

**WORK INSTRUCTIONS FOR ENGINEERS**

Compiled by : YKK/WWS

Checked by : KCM

Approved by : TYC

**G&P GEOTECHNICS SDN BHD**

**CHECKLIST FOR PACKER TEST**

Section: CH-024  
Revision: 0  
Date: 3-10-2005  
Page 2 of 9

| NO. | CHECKLIST ITEMS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Checked By<br>Engineer | Remarks |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|---------|
| 1.0 | <p><b>PROJECT</b><br/> Project Name : _____<br/> Project No.: _____</p> <p><b>SUBCONTRACTOR</b><br/> SI Contractor _____<br/> Location : _____<br/> Borehole : _____<br/> Water level (Before) : _____<br/> Water level (After) : _____</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                        |         |
| 2.0 | <b>Test Equipments</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                        |         |
| 2.1 | <p>For Single Packer and Double Packers</p> <ul style="list-style-type: none"> <li>• Inflation hoses</li> <li>• Injection hoses</li> <li>• Stuffing box</li> <li>• Pump <ul style="list-style-type: none"> <li>- Suitable pump size : a pump of 20 l/s to 25 l/s (0.02 to 0.025m<sup>3</sup>/s) capacity against a total head of 400 to 500kN/m<sup>2</sup> will generally furnish adequate water at sufficient pressure for most tests.</li> <li>- The pump should be able to give a steady pressure readings, e.g. a centrifugal pump.</li> </ul> </li> <li>• Couplings</li> <li>• O-rings</li> <li>• An upper fixed end <ul style="list-style-type: none"> <li>- Both of the rubber element ends fixed to the pipe mandrel.</li> <li>- Equipped with 1 or 2 inflation inlets with adapters.</li> </ul> </li> <li>• An inflatable elements – with steel fittings on both sides. <ul style="list-style-type: none"> <li>- For 76mm dia. borehole, recommended nominal dia. in mm = 42, 56 and 72.</li> <li>- For 101mm dia. borehole, recommended nominal dia. in mm = 56, 72 and 85.</li> <li>- The contact length with the rock (test section) = at least 5D where D = diameter of the borehole.</li> </ul> </li> <li>• A sliding end</li> </ul> |                        |         |

**CHECKLIST FOR PACKER TEST**

|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |  |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
|     | <ul style="list-style-type: none"> <li>- Allows the element gland to slide on one end.</li> <li>- Make sure there is no leak path presents at the mechanical seals of the sliding end.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |
| 2.2 | <p>Extra Equipment for Single Packer</p> <ul style="list-style-type: none"> <li>• The diffuser – made of stainless steel.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |  |
| 2.3 | <p>Extra Equipments for Double Packers</p> <ul style="list-style-type: none"> <li>• Perforated central element.               <ul style="list-style-type: none"> <li>- The total area of the perforations is at least twice the cross sectional area of the pipe.</li> <li>- A 50mm diameter pipe perforated with 6mm diameter holes requires sixteen holes per 100mm length; for a 25mm diameter pipe, eight 6mm or twenty four 3mm holes per 100mm length would be adequate.</li> </ul> </li> <li>• An extension kit (if needed) – for longer injection zone.</li> <li>• Packer end cap – for blocking flow through bottom of packers.</li> <li>• Inflation line in the test zone.</li> </ul> <p><b>Caution :</b> If a sliding end was placed into the test zone, please</p> <p>keep a safety margin for the inflation line to compensate the</p> <p>shortening of the packer after inflation.</p> |  |  |

2.4

### Shroud

A mechanical connection that provides protection and cooling for submersible pumps.

