Honeywell Automatic Overfill Prevention system makes your installation safer, maximizes use of storage space and meets safety standards.

Solution which maximize your storage
This document details the selection criteria for the overfill prevention sensors (OPS) and Honeywell solutions for the automatic overfill prevention system (AOPS) for bulk petroleum storage terminals and refinery tank farms.

The standards and the recommendation which are covered in this note are:
- API MPMS 3.1B, Reaffirmed, Aug 2011
- API STANDARD 2350-2012, 4th Edition
- IEC 61508:2010
- IEC 61511:2004
- OIML R85:2008

Automatic Overfill Prevention System (AOPS)
This document covers the following category of sites while guiding the selection of AOPS:

- Category 2 - Semi attended sites- These sites typically use automatic tank gauging systems (ATG) for level monitoring and hi-hi alarms in control center.

- Category 3 – Un-attended sites –These sites uses both an ATG and an independent level alarm high-high sensor (LAHH).

Basic components of the AOPS:
- Overfill prevention sensors – As per API STD 2350 there are three types of sensors which can be used:
  - Point level Sensor – Level Switch only used for alarm purposes and if used independently can be used in AOPS if meeting other selection criteria. (Examples: Capacitance continuous type, Radar (working on time measurement TDR or GWR) continuous sensors, High accuracy Radar type FMCW principle non-contact continuous electronic sensors, High accuracy Servo type continuous electronic sensors etc.)
  - Continuous level sensors – Sensors measuring the product level continuously. It is used for level measurement in category 2 sites. (if ullage in tank is calculated by operator using strapping table). Used for alarm purposes and if used independently can be used in automatic overfill prevention if meeting other selection criteria. (Examples: Capacitance continuous type, Radar (working on time measurement TDR or GWR) continuous sensors, High accuracy Radar type FMCW principle non-contact continuous electronic sensors, High accuracy Servo type continuous electronic sensors etc.)
- Safety logic solver – SIL2 certified safety logic solver.
- Remote operated shut off valves

Selection of Overfill Prevention Sensor (OPS)
API STD 2350 excludes some storage applications (like pressure vessels, underground tanks, tanks with capacity equal to or less than 5000 liters etc.), however this document covers the sensors which could be considered for AOPS deployment in all petroleum liquids/liquefied gas storage tanks as a recommended design practice.

Use of point level sensors is not covered in this document.

The selection criterion refers to the below Honeywell electronic continuous type level sensors while discussing the AOPS solution, considering various practical scenarios and design requirements:
- TÜV certified SIL 3/2 servo instrument model Honeywell Enraf Servo gauge 854 (High accuracy ATG type continuous electronic sensor)
- TÜV certified SIL 3/2 radar instrument model Honeywell Enraf SmartRadar FlexLine (High accuracy ATG type continuous electronic sensor)
- TÜV certified SIL 3/2 Guided-wave radar (GWR) type continuous sensor model Honeywell SLG 700.
Honeywell Automatic Overfill Prevention System

Application criteria
- Very light and light oils (Gasoline, Jet fuel, Diesel, light crudes, No. 2 fuel oil etc.): Choose servo ATG/radar ATG/Guided wave radar GWR
- Medium & Heavy oils (Heavy crudes, No. 6 Fuel Oils, etc.): Radar ATG preferred, (Servo ATG can be used with requirements on periodic maintenance).
- Liquefied Petroleum/Natural Gases (Propane, Butane, LNG etc.): Choose only servo ATG.

Accuracy requirement (Accuracy defined for safety)
For OPS selection the accuracy defined for safety function critical to consider. As a fail-safe engineering practice for petroleum liquid storage tanks, it is recommended that the accuracies of the sensors used in process control and safety control are comparable. Hence selection of OPS is closely related to accuracy requirements of automatic tank gauging as per below mentioned international standard/recommendation criteria:
- Per API MPMS 3.1B and Or OIML R85:2008: +/-1 mm
  Choose servo ATG or radar ATG
- Guided Wave Radar can be chosen for other accuracy requirements.

Note: Using instruments with lower safety accuracy would require that the alarm set points must be set at lower levels.

Type of tank
- Floating roof tank: Choose servo ATG /radar ATG or GWRs. Servo needs 6 inch or larger stilling well (can be used in smaller diameter stilling well as a customized solution); Radar also requires a 6 inch or bigger stilling well. GWRs needs an opening of 1½ inch within a stilling well. Customized installation possible.
- Cone roof /Dome roof tank: Choose servo ATG /radar ATG or GWRs. Servo needs a 2” inch or bigger opening. Radar also requires a 6 inch or bigger opening, with nozzle location minimum (0.15 times the tank height) distance away from the tank shell, to ensure the consistent accuracy. GWRs needs an opening of 1½ inch or bigger in the roof.

Type of nozzles/stilling wells: See “Type of Tank”

Type of existing auto tank gauging system
To meet requirements of diverse technologies:
- If existing ATG is Radar FMCW type: Choose servo ATG or GWR as OPS
- If existing ATG is servo type: Choose radar ATG or GWR as OPS
  If existing ATG is mechanical float and tape type: Replace/deploy new servo/radar type gauging and use servo ATG /radar ATG or GWR as OPS.

Safety parameters
- SIL2 or better: Choose servo ATG/radar ATG or GWR
- SFF > 90%: Choose servo ATG/radar ATG or GWR
- Optimum use of storage capacity (Fault Tolerant Time) < 1 second: Choose only servo ATG /radar ATG
- Advanced and the reliable safety architecture of 2oo4D (or 1oo2D) : Choose only servo ATG/radar ATG

Proof testing
- Test close to actual alarm situation: Choose servo ATG
- Test through remote display and/or control room without climbing on tank : Choose servo ATG /radar ATG
- Test documentation: Choose servo ATG /radar ATG with Engauge software

Note: Other point level sensors (switch) have critical constraints on proof testing requirements.

