13-Level Applications for Natural Gas Processing

Let's dig into the actual level controls in these applications that are crucial for both process control and safety shutdown systems.

1 – Inlet Separators

Separators are large drums designed to separate well streams into their individual components. They are designed to separate 2-phase (gas/liquid) or 3-phase (gas/crude/water) well streams.
Separators are also classified according to horizontal or vertical configuration, operating pressure, turbulent or laminar flow, and test or production separation.

Challenges: Level measurement will actuate a valve to adjust vessel level. An emulsion layer along the oil/water interface can contaminate the oil with water or the water with oil. Foaming along the gas & liquid interface, if entrained, can cause liquid carryover or gas blowby.

There are two principal types of separators-Vertical and Horizontal.

Vertical separators can accommodate large sums of liquids, are well suited for high sediment loads, and are preferred when well streams have large liquid-to-gas ratios. Horizontal separators are ideal for 3-phase separation due to their large interfacial area between two liquid phases, and are preferred when well streams have high gas-to-oil ratios.

Solutions: Point level switches for interface along with guided wave radar and rf capacitance level transmitters help determine continuous level of each media.

2 – Chemical Injection

Chemical agents are frequently administered by chemical injection skids. Chemicals employed in natural gas processing include drilling fluid additives, methanol injection for freeze protection, glycol injection for hydrate inhibition, produced water treatment chemicals, foam and corrosion inhibitors, de-emulsifiers, desalting chemicals and drag reduction agents.

Challenges: Level monitoring controls chemical inventory and determines when the tanks require filling. The careful selection and application of level controls to chemical injection systems can effectively protect against tanks running out of chemicals or overfilling.

Solutions: Ultrasonic & thermal level switches for low/high level detection and control. Guided wave radar & ultrasonic level transmitters help determine continuous level.

3 – Amine Separation (Sour Gas Treatment)

Pipeline specifications require removal of CO2 and H2S. H2S is highly toxic and corrosive to carbon steel. CO2 is corrosive and reduces BTU value. Gas sweetening processes remove these acid gases for marketability and pipeline distribution.

Challenges: Amine treatment removes these acids through absorption and chemical reaction. Four common amines (MEA, DEA, DGA & MDEA) offer distinct advantages in specific applications.

Solutions: Ultrasonic gap and thermal switches along with guided wave radar level transmitters offer detection, control & continuous measurement for reactors, separators, absorbers, scrubbers and flash tanks.

4 – Sulfur Recovery

A sulfur recovery unit converts H2S in the acid gas into elemental sulfur. Three processes are used for recovery of elemental sulfur and sulfuric acid. Residual gas (aka tail gas) is eventually processed in a gas treatment unit.

Challenges: The sulfur condenser vessel is equipped with a disengagement section on the outlet end to allow for

efficient separation of the liquid sulfur from the process gas. A collection vessel is used to store and remove sulfur product from the process.

Solutions: Thermal level switches along with ultrasonic and guided wave radar transmitters are used to detect and measure continuous level of sulfur and sulfuric acid.

5 – Gas Dehydration

Natural Gas Dehydration removes hydrates which can grow crystals and plug lines and slow down flow of gaseous hydrocarbon streams. Dehydration also reduces corrosion, eliminates foaming, and prevents problems with catalysts downstream. Compressor stations often use a liquid separator to dehydrate natural gas prior to compression.

Challenges: The most common method for dehydration is the absorption of water vapor in the liquid desiccant glycol. The withdrawal of the water-rich glycol from the bottom of the absorber is done via level control.

Solutions: Ultrasonic and thermal switches along with guided wave radar facilitate level control for high and low levels for the reboiler, surge tank and flash separator.

6 – Natural Gas Liquids Recovery & Storage

Separating the hydrocarbons and fluids from pure natural gas produces pipeline quality dry natural gas. Absorption and cryogenic expander are the two methods used for removal of natural gas liquids.

Absorption is similar to dehydration except that an absorbing oil is used instead of glycol. Once NGLs have been removed from the natural gas stream, they must be separated out.

Challenges: Absorption method level control is typically found on flash drums, separation towers and reflux systems. Cryogenic method level control is applied to the separator and dehydrator.

Solutions: Ultrasonic and thermal level switches for point level and guided wave radar transmitters are used for drums, towers, separators & dehydrators.

7 – Vapor Recovery Unit (Flash Drum)

A Vapor Recovery Unit (VRU) captures valuable VOC's and other rich gas streams that may be a significant environmental pollutant. A VRU collects from storage and loading facilities, re-liquifies the vapors and returns the liquid hydrocarbons back to storage.

Challenges: A VRU is a simple, economical process that provides EPA compliance and improves operating economies by capturing up to 95% of fugitive emissions. Critical to the VRU is the flash drum where vapors are re-liquified.

Solutions: Liquid level control with thermal switches and continuous level measurement with guided wave radar are essential for the flash drums

8 – Storage Tanks

Natural gas, oil, liquid fuel, treatment chemicals, extracted condensate from separators and water are stored in gas fields. Diesel generator fuel, potable water, and fire water are also stored in tanks.

Challenges: Overflow control and alarm systems or shutdown pumps are needed to maintain specified levels. Detection of Oil/Water interface during dewatering and control of the water draw-off is also essential

Solutions: Ultrasonic gap and thermal switches sense the beginning of interface along with radar level transmitters for levels of tanks and shutdown pumps.

