



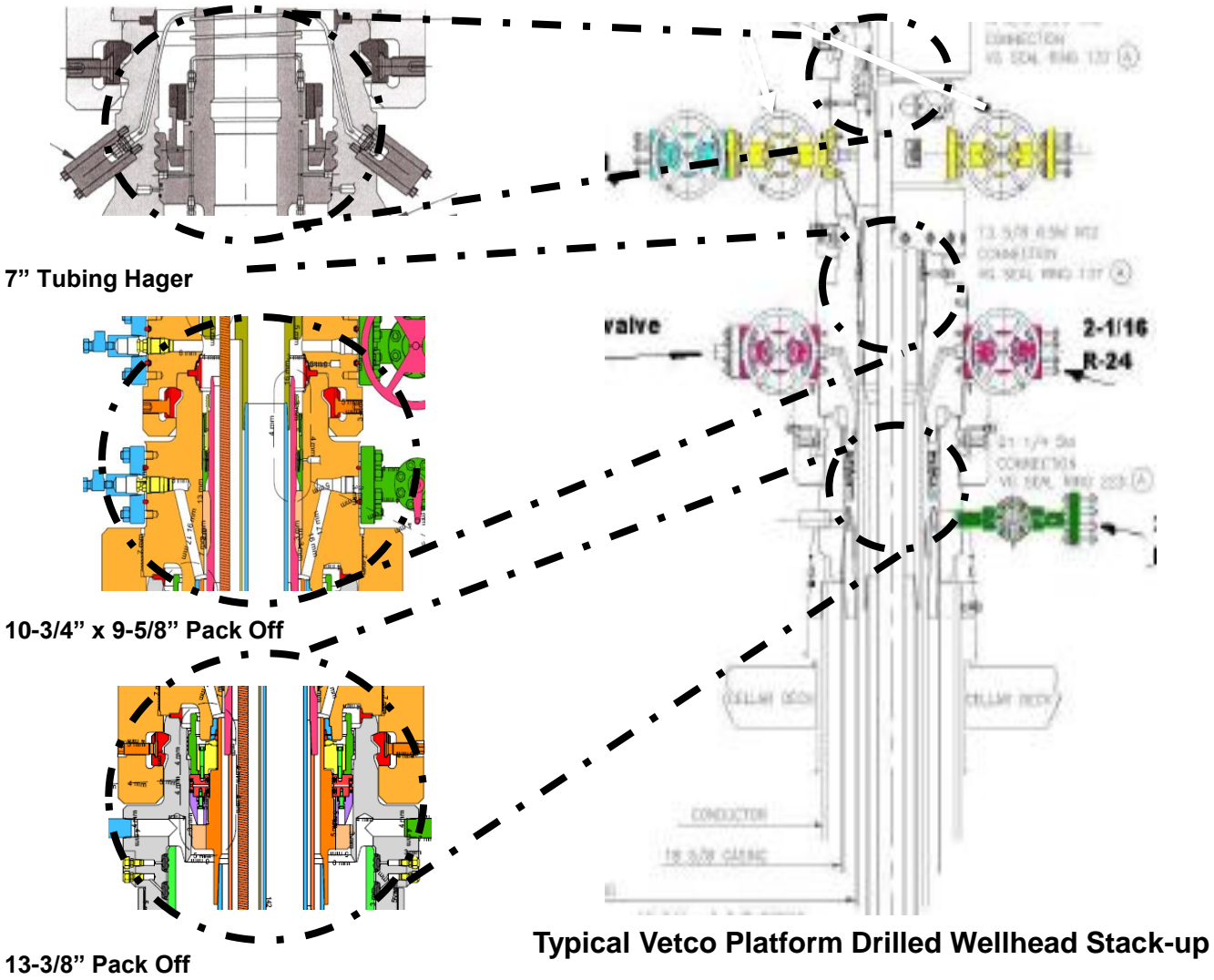
# Case History

## North Sea Platform Wellhead 7",9-5/8" & 13-3/8" Isolation

The following is based on limited information available at the time of this evaluation:

### History:

The A annulus will be utilised to inject gas. In reviewing the current well files the 9-5/8" hanger seal had issues and had been repaired by deploying a silicone type fluid between the metal to metal seals. Due to the introduction of gas injection into the A annulus at 3,500psi test pressure, concerns are that if the existing seal repair leaks, gas injection pressure could pass into the B annulus. The following is proposed as a contingency in providing a number of options in isolating between both A and B annulus at the 9-5/8 metal to metal seal.