Enhancement
- Safety enhancement: Monitor redundant level information, generate additional alarm/diagnostics from OPS and ATG data
- Choose OPS with wireless connectivity to control room
- Add wireless infrastructure device (access points and wireless device manager) and give connectivity to tank inventory software/Terminal Automation System.

Specification – Automatic Overfill Prevention System *6
- Accuracy (for safety): High accuracy servo ATG or radar ATG type continuous electronic Overfill Prevention Sensor (OPS) meeting API MPMS 3.1B and OIML R85. GWR overfill prevention sensors which meets many lesser demanding requirements, gives accuracy of 0.03% of actual measurement.
- SIL certification: OPS certified by TÜV for SIL 3 and SIL 2 rated loops.
- AOPS meeting API STD. 2350 Ed 4 – AOPS shall be independent, physically & electronically separate from ATG system.
- Meeting proof testing requirement per API 2350 and possibility of automatic documenting proof test records
- Servo type OPS: Auto Test mechanism available.
- Diagnostic cycle time (fault tolerant time): < 1 second
- SIL rated Valve – Selection as per line size (non-Honeywell)
- Meets the requirements of diverse measurement technology for ATG and safety devices as per IEC 61508 & IEC 61511.
- Safety function:
  Servo/Radar ATG – Relay Contacts, configurable as per desired safety functions like Overfill and/or dry run.
  Servo ATG/GWR – Analog output corr. to level.
- Response time of AOPS is less than four seconds for actuating the flow diverting/terminating valve (response time of actual valve closure post actuation to be added)
Honeywell Automatic Overfill Prevention System

- Fully engineered, site ready, TÜV certified SIL 2 safety logic solver **HC900**, redundancy of CPU, rack power supply, communications and networking, as well as features such as removal and insertion under power on condition, online monitoring, edits and hardware maintenance during running operation.

- Optional HMI to visualize tank farm alarms, history and record keeping

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overfill Prevention Sensor ATG type - SmartRadar 990 FlexLine or Servo 854 OR Overfill Prevention Sensor - Guided wave radar SLG 700</td>
<td>Select model code as per tank nozzle/stilling well size and location on tank top, type of liquid, power supply available, accuracy requirements</td>
<td>As per site survey</td>
</tr>
<tr>
<td>Grade level display</td>
<td>Useful to proof test, as well provides additional display</td>
<td>Equals Servo/Radar/ GWR</td>
</tr>
<tr>
<td>HC900 Safety Logic Solver</td>
<td>With sufficient I/O modules to take relay contacts from Servo/Radar and control output to shutoff the Valves</td>
<td>1 (1 HC900 system with CPU, power supplies and required I/O modules)</td>
</tr>
<tr>
<td>Safety Logic Solver HMI</td>
<td>HMI application is optional, useful to visualization of alarms, history and event logging etc.</td>
<td>1</td>
</tr>
<tr>
<td>Flow Terminating/Diverting Valve</td>
<td>1st Valve connected to tank body</td>
<td>As per site survey</td>
</tr>
</tbody>
</table>

Table 1: To be prepared by Honeywell representative after a site survey

**Benefits**

- Compliance with requirements of standards, recommendations, guidelines on safety.
- Automatic proof testing continuous type level measurement OPS - No climbing on tank.
- 2oo4D internal architecture gives redundancy and prevents spurious trips.
- Industry best diagnostic cycle time, prevents catastrophic accidents.
- Reduce financial and environmental risks; Safety certified AOPS enhances safety with active guarding and alarming.
- Optimized use of storage capacity, plus optimized available storage capacity
- Increase efficiency: Assures onsite accuracy and product movement guidance, and improves resource planning.

---

Fig 1: The solution above shows the basic overfill prevention system and Auto tank gauging, showing the best in class overfill prevention sensors selection.

Fig 2: The solution above shows an enhanced safety system where the continuous type overfill prevention sensors are connected to control center over wireless, ensuring additional alarming and event recording possibility.

---

1: Standard practice (SP) for level measurements of liquid hydrocarbons in stationary tanks by auto tank gauging.
2: Standard (STD) Overfill Protection for storage tanks in petroleum facilities
4: International Standard (STD) on Functional safety – Safety Instrumented systems – for process industry sector
5: International recommendation on automatic level gauges for measuring the level in stationary storage tanks – Requirements (Metrological & technical), Controls & tests (Metrological)
6: For detailed specifications refer product data sheets of Servo 854 ATG, SmartRadar FlexLine ATG, SmartLine GWR SLG700 and HC900 controllers.
Specifications are subject to change without notice.

For More Information
To learn more about Honeywell’s safety solution, visit our website www.honeywellprocess.com or contact your Honeywell account manager.

Americas
Honeywell Enraf Americas, Inc.
2000 Northfield Ct.
Roswell, GA 30076 USA
Phone: +1 770 475 1900
Email: enraf-us@honeywell.com

Europe, Middle East and Africa
Honeywell Enraf Delftechpark 39
2628 XJ Delft,
The Netherlands
Phone: +31 (0)15 2701 100
Email: enraf-nl@honeywell.com

Asia Pacific
Honeywell Pte Ltd.
17 Changi Business Park Central 1
Singapore 486073
Phone: +65 6355 2828