9 – Water Processing

Produced water, wash-down water or collected rainwater require treatment whether they are disposed of or used for reservoir flooding. Water collected from process operations contains high concentrations of hydrocarbons unsafe for discharge. Well injection is hindered by suspended hydrocarbon droplets in water.

Challenges: Water is the main product in skim tanks, precipitators, coalescers, flotation units, collection tanks and sumps. Proper draining of clean water and removal of residual oil becomes essential.

Solutions: Interface level measurement with RF capacitance or guided wave radar help continuously measure these levels along with thermal switches for control of the tanks.

10 – Compressor Lubrication Tank

Lubrication systems help the equipment run cooler and more efficiently. A wide variety of lubricants vary by ISO grade, viscosity, flash point and formulation.

Lubricating fluids are normally stored in integral SS or CS tanks or remote bulk storage tanks.

Challenges: Proper functioning of compressors are determined by monitoring lubricant reservoirs. Controls need to be removed frequently to change ISO grade lubricants.

Solutions: Thermal switches for level control and continuous guided wave radar transmitters are employed for integral and remote bulk storage tank level measurement.

11 – Compressor Scrubber

A typical compressor station consists of an inlet scrubber to collect liquids and slugs that may have formed in the gas pipeline. The scrubber consists of a primary section where liquids and solid parts are separated from the gas stream and a secondary section where the oil mist is removed from the pipeline.

Challenges: The liquids collected from the suction scrubber are routed to a low-pressure tank. The vapors produced from the flashing liquids are sent to a flare.

Solutions: Low/High thermal level switches for the scrubber tank and continuous level monitoring with guided wave radar transmitters ensure these liquid tanks are monitored prior to periodically being unloaded and trucked out.

12 – Compressor Waste Liquid

Liquid waste from compressor station scrubbers & filters can be condensates or hydrocarbons from the natural gas. The wastes are collected in one or several tanks depending on the size of the remote station. Waste tank trucks are scheduled for emptying operations that are classified as hazardous materials.

Challenges: These condensed hydrocarbons and condensed water tanks can overflow or run pumps dry when the level becomes too low.

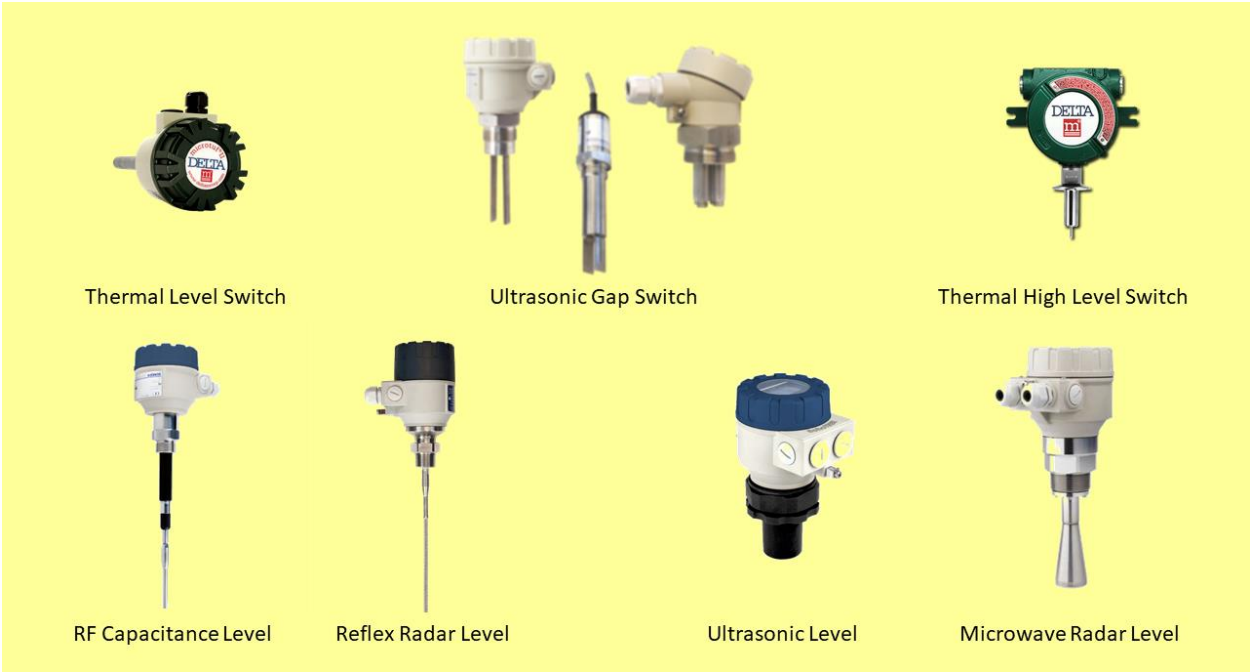
Solutions: Thermal level switches and guided wave radar transmitters protect the condensed tanks from overflowing or running pumps dry along with reporting back to waste tank trunk operations.

13 – Flare Knock-Out Drum

Liquid in the vent stream can extinguish the flame or cause irregular combustion or smoking. Flaring liquids can generate a spray of burning chemicals that create a severe safety hazard. A knockout drum collects these liquids prior to entering the flare system.

Challenges: When a large liquid storage vessel is required and the vapor flow is too high, a knockout drum is required with a pump.

Solutions: Thermal level switches for the drum and guided wave radar level transmitters ensure these liquid tanks are monitored for pump out or to drain.



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