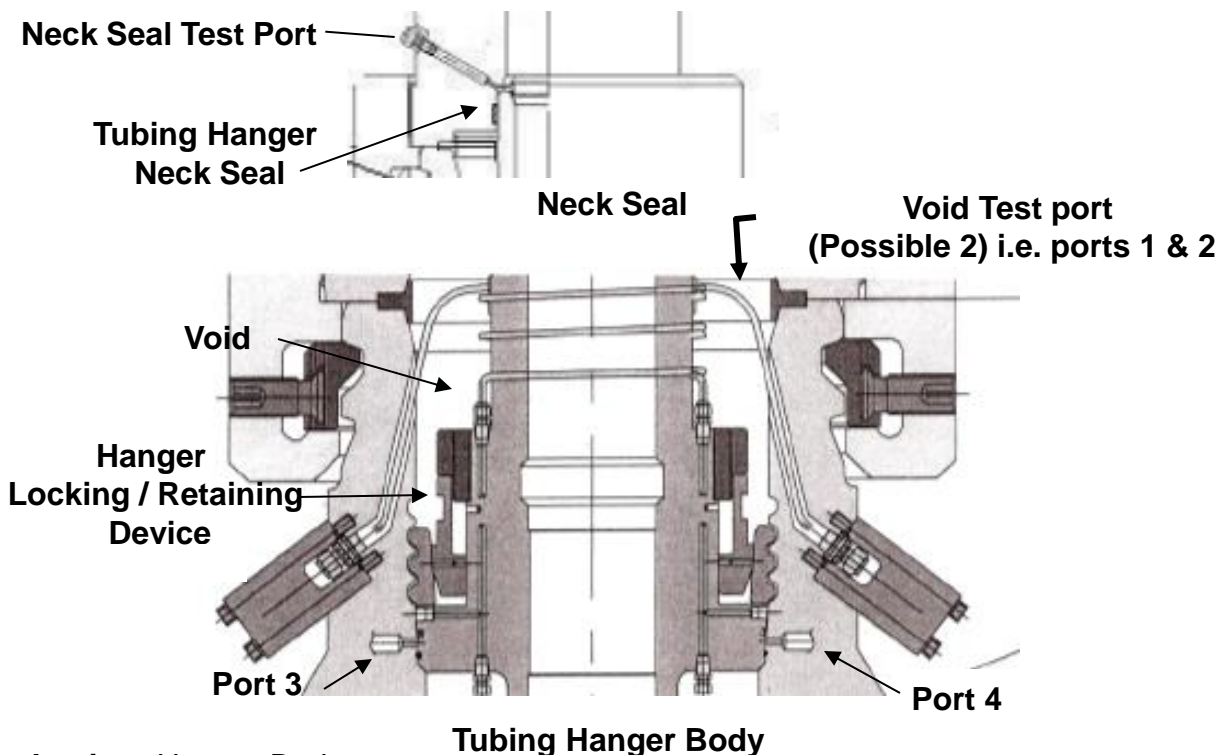


Typical Vetco Platform Drilled Wellhead Stack-up



**Existing Seal Design:**

Neck seal metal to metal with a resilient seal as back up. Single test port (to be confirmed)  
Hanger body is supported by two o-rings providing cavity with two test ports.  
The void contains the locking device which prevents the positioning of sealant above the body.



**Evaluation:** Hanger Body

Sting and vent all annuli and test ports i.e. void and hanger body cavity.  
 Fill the void with light oil (or other fluids) volume T.B.A. though injection ports inject Port 1 and bleed port 2.  
 Monitor oil returns through port 2. Close port 2 and continue to meet pressure test value.  
 Monitor ports 3, 4 & Neck seal port for any fluid displacement i.e. hanger body top seal issues.  
 Vent and bleed down void ports 1&2.  
 Inject light oil (1 to 2Litres) through port 3. Monitor oil displacement through port 4.  
 Close port 4 continue to inject oil to meet pressure test value and monitor leak path if any.  
 Monitor ports 1&2 for any fluid displacement.  
 Vent and bleed down cavity ports 3&4