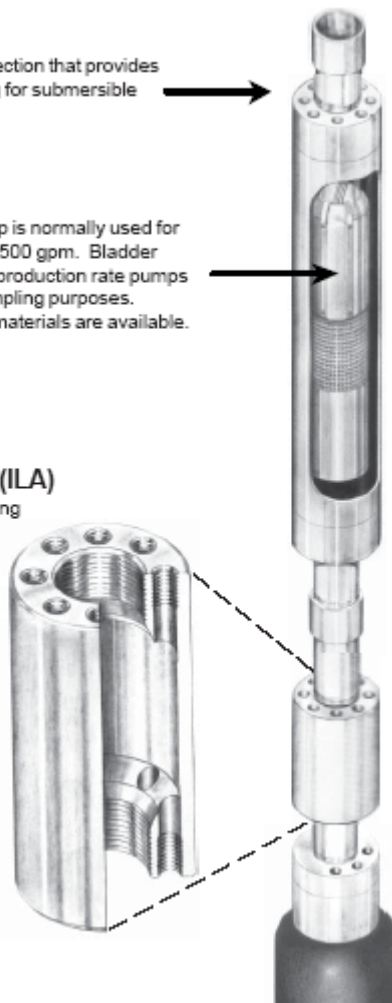
### Pump

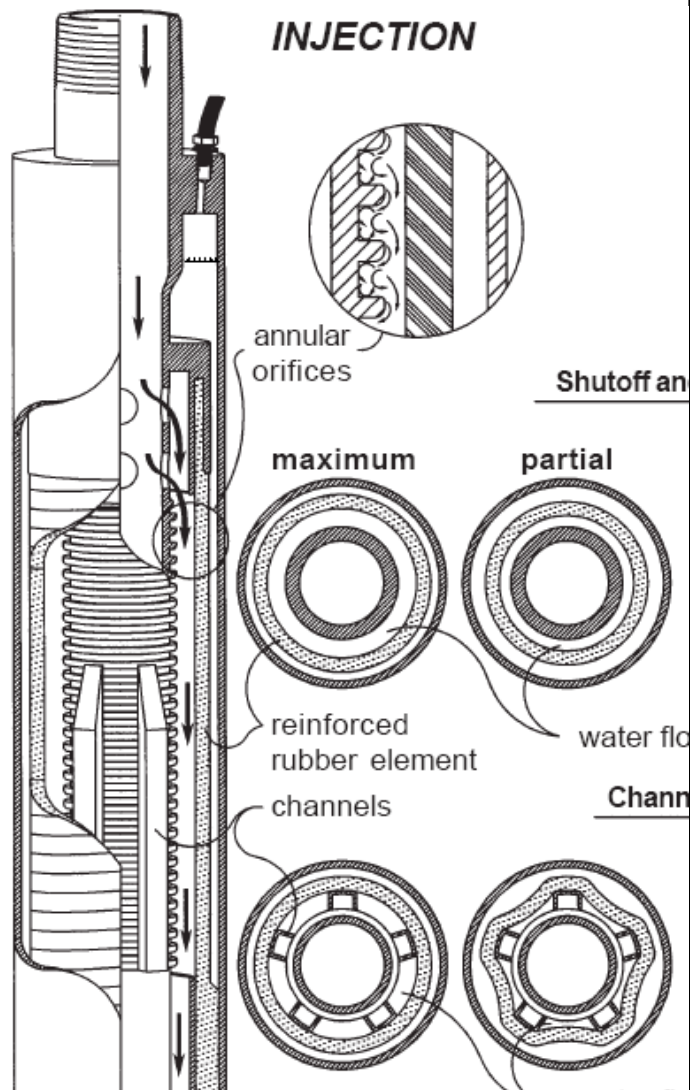
A submersible pump is normally used for pumping rates of 5 to 500 gpm. Bladder pumps and other low production rate pumps are often used for sampling purposes. Various construction materials are available.

### In-Line Adapter (ILA)

An adapter for feeding all leads from outside the packer string to within and through the packer and sealing them.

*Cut away view of In-Line Adapter*





#### Equipments Testing

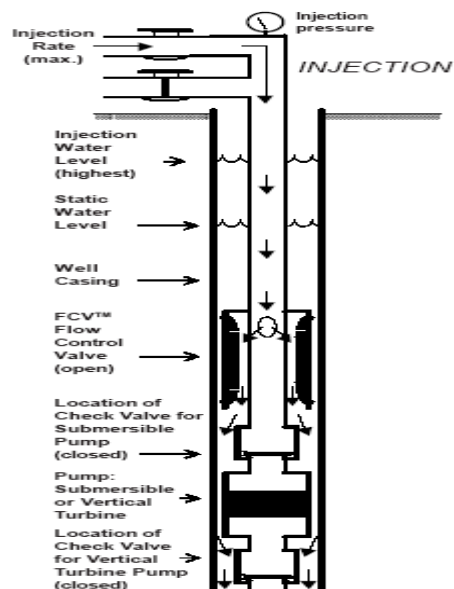
- All packers must be tested to maximum design pressure.
- Require ability to calibrate friction losses in pumping system and packer system prior to testing.
- Will need to have bypass valves installed before and after the pressure gauge/flow meter assembly in order to control pressure/flow and to protect flow meter from back pressure.

Pressure gauges should be calibrated if possible (plumbing in spare gauges and comparing measurements may be only means available on site).

