



Wild Desert

Downhole Equipment Audit

1275548869WLD

3 January 2020

GENERAL REPORT

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Project Information

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Further, any installation practices which vary from those allowed for in Australian or Australian/New Zealand standard, government acts and regulations, the original certification or the manufacturer's original documents, may void the validity of this assessment.

By accepting this report, **the Client** agrees that all measures and decisions based on this analysis and these findings are the sole responsibility of **the Client**.



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EXECUTIVE SUMMARY

On 18th December, HAZ made a site visit to Wild Deserts site for Rig 4, which is approximately 1hr south of Roma, Queensland. The rig was stowed for transport as it had just completed a well and was waiting for the new site to become available in order to do a rig move. The site visit was to investigate the Type CB Wellhead Outlet and the process by which it is installed and handed over to the client (Santos). Huracan is the responsible party for the down hole pressure gauge and associated equipment, while Wild Desert own and operate the rig which is working over the well.

From conversations on site with the Operator Company Representative (OCR) and Wild Deserts HSEQ Manager it was identified that on another site an Inspector from the Department of Natural Resources, Mines and Energy (DNMRE) was present when the downhole pressure gauge was being prepared and installed. The Inspector raised some concerns about the installation process, especially around the wellhead, in that this is a hazardous area.

Huracan's Manager was on site during the site visit and walked HAZ personnel through the process of how their technicians connect the downhole gauge and the Antech outlet. The Technicians are not licenced Electricians although have been provided with on the job training and deemed competent (by Huracan) to be able to perform this task for the company. The scope of work which Huracan are responsible ends when the cable is terminated into the Antech outlet. They do not make the final connection or energise the installation. This is completed by another third party contractor for Santos, for which HAZ was informed are licenced electricians and qualified to work in hazardous areas.



1. INTRODUCTION

HAZ attended the Wild Desert Rig 4 site, which is 1 hour's drive south of Roma. Rig 4 has been operating for Santos in various Coal Seam Gas Fields. The rig equipment was stowed and made ready for rig move. Upon arriving at the site, it was noted that the wellhead was in place and that the Antech Wellhead Outlet had been installed.

The purpose of the visit was to understand and evaluate how the downhole gauge and associated equipment is installed and tested by Huracan (a Santos contracted company). Through conversations with site personnel it was discovered that an Inspector from the Department of Natural Resources, Mines and Energy (DNRME) had witnessed the installation and process on another site and had raised some concerns about how it was being conducted.

The process by which the cable and the **Antech Type C Family Wellhead Outlet Connector** (hereafter called the ‘Outlet’) is installed and tested can be found in Appendix A of this report.

2. HAZARDOUS AREAS

Due to the potential presence of Coal Seam Methane during operation, a hazardous area exists around the wellhead. The hazardous area classification layout drawing (7607-67-5010) was provided by Santos. This is a generic layout drawing applicable to all installations of this equipment. The drawing of the wellsite layout depicts the Wellhead / Cellar which is where the equipment is installed and is identified by a "Red Box" in Figure 1.