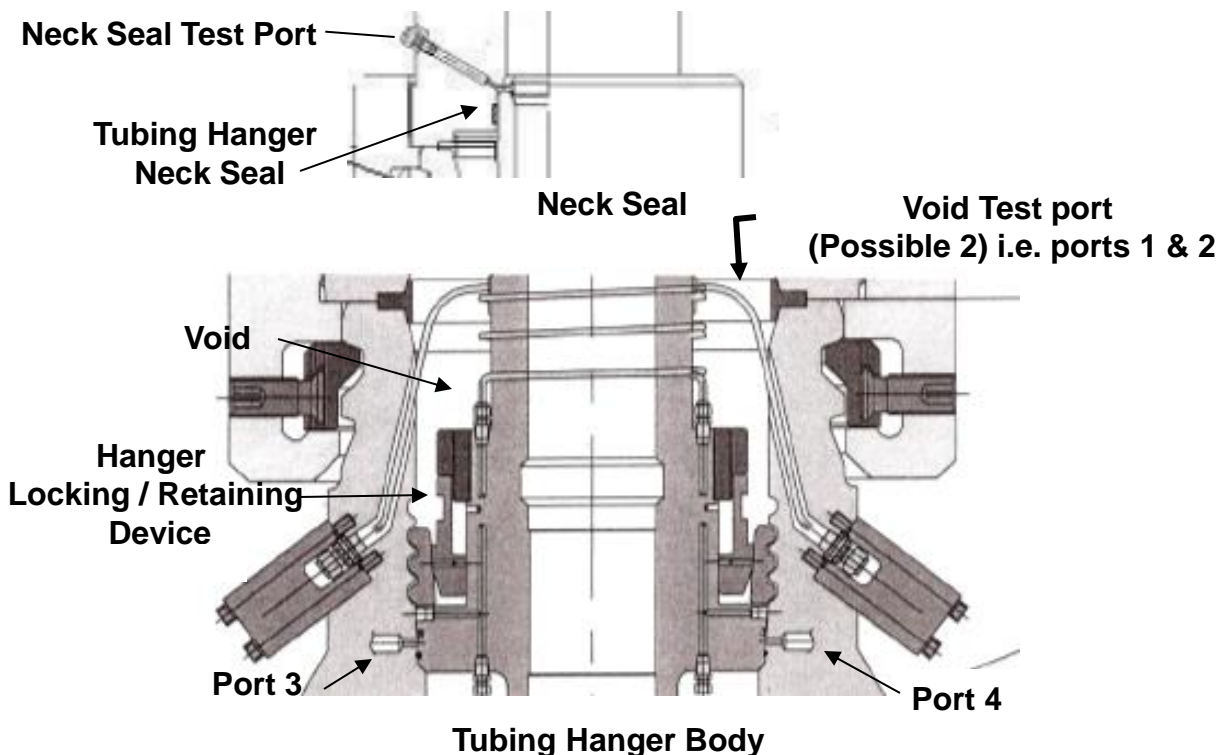
**Hanger Body Seal**



# Kinetics Controls & Innovation Ltd

## Note:

It is not uncommon that the leak paths could include gas pressure passing through the control line fittings i.e. through the hanger body. Isolating this area may be limited. T.B.A.



## Mac-Seal Deployment Hanger Body

Sting and vent all annuli and ports

Mix and inject a set volume (1Litre) of Mac-Seal 04 through port 3, displacing the existing test oil through port 4.

Monitor port 4 for sealant returns and close port 4

Continue to inject the remaining sealant.

Disconnect and close port 3.

Allow 3 hours to cure, Review sample.

## Pressure Test:

Through void or inflow test from below and sting void. Do not pressure test through ports 3 & 4.



