Technical Data

Corrosion & Elastomer Impact Specifications

For

HDC Mk II, Pyrosol ES, PentaFlow Products

1.0 Corrosion Tables A

Test #1 -Mild Steel bar coupon -160 hours

Product	Max. Temp./Pressure	Corrosion Rate (mpy)
HDC Mark II	150°C	8
HCL8%	150°C	695
PentaFlow	150°C	178
Seawater (UK)	150°C	11
Pyrosol ES	150°C	105

Test #2- Chrome bar coupon- 220 hours

Product	Max. Temp./Pressure	Corrosion Rate (mpy)
HDC Mark II	150°C	4
HCL8%	150°C	615
PentaFlow	150°C	25
Seawater (UK)	150°C	5
Pyrosol ES	150°C	9

Test #3 – 316 Expandable Stainless (Weatherford) Body
150°C / 7 days

Product	Body {mpy)	Shroud (mpy)	CouQ on.(mpy)
HDC Mark II	2.1	2.5	7.0
PentaFlow	9	21	56

Sources: 1) Oilfield Chemical Technology Limited & Weatherford

1.1 *Petronas Laboratory Kuala Lumpur*

Resak Material-Chemical Compatibality

Material 13Cr
Total Pressure Ambient
Duration 10 days
Start 30/10/2001
Finish 08/11/2001

HDC

Sample	Weight (mg)			Duration	Corrosion Rate
	Start	Finish	Loss	(hrs)	(mm/year)
1	10.358	10.359	-0.001	240	-0.02887658
2	11.598	11.598	0	240	0.00000000
3	12.32	12.32	0	240	0.00000000

Start 02/11/2001 Average -0.010
Finish 12/11/2001

SPTF

Sample	Weight (mg)			Duration	Corrosion Rate
	Start	Finish	Loss	(hrs)	(mm/year)
1	11.113	11.097	0.016	240	0.46202532
2	11.941	11.929	0.012	240	0.34651899
3	11.335	11.323	0.012	240	0.34651899

Average 0.385

OR(mm/year) = (K*W)/(A*T*D)
K = 8.76e4 (for mm/year)
W= max loss (g)
A = Specimen area(cm2)
T = Exposure time (hours)
D = Density (g/cm2)

Corrosion allowances = 2mm(0.08mm/year)
3mm (0.12mm/year)

HDC (Mark II Version)
SPTF (Super Pickle TF180 = 50% Koplus LO + 50% Super Pickle)

2.0 Elastomer Testing

2.1 Elastomer Coupons and O Ring Test:

1) One Set (A) of Coupons/Rings immersed in hot roll bombs, filled with **HDC Mk II** Formula- pressurized with nitrogen to 5000 psi.
2) A duplicate Set (B) of samples were soaked at ambient temperature and pressure to observe for overt results of cracking, swelling, or general debilitation over periods of 24, 72, hours. And 7 days.
3) Set A samples were hot rolled at 150°C for 96 hours and removed for analysis.

Sample B	Volume Change%	Weight Change%	Hardness Change%	Tensile Strength Change%	Elongation Change%	Remarks Appearance
Baker HNBR (2013)	2.8	2.1	6.1	-3.3	-8.1	OK
Chemraz GT (522062)	-5.7	.02	0	4.4	6.9	OK
Chemraz GT (5100130)	-.5	.8	0	1.9	2.3	OK
Parco Aflas (2902)	1.1	0.3	-1.1	-3.5	1.9	OK
Baker Aflas (7116)	0.2	0.1	1.2	-2.2	-3.0	OK
Neyfor (HN1662-1)	-0.1	-0.4	0	0	0	OK
Varco (Ram) Elements (WC 98-21)	+0.3	0.0	0.0	0.0	0.0	OK
Parco Kalrez (1050)	0.2	.3	0	-12	-11	OK
Baker Viton (9009)	.3.9	.6	0	0	-5.5	OK

* Set A samples showed no blistering, deforming or embrittlement through to the end of the 7 day observation period.
* Set B samples were slowly depressurized after cooling, and removed so as to avoid mechanical damage to the rings and coupons. Where no overt physical changes, blisters, pits or cracks were observed, the notation "OK" is used.

1.2 Additional Elastomer Testing

	ELASTOMER SAMPLES			
	PARKER N 3510-8S IMMERSED 1 DAY		PARKER N 674-70 IMMERSED 3 DAYS	
Colour	AN	BN	AJ	BJ
Before	Black	Black	Black	Black
After	Black	Black	Black	Black
Dimensions (Height) –cm	3.6666	3.3036	3.3457	3.6355
Before				
After	3.6356	3.3000	3.3460	3.6668
Loss / Gain	-0.0310	-0.0036	+0.0003	+0.0313
Dimensions (Width) –cm	3.6000	3.560	3.4770	3.4325
Before				
After	3.6660	3.5566	3.4770	3.4247
Loss / Gain	+0.0660	-0.0034	-	0.0078
Weight (g)	3.1117	2.9406	2.8124	3.0305
Before				
After	3.1114	2.9418	2.8113	3.0302
Loss / Gain	-0.0003	+0.0008	-0.0011	-0.0003
Hardness	86	86	70	72
Before				
After	86	85	70	71
Loss / Gain	-	-1	-	-1

Conclusions:

*Based on testing conducted, it has been concluded that there are no adverse reactions to the elastomers (N3510-85 and N-674-70) whilst in contact with the product HDC.

*No detrimental effect was shown if the elastomer had to be immersed for a longer period of time.

2.3 Baker CentriLift ESP Component Testing- HDC Mark II

Oilfield Chemical Technology Limited

Centrilift provided 2.2 - 2.3 mm thick sheets of elastomers AFLAS 600-9 and CL 636 for testing. Coupons of 1 - 2" size were cut from the sheets and the test piece size, weight and Ourometer hardness measured before immersion in a sample of HDC Mk II. One set of coupons was stored at 50°C and a second at 95°C under static conditions and test pieces removed after 24 and 72 hours for inspection and re-measurement.

Results: Within the experimental error inherent in the test measurement of irregularly sized pieces, the CL 636 elastomer is essentially unaffected by the HDC MK II over 72 hours at up to 95°C. AFLAS 600-9 is largely unaffected at 50°C but shows slight progressive swelling and some softening on exposure at 95°C. However the physical dimension change is still very small and not expected to be problematic.

2.4 ESP Component Testing- Pyrosol ES and PentaFlow

48 hour static aging of components in Pyrosol ES and PentaFlow

Sample	Initial Weight	Final Weight	Observations
Cable 1	39.2g	39.0g	No pitting or discoloration; Minor weight loss due to tape residues washed off
Cable 2	41.55g	41.55g	No Change
Exterior (black) insulation	8.4g	8.4g	No Change ; no change in elasticity or colour
Orange Insulation wire	22.4g	22.4g	No Change
Lead insulation wire	24.6g	23.15g	Weight loss due to pitting and etching of lead surface

Photo 1: Components prior to testing

Photo 2: Post Static Aging - note pitting on lead wire surface; discoloration at wire ends due to absorption of product on epoxy resin sealant