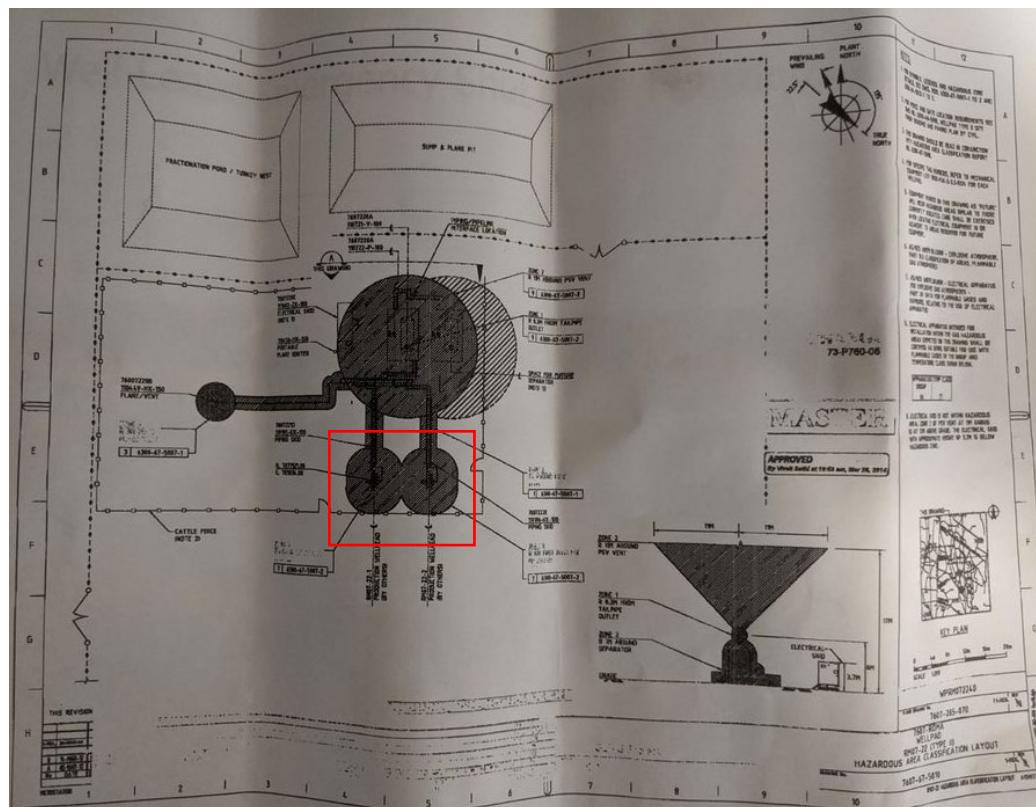


Figure 1 - Hazardous Area Classification Layout

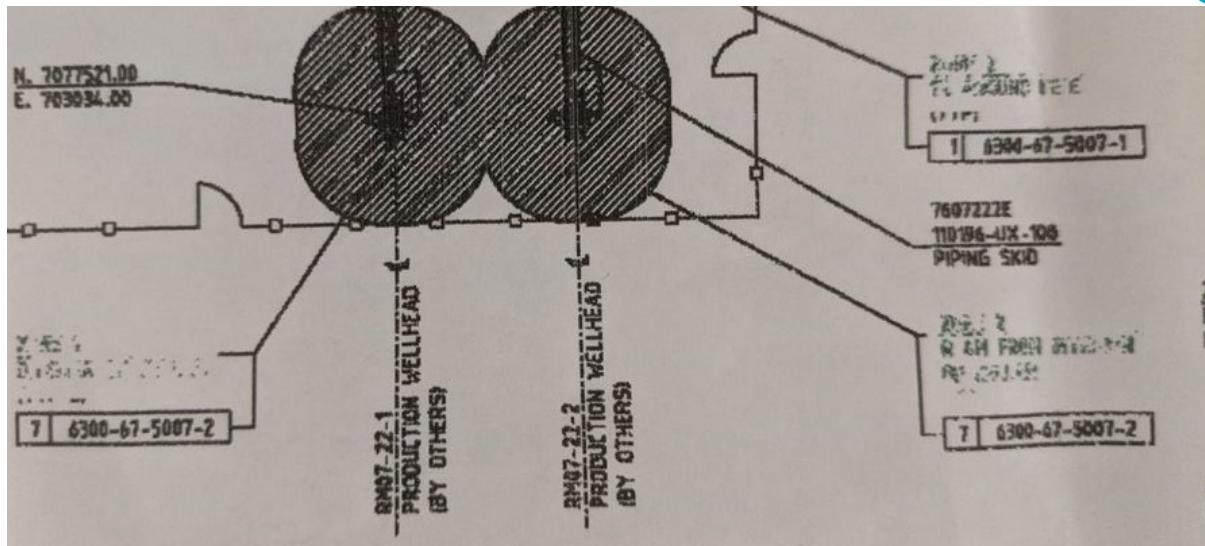


Figure 2 - Wellhead and Cellar

Although very hard to identify from Figure 2, the hazardous area extent, within Santos's "Well Lease Emergency Shut Down Functionality" document (Figure 3), states that a Zone 2 hazardous area exists "4 metres from the interior of the Cellar".