**Hanger Body Seal**

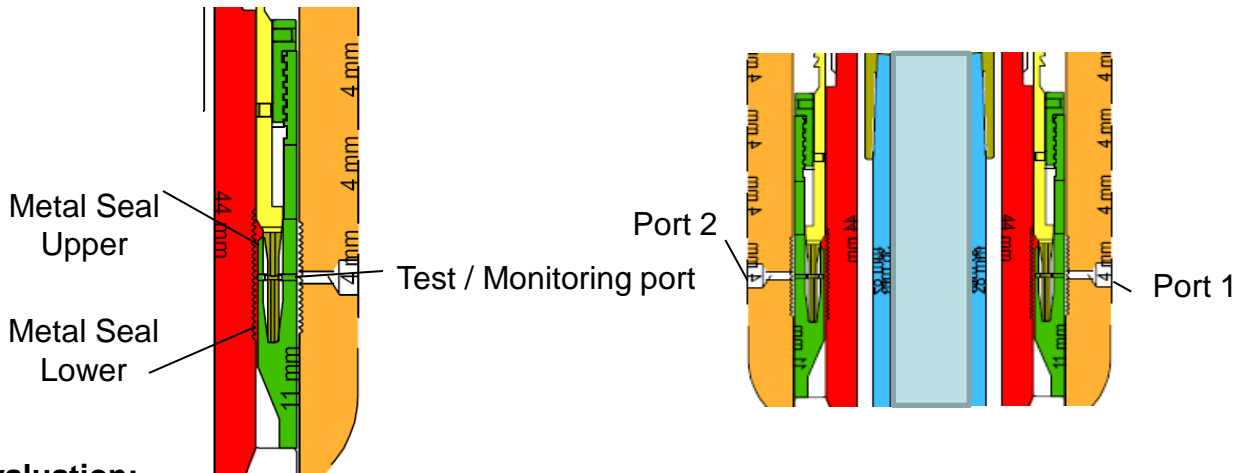


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## Existing Seal Design and Access:

The casing hanger is of a mandrel design, providing a metal to metal seal which has been mechanically energised between the mandrel hanger and the wellhead providing two independent metal to metal seal structures. The seal design allows access between the upper and lower seal areas with the intention of monitoring or pressure testing to evaluate both seals and their integrity.

There are two ports which are used for injecting test fluids and for flushing as and when required.



## Evaluation:

Bleed / flatten both annulus pressures and sting / vent ports 1 & 2.

Inject 1 litre of light oil through port 1, view port 2 for returns.

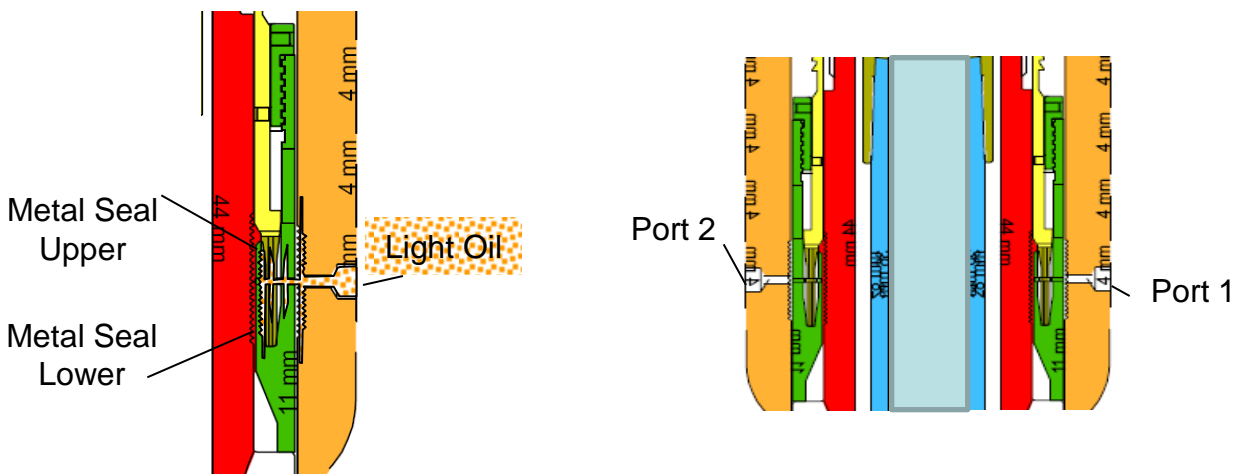
Visual indications of light oil returns through port 2

Monitor leak rate i.e. time over fluid displacement to determine / estimate leak rate Maximum test pressure 3,500psi.

Leak rate will determine product options i.e. Mac-Pac or Mac-Seal 02 or both.

Sting and vent all pressures, remove test / evaluation tooling.

**Note:** In the event that the existing injection fittings are damaged / blocked the following must be met . Bleed down both A & B annulus sting and vent ports 1 & 2 and replace fittings.





