P-SL100

CEMENTING SERVICE BULLETIN

02/14/14

P-SL100 (PETROCHEM – SPHERICAL LIGHT 100 ADDITIVE (POWDER)

TECHNICAL DATA

P-SL100 is a hard, inert, hollow, silicate glass sphere with a lower specific gravity (0.60) than water allowing the addition of solid materials while reducing the density of the resulting slurry. The resulting set cement will have higher compressive strengths and lower permeability's than is achievable with chemical extenders, even down to densities as low as 9 lb. /gal.

P-SL100 applications range from cementing surface and conductor casings to unconsolidated and low fracture pressure formations. P-SL100 is also useful for mufti-stage cementing, grouting, setting plugs in severe loss circulation formations and insulative cements for permafrost or high temperature cementing such as in geothermal or steam flood situations. However, note the maximum exposed temperature during steam injection or recovery, as above 450^{o}F. the long-term properties are not acceptable for zonal isolation.

P-SL100 is the preferred method for extending P-1000 Gas Control or thixotropic slurries, and is applicable through a temperature range of 40^{o}F to 450^{o}F However, when used at temperatures above 230^{o}F it is recommended that 35% silica flour (BWOC) be included in the design.

P-SL100 requires a minimum of 5 to 10 lb. /100 ft^{2} to maintain slurry stability since the P-SL100 is lighter than the water and four times lighter than cement, it can float to the top of the slurry if the yield value is insufficient.

PROPERTIES

PRODUCT	FORM	SP.GR.
P-SL100	WHITE POWDER	0.60

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SAFETY

If the product gets in the eyes flush the eyes with water for at least 15 minutes, and get medical attention. If exposed to the skin, flush skin with soap & water. Inhalation: Move to open air, if irritation persists, get medical attention.

P-SL100 does not normally require a dispersant. In fact the inverse is more likely true, in that maintaining sufficient viscosity is more frequently the problem. P-SL100 slurries can be blended with salt concentrations up to 37% (BWOW). P-SL100 can be mixed with fresh water or seawater, so long as minimum viscosity values are maintained, and compatibility with other additives in the slurry is observed.

The normal application density of P-SL100 is from 9.0 to 12. lb. /gal to maintain a cost effective slurry. Since P-SL100 is composed of hollow silicate spheres, a percentage of them break under pressure, losing the gas (N_2 and CO_2) trapped in them, subsequently losing their low specific gravity. The maximum recommended pressure for application is 10,000 psi total pressure.

As a guide the equivalent specific gravity after exposure can be estimated by the following equation.

$$BSG = 2.65 \left(\frac{\%\ crushed}{100}\right) + SSG \left(\frac{1 - \%\ crushed}{100}\right)$$

Where:
BSG = specific gravity of the blend
SSG = surface specific gravity of the P-SL100

And the absolute volume in gal/lb. is calculated by:

$$BAV = \frac{0.1202}{BSG}$$

Where:
BAV = absolute volume of the blend in gal/lb.
BSG = specific gravity of the blend

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While P-SL100 is a satisfactory extender alone, it can easily be blended with other extenders to enhance the slurry properties, and offset the cost of using P-SL100 by itself. Properly designed slurries should provide the resulting set cement with higher compressive strengths and lower permeability's than is achievable with chemical extenders, even down to densities of 9.0 lb. /gal. P-SL100 is also the preferred method for extending Gas Control (P-1000) or thixotropic (P-TTCL) slurries.

The general concentration range for P-SL100 is between 14% to 85% BWOC at densities ranging from 13.0 lb. /gal to 9.4 lb. /gal, with water requirements ranging from 6.8 gal/sk. to 12.6 gal/sk. producing compressive strengths of approximately 1570 psi to 360 psi at 150^{o}F, respectively.

P-SL100 slurry design care should be taken when using retarders, since most retarders have a concentration range where dispersion is a secondary effect and over dispersed slurries may cause separation and or settling, rendering the slurry instable.

Calculation of P-SL100 and water content method assumes 0.8% water per 1.0% P-SL100. In doing hand calculations, you must have some starting point for the water-to-P-SL100 ratio to design a given density. As a starting point in the calculation table, assume an increase of 0.8% mix water for each 1% P-SL100 (both BWOC). Starting with 44% mix water, 94 lbs. cement, and P-SL100 with surface properties of density = 0.54 S.G. and absolute volume = 0.262 gal/lb., the density/volume table for calculation would look similar to the one below. Correct values for absolute volume of the landed P-SL100 will have to be inserted to replace the value of 0.262. This table is assuming calculations with fresh water.

Material	Mass lb.	Absolute volume gal/lb.	Total Volume gal
Cement	94.0	0.0380	3.59
Water	41.36 + 0.8 Y	0.1202	4.97 + 0.0962 Y
P-SL100	Y	0.262	0.262 Y
Others	--	--	--
	135.36 + 1.8 Y		8.56 + 0.359 Y

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From this point calculations continue as with conventional slurries, solving for P-SL100 content in pounds (Y) by setting:

$$\frac{(135.36 + 1.8Y)}{(8.56 + 0.359Y)} = \text{The design density}$$

Continuing with the value for Y: % P-SL100 BWOC = Y/94

Mix water in gal/sk is solved from 4.97 + 0.0962 Y

Slurry yield in cu ft. /sk is solved from: $\frac{(8.56 + 0.359Y)}{7.48}$

Finally, slurry porosity in percent is: $\frac{(4.97 + 0.0962Y)}{(8.56+0.359Y)} * 100$

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