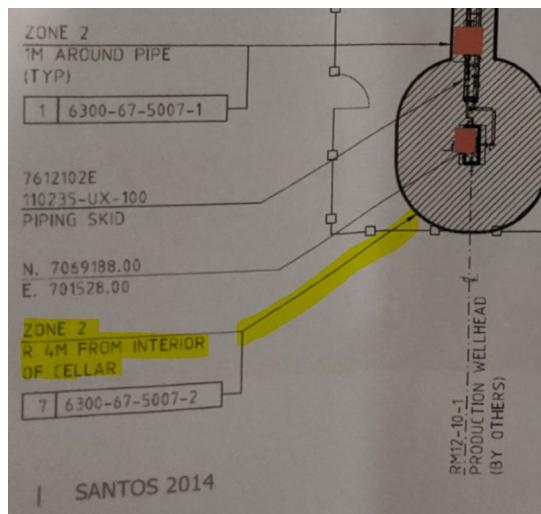


Figure 3 - Cellar Zonal Radius

A comment was made that the hazardous areas zonal radius was taken from Rig 4s area classification, although as it can be seen in Figure 4 below, there is a discrepancy in the hazardous area extent of 1 metre (only 3 metres on this drawing), worst case extent of 4 metres will be adopted.

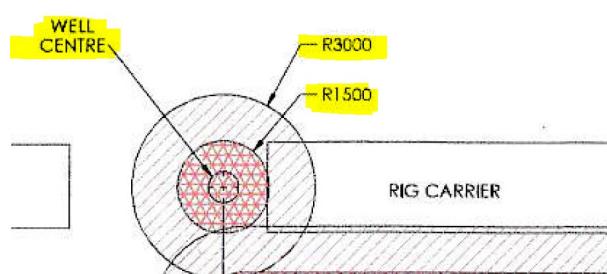


Figure 4 - Rig 4 Area Classification Drawing



3. WELLHEAD OUTLET EQUIPMENT

3.1 Down Hole Gauge (Pressure Sensor)

The Down Hole Gauge (DHG) is assembled by the Huracan technicians prior to the sensor going into the well. There is one connection which is made which connects the Stainless Steel tube sheathed single core cable (with yellow protective coating) to the pressure sensor. Prior to making this connection the cable on the drum is 'meggered' (insulation tested) to ensure the integrity of the insulation prior to use. The final assembly can be seen in Figure 5 below. This assembly is then banded to the String every 1 metre and lowered to the bottom of the well.



Figure 5 - Pressure Sensor Final Assembly

The pin (Figure 6) is connected to the single core cable which is then secured to the stainless-steel cable with two fail safe connections in the pressure sensor assembly.

Pressure sensor and connection
via pin (Figure 1)



Figure 6 - Conductor Pin

Double Cable head is fitted with a permanent miniate metal to metal seal with backup O-ring.



Figure 7 - Pressure Sensor Assembly

This pressure sensor is not certified. It operates on a 4-20mA loop (28V dc maximum) whose output is proportional to the pressure in the well. Inside the well itself is not considered to be a hazardous area as an explosive atmosphere cannot form due to the Oxygen content being below the LOC for methane (LOC = Limiting Oxygen Concentration ~10.7%).

When the DHG is lowered into the well, the cable drum is located approximately 30 metres from the wellhead. The pressure is constantly being measured to ensure that the sensor is operating correctly as it is lowered. This is monitored using the Huracan test box (IRO-15DO) which is connected to the cable drum. (Figure 8).



Figure 8 – Reservoir Monitor Attached to the Drum

The Test Box (IRO-15DO) is not suitable for use within a hazardous area, which is clearly stated on the device.



Figure 9 - Huracan's Reservoir Monitor

When at depth, the cable is cut and the reservoir monitor is used to prove for the last time that the DHG is operational. To do this, a connection was made to the monitor and the gauge switch (Figure 10 red circle) is energised. This process takes less than three minutes.



Figure 10 - Final Reading



3.2 Wellhead Outlet

The Antech Type CB Wellhead outlet is an adaptor which is a screwed connection to the wellhead. Figure 11 depicts the final location and how the connection is made. When connected to the wellhead the entire assembly is pressure tested to verify there are no leaks present. The outlet is rated at 10,000 psi (68948 kPa). The procedure on how to make this connection is reproduced in Appendix A, as well as in the Antech document “DC-00611 Wellhead Outlet Manual Type CB Single Line”.



