - From an auxiliary, self-contained seal oil system, including reservoir. Pumping or other pressurization equipment, instrumentation, and piping, shall be provided by the Purchaser or vendor, as specified.
- R 5.24 The mechanical seal cavity shall be self venting or provided with a vent connection.

CRITICAL SPEED

- O,R 5.25 **First lateral critical speed** shall not be less than 140% of the maximum operating speed.

SHUT-OFF DEVICES

- R,M 5.26 **Metal sealing faces and all sliding surfaces**, in any shutoff device, shall be corrosion resistant.
- R 5.27 A means shall be provided for **testing the effectiveness of the shut-off device** after it has been applied, and prior to servicing the agitator.