FMC Measurement Solutions has the experience and knowledge to provide the best and most economical solution for your sphere applications.

In many situations, FMC Measurement Solutions Spheres are more economical and versatile than conventional pigs. They will pass through out-of-round pipe, pipe of varying wall thickness, short radius bends, full open thru conduit valves, properly designed tees and other obstacles difficult, if not impossible for conventional pigs to pass.

Typical Applications

FMC Measurement Solutions has developed a modern line of high quality, heavy duty spheres for meter prover and pipeline applications. FMC Measurement Solutions spheres have been designed to lessen or eliminate problems which the pipeline industry has encountered in the past. A strong effort has been made to improve the compounds and the structural design of its spheres.

FMC Measurement Solutions Pipeline Spheres are used in the various stages of pipeline construction, acceptance testing, commissioning, batch separation, and pipeline maintenance/cleaning operations. Maintaining and cleaning pipelines with spheres reduces pressure loss, increases efficiency.

New Construction

Offshore pipelines preinstall spheres into the initiation head used to start-up pipelay. During the laying of the underwater lines, when major physical damage occurs to the pipeline such as a wet buckle, spheres are run to dewater the partially built pipeline prior to recovery, repair, and reinitiation of pipelay.

Acceptance Testing (Hydrostatic Testing)

FMC Measurement Solutions spheres are used during the filling of pipelines with water to insure any trapped air is removed prior to hydrostatic testing.

Commissioning (Dewatering)

FMC Measurement Solutions spheres are used to dewater pipelines after successful completion of the hydrostatic testing.

Operational Applications

Product Separation

FMC Measurement Solutions spheres are used for product separation during batching of multiple products in pipelines to minimize interface mixing.

Liquid Condensate Removal

In natural gas pipelines, variations in the temperature and pressure can cause liquid drop-out. This drop-out varies with the process condition and whether the gas is raw or processed. Some gas pipelines are designed to transport condensate as two phase flow.

This liquid formation can cause a number of adverse effects such as corrosion reduced efficiency, increased operating cost of overloading of downstream processing plants.

Using FMC Measurement Solutions spheres and developing a routine sphering operation can greatly reduce or control these adverse effects.

Pipeline Maintenance

Controlling wax buildup on the pipewalls of crude oil pipelines is effective using FMC Measurement Solutions spheres in a routine maintenance program.

Batching of corrosion inhibitors in the pipeline is another ideal application for FMC Measurement Solutions spheres.
Sphere Compounds

Sphere compound materials vary as widely as the applications for which they are to be used. No one material or compound is ideal for all applications, therefore proper material selection is important. FMC Measurement Solutions has developed various materials and compounds to best suit your application. Available in neoprene and several polyurethane compounds, FMC Measurement Solutions’s spheres are specially compounded for optimum resiliency, wear resistance, freedom from deterioration, and longer operating life.

Service Recommendations

Liquid Meter Prover Service
PEC0 Model PS-53 (Polyurethane)
FMC Measurement Solutions PS-53 polyurethane sphere was developed especially for liquid positive displacement meter prover service. With FMC Measurement Solutions’s improved structural design you get a rounder sphere ensuring tight fits with no liquid bypass that causes inaccuracies in meter proving.

FMC Measurement Solutions PS-53 spheres are used in sweet crude oil, gasolines, heating oils, jet fuels, butane/propanes, natural gas liquids, and common refined products that are not defined as aromatics.

Pipeline Service
FMC Measurement Solutions Model HD-58 (Polyurethane)
FMC Measurement Solutions HD-58 spheres are used in natural gas pipelines, including high pressure lines, to remove liquids, maintain line efficiency, and in general keep lines clean. Model HD-58 is normally recommended where a routine sphering program is followed requiring repeated runs of the same spheres. FMC Measurement Solutions Model HD-58 sphere can also be used for general pigging of liquid pipelines, including the cleaning of plant piping systems.

FMC Measurement Solutions Model SP-66 (Polyurethane)
FMC Measurement Solutions’s Model SP-66 spheres are most commonly used in pipelines where other compounds tend to blister and deteriorate to an extent that destroys their useful life. In these situations, FMC Measurement Solutions’s Model SP-66 spheres provide a longer useful life.

Neoprene Spheres
Neoprene spheres have many uses in the pipeline industry. It is ideal for dewatering pipelines, line fill for hydrotesting, general line cleaning, batch separation, and field waterdraw calibrations of meter provers. It is well suited for the pipeline operator who needs to run a sphere infrequently or for a short distance. It is also useful in purging plant piping systems where exposure time is short. Neoprene is not recommended for exposure to aromatics or hydrogen-sulfide.

FMC Measurement Solutions GPS Spheres (Polyurethane)
FMC Measurement Solutions General Purpose Sphere is manufactured from high quality polyurethane for superior performance in the rugged environment they operate in.

Spheres are useful for so many applications because they are easily automated, will negotiate almost any radius, and have a long, useful life.

LF (Low Friction) Additive
FMC Measurement Solutions has developed a Low Friction (LF) additive for the blended polyurethane prover spheres. The LF additive is blended into the polyurethane to add additional lubricating properties for low flow rates, reduced sphere velocity, proving of dry, unlubricated products such as LPG and NGL’s and also for waterdraw calibrations. This LF additive assists in permitting the sphere to travel uniformly through the calibrated section of the prover and thus allowing adequate repeatability.

