INTERNAL CORROSION MONITORING SPECIALISTS

Hydrostatic Test Report
(Standard Access Fitting)

BACKGROUND

Caproco supplied a standard flareweld *(SAE 1025)* access fitting, complete with a standard 316 stainless steel solid plug and a standard glass reinforced teflon packing for the test.

Ball Engineering determined the method of testing, arranged for the test piece to be welded, and organized the testing at the University of Alberta.

PURPOSE

The purpose of the test was to verify the performance rating of the standard Caproco access fitting assembly.

PROCEDURE

Caproco supplied equipment as follow and was selected randomly from stock:

-Access Fitting Body FW Flat x 2"UN 6.25" lg P/N 10008
-Solid Plug Assembly 316 Stainless Steel P/N 10584
-Primary Packing 25% Glass Filled Teflon P/N 10587

The access fitting was welded to a 25 mm plate of A516 Grade 70 in accordance with Caproco weld procedure CSI, using E7018 electrodes. Micromeasurement epoxy bonded strain gauges were installed at suspect high stress areas. These gauges were temperature compensated and thermal co-efficient of expansion matched for steel.

The gauge locations were:

Gauge 1 - Hoop stress at bottom thread of external acme threads.
Gauge 2 - Longitudinal stress at bottom thread of external acme threads.
Gauge 3 - Hoop stress at mid chamber height
Gauge 4 - Hoop stress at toe of flareweld.
Gauge 5 - Longitudinal stress at toe of flareweld.

The fitting body was plugged in the normal way with a standard solid plug manufactured from 316 stainless steel and standard packing made from glassified telfon.

Hydrostatic testing was done using water and a high pressure hand pump, capable of reaching a maximum pressure of 30,000 psig.

Two tests were undertaken using previously unused packing on each test. Both tests were conducted at room temperature *(20○C)*.

TEST 1

The assembly was filled with water and all strain gauges were checked to confirm a zero reading.

The assembly was pumped up using the hand pump to 10,000 psig and held for several minutes. The five strain gauges were read and recorded *(see table 1)*. The pressure was then increased to 17,500 psig at which point the primary packing could not maintain a proper seal and began to leak slightly. The solid plug assembly was retightened resulting in an adequate seal. The pressure was then increased to 20,000 psig and held for several minutes. All five strain gauge measurements were recorded*(see table 1)*.

The pressure was then increased until at 22,500 psig the packing again failed resulting in leakage. Further tightening of the solid plug could not prevent leakage of the packing. The pressure was then raised until the pressure drop, due to leakages at the packing, equaled pump rate of increase in pressure.

This equilibrium with the pump occurred at 27,500 psig. Due to the problems maintaining equilibrium only strain gauge 3 was recorded at this indicated the maximum stress at the 10,000 and 20,000 psig readings.

The solid plug was removed and checked for physical damage. The primary packing was then replace in preparation for Test 2.

TEST 2

The solid plug and access fitting was reassembled and repressured. The purpose of the test was to increase the pressure to the maximum level possible and record the strain on gauge 3.

The primary packing again failed in the 17,500 psig area but pressure increase could be maintained. The maximum pressure achieved was 29,000 psig. The valve on strain gauge 3 was recorded *(see table 1)*.

DISCUSSION

The valves of the strains recorded on the strain gauges have been tabulated as stresses in Table 1, to give a more meaningful representation of the results.

The stresses were calculated using the following relation - E = *o* /*e* *(units: psi)*

Where E = modulus of elasticity
o = stress
e = strain

As long as the stress is not too high, the deformation is principally elastic and E is a constant. For each group of materials E has a characteristic value. E = 30 x 10^6 psi for steels. The modulus is basically related to the bonding between atoms.

It can be seen in Table 1 that no longitudinal stresses were present *(gauges 2 and 4)*. The most serious hoop stress occurred at mid chamber height *(gauge 3)*. Even here, the stresses measured were well below the 0.2% offset yield strength for the material.

Since all standard access fittings are manufactured to the same dimensions above the end connection; that the modulus of elasticity is the same for the various steels Caproco uses for the manufacture of access fittings, similar results should be achieved on all standard access fittings unless limited by the type of end connection *(eg: flange rating)*.

CONCLUSION

The results should apply for access fittings made to the same dimensions but of a different steel as the modulus of elasticity is the same, or very close.

The results apply for the various types of fittings but limited by the rating of the end connection.

Based on the results of the two tests, Ball Welding & Metallurgical Engineering Limited made the following recommendations;

1. The access fitting body is suitable for use up to 20,000 psi.
2. The teflon packing is recommended for use to a maximum service pressure of 15,000 psi.

Accepting the above recommendations, Caproco reserves the right to limit the maximum working pressure of a particular access fitting to what it determines shall be maximum working pressure for a particular service, not exceeding the above recommended pressures.

TABLE 1

Gauge	Pressure *(psig / MPa)*				
	0	**10,000** (68.9 MPa)	**20,000** (137.9 MPa)	**27,500** (189.6 MPa)	**29,000** (199.9 MPa)
	Stress Value *(psi)*				
1	0	3,000 (20.7 MPa)	6,600 (45.5 MPa)	-	-
2	0	0	0	-	-
3	0	6,450 (44.5 MPa)	13,200 (91.0 MPa)	17,800 (122.7 MPa)	20,800 (143.4 MPa)
4	0	0	0	-	-
5	0	1,500 (10.3 MPa)	3,900 (26.9 MPa)	-	-

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