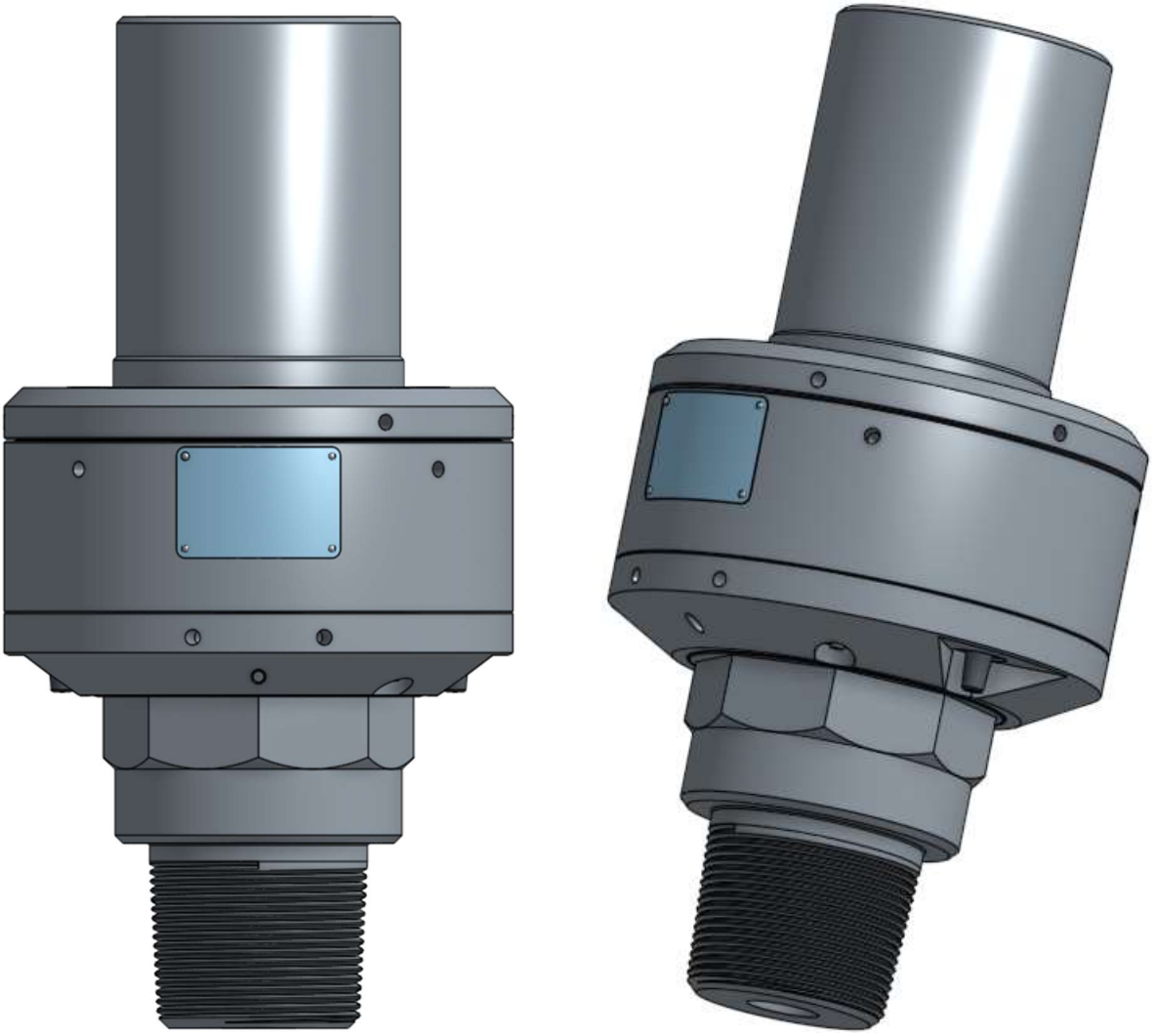
User Manual

WITS™ Wireless Information Technology System

Aelium WITS™



P/N: 700033

Revision: 4

(DCN: 230714-1)

ORIGINAL INSTRUCTIONS

Keep this document for future reference.