Figure 11 - Wellhead Outlet Assembly

The Huracan technicians are responsible for the assembly and connection to the Outlet Terminal Block (Figure 12). The technicians have no specific trade or competencies, over and above on the job training. The installation is not energised at this point.

The process of connecting the Outlet has been revised, since the DNRME visit to another rig. The Procedure is now to have at more than 4 meters of cable slack from the well-head for testing the DHG due to the 4 metre Zone 2 hazardous area extent. This then places the uncertified equipment outside of the hazardous area. The reservoir monitor (Figure 9) is used to confirm the DHG is operating correctly - basically a quality check prior to handing the installation over to Santos. Note that there are two terminals in the connection block where the equipment Earth is connected at the factory.

Huracan do not fit any cables to the outlet side of the terminal block nor do they fit any gland to the outlet, as this is conducted by another contractor engaged by Santos.



Figure 12 - Terminal Block

The Antech Outlet is an IECEx certified equipment (IECEx EXV 16.0008X). This certificate can be found on the IEC website (<https://www.iecex-certs.com/>). Two issues exist (0 & 1). The certification is still current.



Figure 13 - Antech Certification Details

The “X” at the end of the certificate number indicates there are special conditions (of Safety and of Use) which must be complied with, in order for the equipment to be used in a safe manner. The Conditions, as stated in the original certificates, can be found below, which have been taken from IECEx EXV 16.0008X – Issue 1.



	<p>SPECIFIC CONDITIONS OF USE: YES as shown below:</p> <p><u>Conditions of Certification</u></p>
	<p>Special Conditions for Safe Use</p> <ul style="list-style-type: none">- The user/installer shall install the equipment taking into account any restrictions or special conditions of safe use that are applicable to any previously certified devices that are fitted to the assembly- After the cable from the wellhead has been installed into the swage/pressure barrier arrangement, each unit shall be subject to the relevant routine tests of API 6A on the basis of the working pressure marked on the equipment. The pressure shall be applied from the side of the adaptor which is mounted to the wellhead. It must be shown that there is no leakage of the test medium into the flameproof enclosure.- Installation must ensure correct cable selection for the temperature range marked on the equipment or maximum local site requirements. A 5K temperature rise was measured at the entry point, cable selection should account for this for ambient ranges above +65°C
	<p>Conditions for Use</p> <ul style="list-style-type: none">- When Antech supply the cable gland it shall have a suitable temperature range to match the marked ambient range on the equipment.- The manufacturer shall supply the user/installer with an appropriate copy of the certificate for each certified device that is to be supplied and fitted to the equipment.- It is the manufacturer's responsibility to ensure the cable head/conductor seal supplied is appropriate for the marked pressure rating.

Figure 14 - Conditions of Use

3.3 Final Installation (Completed by Others)

There were other well installations, which had been completed, in the same area as the Rig 4 location. This provided HAZ an opportunity to see the completed product. It must be emphasised, that the final connection works **CANNOT be completed by the Huracan Technician**, but by an **Electrical Contractor engaged by Santos** with the **correct hazardous area competencies** and a **valid Queensland Electrical Licence**.

Speaking to the OCR and Huracan representative the personnel who wire up the final installation are licenced electricians who hold EEHA qualifications. This was taken at face value as there was no representative onsite at the time of the visit to confirm this, although Santos should follow this up to ensure this work is completed by a Licenced Electrician with EEHA qualifications.



Figure 15 - Cable and Gland Installed



Figure 16 - Final Installation



Inside the control panel a Pepperl+Fuchs SMART Transmitter Power Supply KCD2-STC-1, was found which is connected to the DHG (Figure 17).