Recommended Service Applications

<table>
<thead>
<tr>
<th>Sphere Material</th>
<th>Operating Temp. Min.</th>
<th>Operating Temp. Max.</th>
<th>Service Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neoprene</td>
<td>-20°F -29°C</td>
<td>270°F 138°C</td>
<td>General purpose pipeline, hydrocarbon and chemical service</td>
</tr>
<tr>
<td>Polyurethane</td>
<td>0°F -18°C</td>
<td>140°F 60°C</td>
<td>Meter prover service, low temperature distillate removal</td>
</tr>
<tr>
<td>HD-58 (Yellow)</td>
<td>0°F -18°C</td>
<td>140°F 60°C</td>
<td>Gas distillate removal at pressures greater than 600 psig general purpose pigging</td>
</tr>
<tr>
<td>HD-58 (Green)</td>
<td>0°F -18°C</td>
<td>140°F 60°C</td>
<td>Toluene, Propylene unleaded gasoline service</td>
</tr>
<tr>
<td>HD-58 (Red)</td>
<td>0°F -18°C</td>
<td>140°F 60°C</td>
<td>Reformulated gasolines containing MTBE and other additives</td>
</tr>
</tbody>
</table>

NOTE: Please consult the factory when unusual conditions are encountered or a recommendation is required.

Sphere Filling and Sizing Instructions and Recommendations

For efficient operation, spheres must be filled with liquid and sized to a proper diameter.

Fluid Recommendations
Clean water is the most commonly used liquid used for filling a FMC Measurement Solutions sphere. If there is any possibility of freezing, a mixture of 50% water and 50% glycol is recommended. Where there may be extreme temperatures changes, the 50/50 water-glycol mixture should be considered. In certain instances 100% glycol is used where operators have determined it best
for their particular circumstance.

**IMPORTANT:** A sphere should never be placed under pressure in a meter prover or pipeline until the cavity has been completely filled with liquid. No attempt should ever be made to size a sphere with air or gas as the filling media.

**Sizing Recommendations**

The size of a sphere, the diameter, required for use in a meter prover loop or a pipeline should be determined before beginning the sizing procedure. The diameter to which the sphere is to be sized should be considered in relationship to the internal diameter of the meter prover loop or pipeline, never the outside diameter of the pipe.

General sizing recommendations are as follows and apply to both meter provers and pipelines:

- All Polyurethane Spheres - 1-1/2% larger than the internal diameter
- Neoprene Spheres - 2% larger than the internal diameter. 

Note that these are general recommendations only. Experience will determine if the sphere should be larger or smaller in order to provide the best results. Dry, non-lubricating liquids may require looser fits in the pipe.

**Sizing Rings**

FMC Measurement Solutions Sizing Rings should be used to accurately measure the diameter of the spheres. FMC Measurement Solutions Sizing Rings are made of material which will not expand or shrink thereby maintaining their accuracy.

<table>
<thead>
<tr>
<th>Temperature Range</th>
<th>Liquid Fillers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 32°F (0°C)</td>
<td>50% Glycol and Water</td>
</tr>
<tr>
<td>(32°F to 150°F)</td>
<td>Water</td>
</tr>
<tr>
<td>(0°C to 65°C)</td>
<td></td>
</tr>
<tr>
<td>Above 150°F (65°C)</td>
<td>Glycol</td>
</tr>
</tbody>
</table>

**CAUTION:** Do not use hydrocarbon as a filling liquid.

**Filling The Sphere**

The steps below should be followed to properly fill a FMC Measurement Solutions sphere with liquid.

**Step 1 - Remove Valves**

Remove valve caps and depress valve core to assure no pressure is inside the sphere.

**Step 2 - Inspect Valves**

Remove both valves and make certain that the o-rings are not damaged (replace if necessary). Be sure that the valve cores are tight and the stems are seating properly. Replace the valve cap and reinstall one of the valve bodies and valve caps hand tight. Over tightening may damage the o-ring. Use the core extractor to remove or tighten the stem if necessary. Do not install second valve at this time.

Valve Wrench - The small end fits the valve cap and the large end fits the hex on the valve body.
**Step 3 - Fill Sphere With Liquid**

Attach the filling tool to the pump hose and insert into the sphere through the valve hole. Fill the cup on the inflation pump with the liquid you have decided to use (water, glycol, water and glycol) and pump the liquid into the sphere until the sphere is full -i.e. liquid is running out of the valve hole.

*Note:* You will have to keep refilling the filling cup on the pump until the sphere is full.

When the sphere appears to be full, it is important to make sure there are no air pockets trapped in the sphere cavity. If the sphere is small enough to pick up, gently bump it on a hard surface. Watch to see if the liquid in the valve hole settles into the sphere. If it does, pump in more liquid and again bump sphere. Repeat until the liquid remains outside the sphere cavity.

In the sphere is too large to pick up, tap it on the side with something which will not damage the surface of the sphere. It is important that all air pockets be removed and replaced with liquid.

**Step 4 - Install Other Valve**

When the sphere is completely filled with liquid and ensuring that all the air has been displaced from the cavity, it is ready to be sized to the predetermined diameter.

Reinstall the valve body, first making sure that its o-ring is not damaged and the valve stem is tight and seating properly. Leave the cap off.

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**Sizing The Sphere**

Screw the sizing tool down over the valve body and attach the pump hose. Pump more liquid into the sphere until it expands to the proper diameter. Replace the cap with the small end of the valve wrench.

The sphere is now ready for use. In the case of pipelines, each time the sphere is loaded into a launching barrel the valve wrench should be used to make certain both the valve body and the cap are secure.

**The Sphere Pump**

Before storing or using the sphere pump again, be certain to remove any pressure build-up in the pump hose by simply inserting the filling tool into the quick coupler on the end of the hose. Keep the filling tool pointed away from you. Operate pump handle a few strokes to remove any remaining fluid.