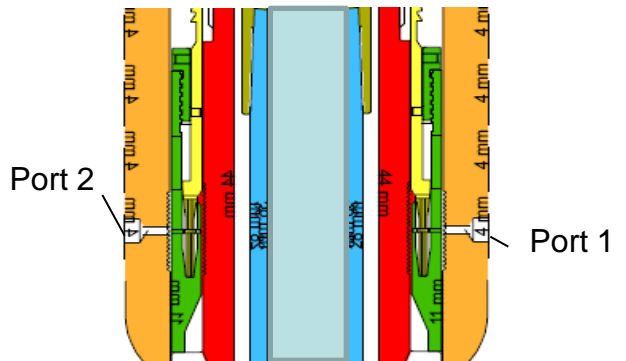
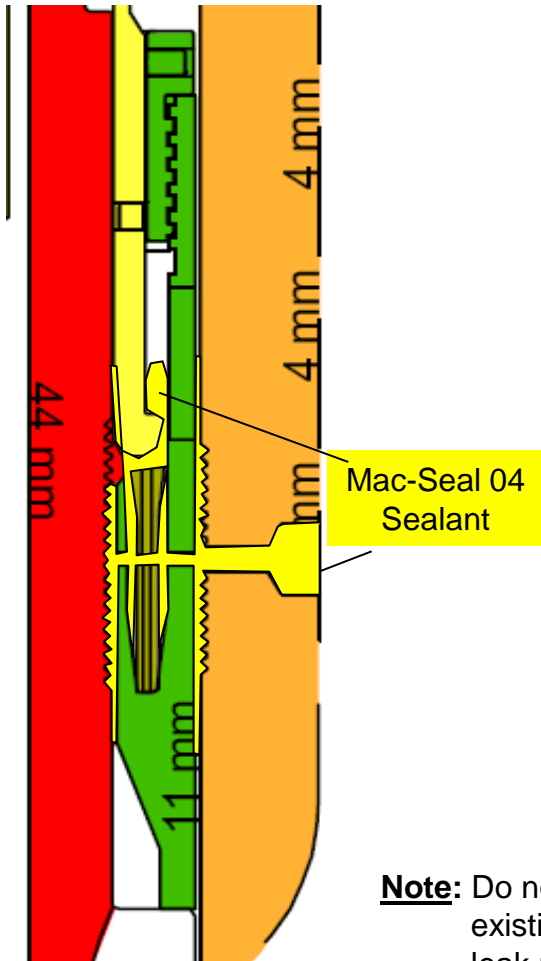
Pre-injected but unsuccessful . Review operational summary report page 16 of 16 date 19-06-09

No returns through port 2 during evaluation and sealant deployment. Visual indication of the sealant passing port 2, which indicates a blockage.

The object is to evaluate the possibility of injecting additional sealant through port 2 to isolate any existing leak paths. Oil testing will be conducted to confirm access.

**Mac-Seal 04 Sealant: Deployment**

KCI Mac-Seal 04 is a viscous fluid which will convert to a solid but flexible self-energising seal between and through the leak path. Sealant volume 1.5 litres



**Deployment:**

- Sting and vent ports 1 & 2
- Mix and inject 1.5 litres of Mac-Seal 04 through port 1
- Monitor port 2 for sealant displacement
- Close port 2 and deploy the set volume of 1.5 litres

**Testing: 3,500psi maximum test pressure**

- With pressure in the annulus sting port 1 monitor only.
- With pressure in the annulus sting port 2 monitor only.

**Note:** Do not apply pressure to ports 1 & 2 as this will disturb the existing seal structure. Cure time is subject to evaluation / leak rate. Current cure time is 2-1/2hours from mixing at 20°C