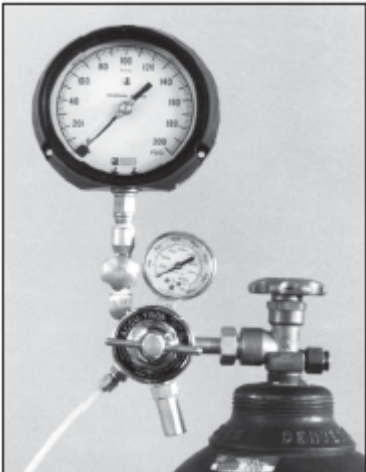
**CHECKLIST FOR PACKER TEST**

|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |  |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
| 3.0 | <b>Packer Test Preparation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |  |
| 3.1 | <ul style="list-style-type: none"> <li>• Prepare packer assembly according to the needs.</li> <li>• Check inflation line connecting the packers and fittings – do not over tighten as you might strip the threads.</li> <li>• Check packer assembly for any leakage. Inflate to maximum gland working pressure in appropriate length and diameter of drill casing or drill rods.</li> <li>• Check wire line connectors on packer assembly and stuffing box components (especially seals).</li> <li>• Prepare and check water feeding system : tank, supply, pump, connection hoses, pressure gauges, valves and flow-meter.</li> <li>• Design test parameter : depth and length of tested zone, drilling bit depth, position of packers, inflation pressure and water pressure for three stages.</li> <li>• Drill hole preparation : Flush the drill hole with clean water in order to remove the drilling mud and cuttings).</li> <li>• Pull rods up to locate drill bit at selected depth.</li> <li>• Prepare wireline winch.</li> <li>• Install stuffing box on drill rods.</li> <li>• Measure groundwater level prior to installing packer system several times to assess static groundwater level.</li> <li>• Lift the packer assembly using the wireline and lower to landing ring at drill bit – check if seats on landing ring by “listening” to rods using wrench, etc. If possible, check depth marking on wire line if this has been marked for the expected depth.</li> <li>• Inflate packer slowly (by 50 psi steps) until working pressure has been reached.</li> <li>• After inflation is complete, monitor packer inflation line pressure for 2 minutes minimum to see if system is leaking. If no leaks apparent, then,</li> <li>• Seal stuffing box cap and attach water feed system.</li> <li>• Check inflation lines and inflation pressure to ensure no leaks occur, check water feeding system, prepare stop-watch and field test form.</li> <li>• Packer system is now ready for testing.</li> </ul> |  |  |
| 4.0 | <b>Test Description (Procedure)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |

# CHECKLIST FOR PACKER TEST



**CHECKLIST FOR PACKER TEST**

|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
| 4.1 | <p><u>Specified the test level and length of the test section.</u></p> <ul style="list-style-type: none"> <li>• Pump water into the test section (normally 0.5 – 1.0m) under constant pressure.</li> <li>• Limit the pressure to ensure that hydraulic fracturing of the rock cannot occur.</li> <li>• The quantity of water pumped into the borehole in m<sup>3</sup>/s should not exceed 0.03 times the total area of the test section in m<sup>2</sup>. If this condition is not satisfied, a lower delivery pressure should be tried.</li> <li>• Observe the flow for every 5 minutes until measurements of 5 minutes interval show variations of not more than about 0.1 l/s (1x10<sup>-4</sup>m<sup>3</sup>/s).</li> <li>• Increase the pressure, usually for 5 equal increments, followed by 3 decreasing pressures.</li> <li>• Record the steady-state flow of each pressure.</li> </ul>  <ul style="list-style-type: none"> <li>• After the completion of the test, deflate the packer.</li> <li>• Do not remove the packer before complete deflation. A few minutes are needed when water has been used to inflate the packer.</li> <li>• Carefully clean the packer with water after each use.</li> <li>• Store packers away from light.</li> <li>• Since natural rubber is very sensitive to UV rays, packers should not be exposed to sunshine.</li> </ul> |  |  |
| 5.0 | <b>Data Interpretation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |  |

**CHECKLIST FOR PACKER TEST**

- Plot the graph flow rate (q) versus total head (h).
- Observed the pattern of the graph, the type of material in the test section roughly can be known.

Calculate the permeability of the material (k),

$$\text{For } L \geq 10r; \quad k = \frac{Q}{2\pi LH} \ln \frac{L}{r}$$

$$\text{For } 10r \geq L \geq r; \quad k = \frac{Q}{2\pi LH} \sinh^{-1} \frac{L}{2r}$$

k = permeability (m/s)

Q = rate of flow into the test section (m<sup>3</sup>/s)

L = length of the test section (m)

H = h<sub>1</sub> + h<sub>2</sub> - h<sub>f</sub> = differential head of water (m)

h<sub>1</sub> = gravity head (m)

h<sub>2</sub> = pressure head at swivel (m)

h<sub>f</sub> = head loss in delivery pipes (m)

r = radius of hole tested (m)

**Signature by Engineer**