

SCOPE

- I 1.1 This practice covers the design and selection of level instruments, including level gauges and switches. It does not cover the selection of level instruments for storage tanks, which is covered by [IP 15-1-3](#).
- I 1.2 **An asterisk (*)** indicates that either a decision by the Owner's Engineer is required, that additional information is to be furnished by the Owner's Engineer, or that information for Owner's Engineer approval is to be supplied by the vendor or Purchaser.

SUMMARY OF ADDITIONAL REQUIREMENTS

- I 2.1 [Table 1](#) lists the practices and standards which shall be used with this practice.
- I * 2.2 [Table 2](#) lists the practices which shall be used with this practice as specified by the Purchaser.

TABLE 1

PRACTICES	
IP 3-6-1	Piping for Instruments
IP 3-9-1	Winterizing and Protection Against Ambient Temperatures
IP 3-16-1	Flanged Joints, Gaskets, and Bolting
IP 15-6-1	Electronic and Pneumatic Instruments
IP 16-5-1	Lighting
IP 20-1-1	Inspection of Equipment and Materials
STANDARDS	
ASME Standards	
B1.20.1	Pipe Threads, General Purpose
B31.3	Process Piping
API Standard	
RP 551	Process Measurement Instrumentation

TABLE 2

PRACTICES	
IP 7-2-1	Industrial Boilers
IP 15-7-2	Protective Systems

BASIC DESIGN

- S [3.1](#) **Pressure / temperature rating** of level instruments, switches and gauges shall be equal to or greater than the pressure / temperature rating of the vessel to which they are connected.
- R [3.2](#) **Materials of construction** shall be compatible with the service conditions.
- S [3.3](#) **Pressure retaining welds** on all instruments shall be **full penetration** welds and shall be in compliance with the requirements of **ASME B 31.3**, Process Piping.
- S * [3.4](#) **Insertion type level instruments** shall be equipped with a blowout prevention device, such as a mechanical stop or safety chain. Insertion type instruments that are installed in a toxic or flammable service and rely on a non fire resistant elastomer seal (PTFE, for example) for process pressure containment, shall be equipped with a secondary seal that will prevent the process fluid from being released in the event that the instrument is subjected to a fire. The use of insertion type level instruments shall be approved by the Owner's Engineer.

CONTINUOUS LEVEL INSTRUMENTS

- O,C 4.1 **Either differential type or external displacer** instruments are preferred for measurement ranges up to 48 in. (1200 mm). For ranges greater than 48 in. (1200 mm), differential type instruments are preferred. The minimum range and connection spacing for an external displacer type instrument shall be 14 in. (350 mm).

IP 15-5-1		Level Instruments	
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(This practice is appropriate for attachment to Inquiry or Purchase Document)

- R,M 4.2 **Connections for external displacer type instruments** shall be NPS 2 (50 mm) minimum size, flanged. Top-side and bottom connections are preferred.
- M 4.3 **Rotatable head construction** is required for external displacers.
- O 4.4 **External displacer type** instruments shall not be used in services where the fluid in the chamber **may boil** under service conditions.
- O 4.5 A **suppression or elevation adjustment** shall be supplied for differential type instruments in level service. Suppression or elevation shall be adjustable when the instrument is in service and under pressure.

LOCAL CONTROLLERS

- O * 5.1 **Proportional control action** adjustable to 100% maximum proportional band and without automatic reset shall be provided for level control applications where the outflow goes to sewer or storage directly (through no process equipment), and for level ranges corresponding to ten seconds or less holdup time. For all other level control applications, proportional action adjustable up to 300% proportional band minimum and reset adjustable down to 0.05 repeats per minute (integral action 20 minutes per repeat) or less shall be provided.

LEVEL SWITCHES

- O,R * 6.1 **External float or displacer type** switches are preferred. Other types of switches require approval by the Owner's Engineer.
- I 6.2 **Level switch** connections at the external chamber shall be a minimum of 1 in. (25 mm).
- R 6.3 **Level switch electrical contacts** shall be **hermetically sealed**. Temperature and contact-ratings shall be suitable for the service specified. Mercury type switches are not permitted.

LEVEL GAUGES

GENERAL

- O * 7.1 **Level gauges** shall be of sufficient length to **provide complete coverage of the range of the associated level instrument**.
- O,M * 7.2 **Separate valving** shall be provided for the **level instrument** and its **associated level gauge**. The use of a **bridle assembly** to reduce the number of vessel connections is acceptable, when approved by the Owner's Engineer.
- S * 7.3 **Level gauges** shall be **hydrotested** to 1.5 times the process design pressure by the manufacturer prior to shipment. The manufacturer shall include the hydrotest documentation with shipment.
- O,R * 7.4 **Magnetic type level gauges** shall be considered for all services but in particular for:
 - a. Cryogenic services
 - b. Fluids that attack glass (e.g., strong acids, alkalies, boiler feed water)
 - c. Light ends services
 - d. Toxic services
 - e. Pressures above 500 psig (3450 kPa)
 - f. Temperatures above the auto-ignition point

SPECIAL REQUIREMENTS FOR GAUGE GLASSES

- S 7.5 **Reflex type gauge glass columns** shall have the minimum pressure rating of 1000 psig (6900 kPa) at 600°F (315°C). **Thru-vision type gauge glass columns** shall have the minimum pressure rating of 550 psig (3800 kPa) at 600°F (315°C).
- S,O 7.6 A **gauge glass unit length** of approximately 12.5 in. (300 mm) visible length shall be used. **No more than five units may be used in one column**. When **two or more columns are required to cover a longer range**, the visible portion of the gauge glasses shall overlap at least 1 in. (25 mm).
- S 7.7 **Above 400°F (205°C) operating fluid temperature**, a single gauge glass column shall not contain more than three units nor exceed 48 inches (1200 mm) between gauge glass column connections.
- S 7.8 **Armored type** gauge glasses shall be used. **Tubular type** is not permitted.
- O * 7.9 **Frost shields** shall be used if specified operating temperature is below 32°F (0°C).