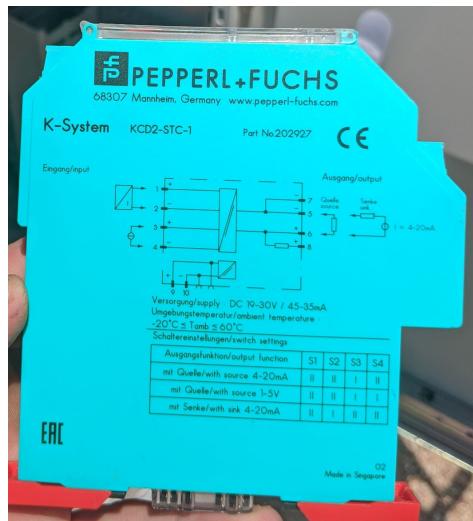


Figure 17 – Pepperl+Fuchs KCD2-STC-1 SMART Transmitter

The outputs of this device are detailed in the Pepperl+Fuchs data sheet below, where the output is a single 4 - 20mA type with voltages ranging from 15.5 to 26V.

Technical data		KCD2-STC-1
General specifications		
Signal type	Analog input	
Functional safety related parameters		
Safety Integrity Level (SIL)	SIL 2	
Supply		
Connection	Power Rail or terminals 9+, 10-	
Rated voltage U_r	19 ... 30 V DC	
Ripple	$\leq 10\%$	
Rated current I_r	$\leq 45\text{ mA}$	
Power dissipation	$\leq 800\text{ mW}$	
Power consumption	$\leq 1.1\text{ W}$	
Input		
Connection side	field side	
Connection	terminals 1+, 2-; 3+, 4-	
Input signal	4 ... 20 mA limited to approx. 30 mA	
Open circuit voltage/short-circuit current	terminals 1+, 2-: 22 V / 30 mA	
Voltage drop	terminals 3+, 4- : approx. 5 V	
Available voltage	terminals 1+, 2-: $\geq 15\text{ V}$ at 20 mA	
Output		
Connection side	control side	
Connection	terminals 5-, 6+	
Load	$0 \dots 300\Omega$ (source mode)	
Output signal	4 ... 20 mA or 1 ... 5 V (on 250Ω , 0.1 % internal shunt) 4 ... 20 mA (sink mode), operating voltage 15.5 ... 26 V	
Ripple	20 mV _{rms}	

Figure 18 – Pepperl+Fuchs KCD2-STC-1 Data Sheet



4. CONCLUSION

The Technicians who are working for Huracan are not Licensed Electricians nor have they any electrical background. There didn't appear to be any formal training in the electrical industry other than on the job training and being shown and deemed competent by the Manager of Huracan (Appendix B – Huracans Evaluation Sheet), on how to perform the assembly and connect the DHG (pressure switch) and the outlet to the cable. Within this evaluation sheet there is a section for “Electrical Skills”, it is unclear how or what is being assessed.

The task requires the Technician to make terminations and use testing equipment to ensure the instrument works prior to it going into the well. When they perform this task, the only supply is from the reservoir monitor being 4-20mA which is Extra Low Voltage supply for the measuring instrument.

The final connection, energisation and signoff of the DHG equipment is conducted by another third party contractor engaged by Santos.

During the process of the installation of the DHG and Antech outlet the Huracan Technician performs an insulation test (“megger”) on the cable. This is only done to ensure the cable is not damaged prior to going into the well. This could be checked using the Huracan’s reservoir monitor (Figure 9) as it is lowered into the well and watching the pressure increase. When the DHG is being lowered into the well the cable drum and monitor are approx. 30 meters from the wellhead (Figure 8).

Once at depth the cable is then cut with 4 meters of slack which is carefully fed through the BOP as it is removed. The Technician performs a test on the cable 4 meters away (outside of the zone) as a quality check tests the DHG to verify with Santos’s OCR that its operational and makes the connection into the terminal of the outlet. This is where Huracan’s Technicians scope of work ends.

4.1 Is this Electrical Work?

According to the Electrical Safety Code of Practice 2013 – Managing Electrical Risks in the Workplace, the connection of the DHG (being a device whose maximum applied voltage can never exceed 28V) is **NOT** electrical work:

This Code does not apply to:

- electrical work on extra-low voltage electrical equipment, including extra-low voltage electrical installations
- electrical work on high voltage equipment after switching, isolation, short circuiting and earthing, subject to summary guidance in Chapter 10 of this Code
- the manufacture of electrical equipment
- automotive electrical work
- work that is not electrical work carried out on telephone, communication and data systems
- repair of consumer electrical equipment when unplugged from any electrical socket outlet.