**Evaluation:**

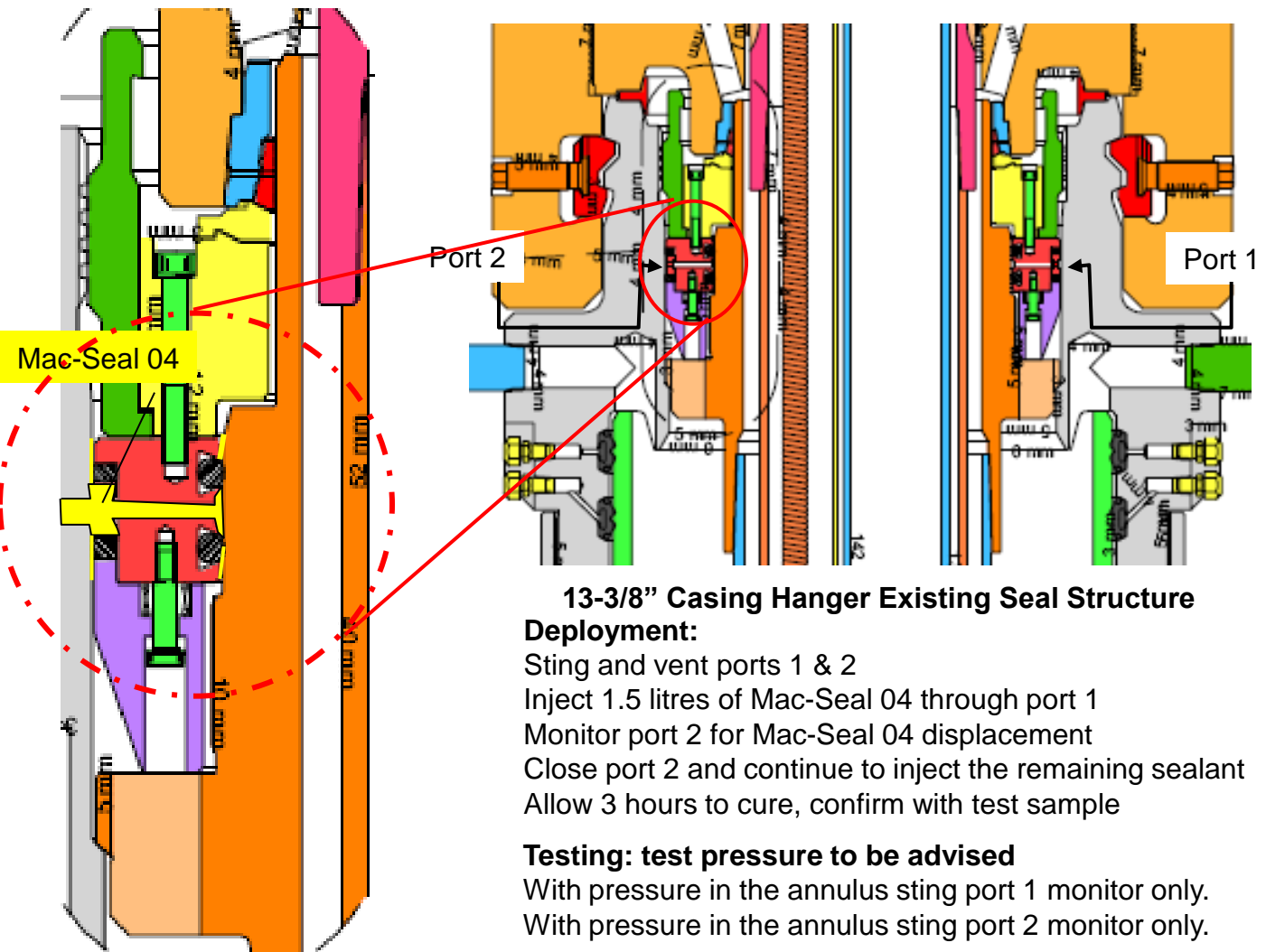
Bleed / flatten both annulus pressures and sting / vent ports 1 & 2.

Inject 1 litre of light oil through port 1, view port 2 for returns.

Visual indications of light oil returns through port 2, close port 2

Monitor leak rate i.e. time over fluid displacement to determine / estimate leak rate.

Sting and vent all pressure remove test/ evaluation tooling.



**13-3/8" Casing Hanger Existing Seal Structure**

**Deployment:**

Sting and vent ports 1 & 2

Inject 1.5 litres of Mac-Seal 04 through port 1

Monitor port 2 for Mac-Seal 04 displacement

Close port 2 and continue to inject the remaining sealant

Allow 3 hours to cure, confirm with test sample

**Testing: test pressure to be advised**

With pressure in the annulus sting port 1 monitor only.

With pressure in the annulus sting port 2 monitor only.

**Note:** Do not apply pressure to ports 1 & 2 as this will disturb the existing seal structure. Cure time is subject to evaluation / leak rate. Current cure time is 2-1/2hours from mixing at 20°C