

TABLE 1 SOUR GAS OPERATING CONDITIONS—MORE CORROSIVE THAN EARLIER CONDITIONS

Process Parameter	New Gas Field Condition 1	New Gas Field Condition 2	Earlier Tested Gas Field Condition	Remarks
Service	Sour Gas	Sour Gas	Sour Gas	
Temperature	74 °C (165 °F)	74 °C (160 °F)	120 °C (49°F)	Higher
Pressure	132 bar (1915 psi)	132 bar (1915 psi)	132 bar (1915 psi)	
CO ₂ mol%	6.5%	5%	8%	
H ₂ S mol%	4.5%	8%	5%	Higher
MEG (wt%)/ liquid phase	50%	80%	30%	Higher

as pinholes, cracks, blisters, and change in colors. During EIS, good coatings will show high impedance values after exposure above 10⁸ Ω-cm, while poor coatings will exhibit impedance values of 10⁷ Ω-cm and below. In a hardness testing, an increase in hardness indicates that the coating exhibited additional curing during exposure. During adhesion testing, the higher the adhesion strength of the coating, the better the coating resistance to under-paint corrosion.

The high-pressure and high-temperature static autoclave shown in Figure 2 was utilized to simulate the type of service and environment the coating would be exposed to in the field. Pull-off adhesion tests (ASTM D4541), EIS measurements, hardness measurements (ASTM D2240 Shore Scale D), thickness measurements (ASTM D70914), holiday detection (ASTM G625), and pull-off adhesion tests (ASTM D4541) were carried out on the coated panels before and after exposure.

A pair of standard coating test panels from each type of internal coating system, shown in Table 2, were exposed in the autoclave reactor at each condition, shown in Table 1, after passing the preliminary tests (visual examination, holiday, hardness, thickness, adhesion, and EIS). The coated panels were mounted in the autoclave vessel such that the bottom half of each panel was immersed in the liquid phase, whereas the remaining upper half is exposed to the gas phase in the upper portion of the vessel. Once the test duration of seven days was complete, the autoclave was opened and the samples were

TABLE 2 TEST PROGRAM COATING SYSTEMS INFORMATION

#	Coating System	Application Area	Coating Manufacturer	Type
1	CS-MB-1	Main body	CM-1	FBE
2	CS-MB-2	Main body	CM-2	FBE
3	CS-MB-3	Main body	CM-2	FBE
4	CS-MB-4	Main body	CM-3	FBE
5	CS-MB-5	Main body	CM-2	FBE
6	CS-MB-6	Main body	CM-4	FBE
7	CS-GW-1	Girth weld	CM-1	FBE
8	CS-GW-2	Girth weld	CM-2	FBE
9	CS-GW-3	Girth weld	CM-2	FBE
10	CS-GW-4	Girth weld	CM-5	Liquid
11	CS-GW-5	Girth weld	CM-6	Liquid
12	CS-GW-6	Girth weld	CM-7	Liquid
13	CS-GW-7	Girth weld	CM-8	Liquid
14	CS-GW-8	Girth weld	CM-9	Liquid

**FIGURE 1** Electrochemical impedance spectroscopy.