Note: ‘Extra-low voltage’ means voltage that does not exceed 50 volts alternating current (50 V AC) or 120 volts ripple-free direct current (120 V ripple free DC).

The Code of Practice is a guide to interpreting the requirements of the Electrical Safety Act and Regulation and adherence to this Code is mandatory.



As the equipment clearly operates at Extra Low Voltage by definition, there is no need for a licenced electrician to connect it, as it:

- **(a) Does not control, generate, supply, transform or transmit electricity at a voltage greater than extra low voltage** (Extra Low Voltage is < 50V ac or < 120V dc and this equipment is on a 4 to 20 mA control loop and will never see more than 28V dc across its terminals)
- **(b) Is not operated by electricity at a voltage greater than Extra Low Voltage** (it is operated at a voltage of 28V dc maximum, which is very much less than the limits for Extra Low Voltage).
- **(d) Is not part of a cathodic protection system**

However, when the final connection is made and signed off by the third party contractors engaged by Santos to the Antech outlet the equipment is

- **(c) Part of an electrical installation located in an area in which the atmosphere presents a risk to health and safety from fire or explosion**, which would require the appropriate EEHA competency or at the very least, supervision during assembly and final checking of the assembly by a person with the correct EEHA competencies.

In addition to the above regarding Electrical Work, a definition for electrical equipment can be found in the Electrical Safety Act in Section 14.

14 Meaning of *electrical equipment*

- (1) Electrical equipment means any apparatus, appliance, cable, conductor, fitting, insulator, material, meter or wire that—
 - (a) is used for controlling, generating, supplying, transforming or transmitting electricity at a voltage greater than extra low voltage; or
 - (b) is operated by electricity at a voltage greater than extra-low voltage; or
 - (c) is part of an electrical installation located in an area in which the atmosphere presents a risk to health and safety from fire or explosion; or
 - (d) is, or is part of, a cathodic protection system.

This also confirms that that electrical apparatus that is not operating at greater than Extra Low Voltage is **not considered** as Electrical Equipment under the Electrical Safety Act.



5. RECOMMENDATIONS

1. Huracan to engage a specialists company to provide hazardous areas awareness training to those who are working on the Wellhead, including the dangers of flammable gases and ignition sources.
2. It would be of benefit to Huracan (though not essential) if the Technicians held Restricted Electrical Licences. This would remove any possible legal issues going forward.
3. Huracan should formalise the training of their technicians and deem them competent by means of an internal document (letter or certificate) by the manager or a delegate. This should also be filed in the employees training records.
4. A suitably certified (IECEx or ANZEx), calibrated Intrinsically Safe Meter should be used to test the final connection when inside the zone.
5. Huracan should review their Safety Management System and ensure it aligns with the requirements for working and operating in the Coal Seam Gas industry and the services they perform.
6. Huracan to review their Standard Operating Procedures to include the dangers and requirements for working in hazardous areas.

6. REFERENCED DOCUMENTS

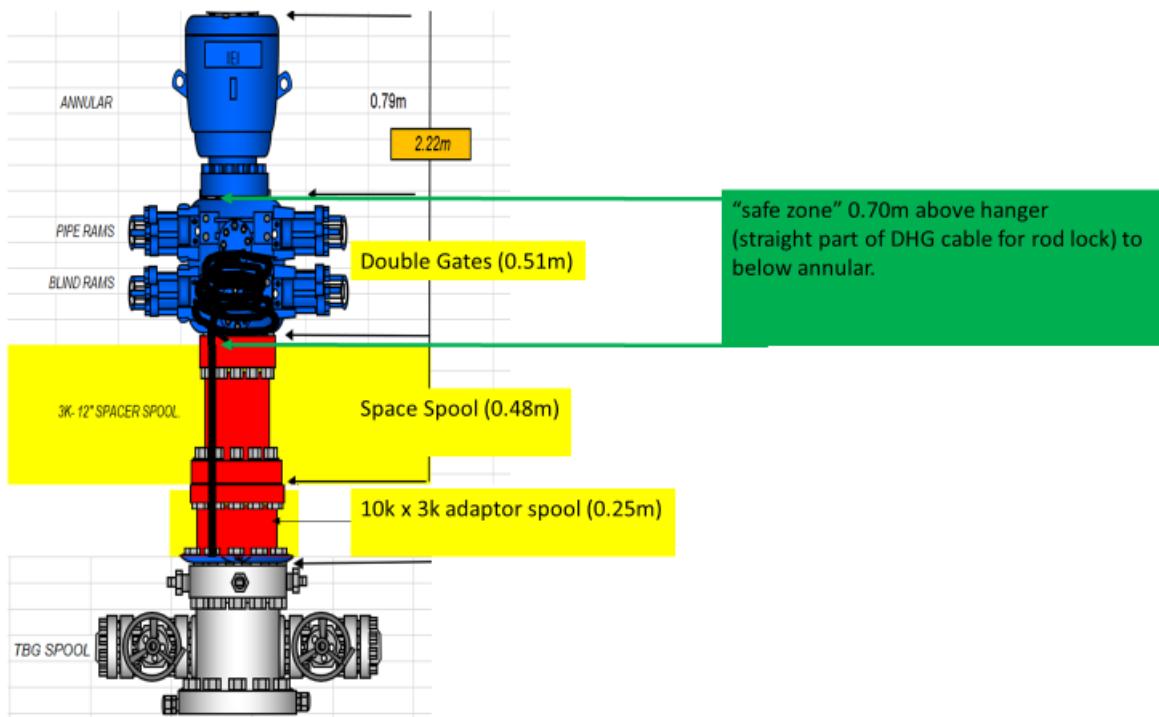
Type	Description	Revision/Date
Antech Outlet Manual	DC-00611 Wellhead Outlet Manual Type CB Single Line	Revision RD
Data Sheet	Pepperl+Fuchs KCD2-STC-1 SMART Transmitter Power Supply	Release date 2017-08-09 14:35 Date of issue 2017-08-09 202927
Certificate of Conformity	IECEx EXV 16.0008X “Antech” Type C Family Wellhead Outlet Connectors	Issues 0 and 1
Code of Practice	EESOPDF179 Electrical safety code of practice 2013 Managing electrical risks in the workplace	1 January 2014
Data Sheet	Permanent Monitoring—Fortress PCP-4000	---
Electrical Licensing	Electrical licensing eligibility guide Electrical Safety Office	January 2020
Job Safety Analysis (JSA) and Risk Assessment (RA)	Permanent Gauge Installation Onshore, Australia	KIN-WIS-QHSE-FRM015-JSA & RA-V1.0
Standard Operating Procedure	Install Permanent Down-hole Gauges SOP	SOP# GN013

Table 1 - Referenced Documents



APPENDIX A – PROCEDURE

The procedure to connect made the final connection to the Wellhead outlet device.



Measure & cut 4.00m above top of tubing hanger (remove yellow protective coating)



Install lower hanger fittings





Install DHG cable through hanger



Make up lower fittings

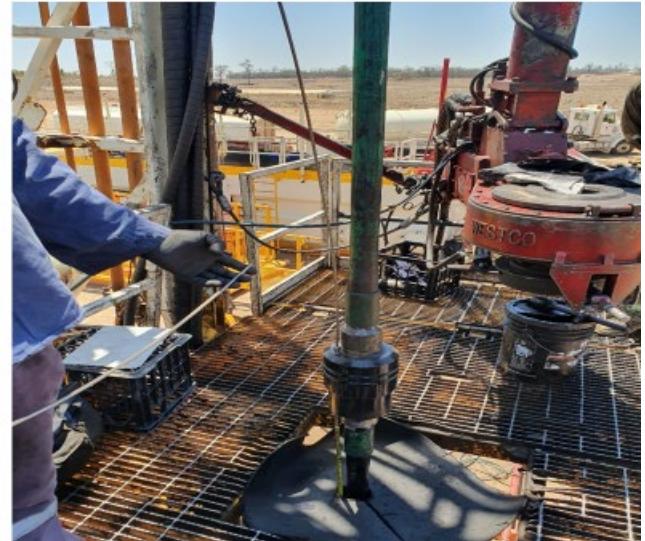


Install top hanger fittings





Lower hanger & roll up 4m tail



Roll up DHG cable

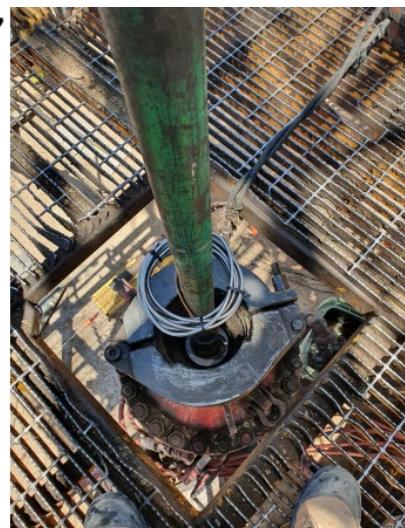




Added zip ties to help keep the shape of the DHG cable to help getting the landing joint out / BPV in



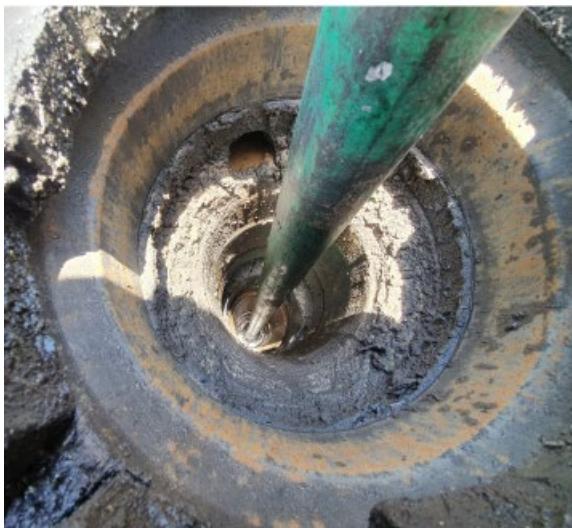
Ensure cable is neat & within 7-1/16"







After P/T, carefully remove landing joint & install BPV



N/D BOP's & spacer spool





Remove zip ties and straighten out DHG cable



Feed DHG cable through rod lock





Take cable end outside of 3m zone & conduct final test



After final test complete, cut cable and finish tie in to rodlock as normal.





APPENDIX B – HURACANS EVALUATION SHEET

Evaluation Sheet - Permanent Gauge Technician								HURACAN	
Gauge Technician Information									
Name				Seniority Date					
Kurt Rowbotham				15-Feb-18					
Location Code		Location		Evaluation Date					
FBFV		Roma		19-JUN-18,					
Well		Rig		Company Man					
B1 SO -23-1.		WILDESEERZ 16.		T. SAINY,					
Technical Quality									
A B C D				A B C D					
Manual Skills		<input checked="" type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		Quality of Work	
Mechanical Skills		<input checked="" type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		Electrical Skills	
Wellsite Performance									
A B C D				A B C D					
Pre-job Check & Pre-departure		<input checked="" type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		Comments	
JM & Driving		<input checked="" type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		Comments	
Location Arrival & OCR meeting		<input checked="" type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		Comments	
Wellsite Preparation & Check		<input type="checkbox"/>		<input type="checkbox"/>		<input checked="" type="checkbox"/>		Comments	
Safety Meeting & PTW		<input type="checkbox"/>		<input checked="" type="checkbox"/>		<input type="checkbox"/>		Comments	
Gauge Installation		<input checked="" type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		Comments	
Cross Coupling Protectors		<input checked="" type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		Comments	
Tubing Hanger Termination		<input checked="" type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		Comments	
Wellhead Outlet Termination		<input checked="" type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		Comments	
Gauge Final Check		<input checked="" type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		Comments	
Liaising with Rig Crew		<input checked="" type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		Comments	
Final Product		<input checked="" type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		Comments	
Field Ticket		<input checked="" type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		Comments	
Evaluators Comments									
Good work.									
Gauge Technician Comments									
Overall Performance				Passed <input checked="" type="checkbox"/>				Failed <input type="checkbox"/>	
Evaluators Name				Evaluators Signature					
Jon Hollingworth									