Cheetah Oilfield Solutions ("COS") has made every effort to ensure that all information in this document is as accurate and current as possible. Some graphic or visual differences from this manual to the actual product are possible.

This document is intended for guidance and informational purposes and must be used in association with adequate training and on-the-job supervision to provide safe and effective equipment use.

The user must comply with the information and instructions included in this document.

It is the responsibility of the user to conform to all regulations and requirements issued by an authority or agency which may affect the operation, safety, or equipment integrity, that may overrule the content of this documentation.

The user of this document shall protect, indemnify, and hold harmless COS and its directors, officers, employees, and agents from and against all liability for personal injury, death, or property damage resulting directly or indirectly from the use of the information contained in this manual.

Under no circumstance will Cheetah Oilfield Solutions be liable for any incidental, consequential, or special damages of any kind whatsoever, in any association with the use of Cheetah Oilfield Solutions' equipment or this document.

Cheetah Oilfield Solutions
32914 Tamina Road, Suite A
Magnolia, TX 77354
USA

Office: +1-346-703-3080
Email: info@cheetahoilfield.com
Web: www.cheetahoilfield.com

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Change Summary

Document Revision	Date	Written by	Approved by	Description of change
0	03 June 2021	J. Pfrenger	R. Roling	Initial Release
1	21 April 2022	J. Pfrenger	R. Roling	Branding change from Aelium Solutions to Cheetah Oilfield Solutions and associated logo and name changes. Expanded Operation section.
2	04 Nov 2022	J. Pfrenger	R. Roling	Updated WITS Model references throughout. Section 1.1: updated Section 1.6.2: updated label. Added section 4.4.2. Updated Section 12.
3	14 Mar 2023	J. Pfrenger	R. Roling	Updated Torque Table, corrected item numbering and updated torque values; Added exploded views for Power On/Off Switch and Lower Housing Set Screws; Updated WITS-1 assembly table; Updated SECTION 1.5 "Specifications";
4	10 July 2023	J. Pfrenger	R. Roling	Updated Branding. Updated special tools list. Added section 1.6. Updated Specific Conditions of Use with translation into French.

Table of Contents

1 Introduction, Description, Specifications

1.1 Introduction

This document applies to the below listed WITS™ Torque Sub models and their variants:

Model	**COS Part Number** (100XXX) **– Variants** (-X-XXX-XXX-XXXX)
WITS-1C	100701-X-XXX-XXX-XXXX
WITS-2C	100703-X-XXX-XXX-XXXX

Table 1: WITS™ models and variants

The WITS™ Torque Sub models are a continual improvement from the previous models with stronger housing materials, added power On/Off switch, modified internal design for a WITS™ universal battery, and updated lower housing design for improved structural strength and added protection of the antennas and power switch.

The purpose of this document is to provide installation, operation, and safety instructions.

It is the user's full responsibility to observe all descriptions, information, and instructions contained in this document.

The user will acknowledge and obey any general legal or other mandatory regulation in force relating to accident prevention, safety, and equipment integrity.

COS does not warrant or guarantee that the information contained in this document is complete or accurate in every aspect. The user should consult with a COS representative for any questions, clarifications and/or updates.

1.2 Storage of Document

Keep this Document safe in the vicinity of the WITS™ product. All persons who work on or with a WITS™ product should be advised on where the manual is located.

An electronic copy of the Document is stored on the COS provided PC or Tablet with the User Interface Software (UISW) pre-installed.

1.3 Description of the WITS™ products

The Aelium Wireless Information Technology System (WITS™) Torque Sub System is a data acquisition and management tool for drilling and tubular running applications, commonly referred to as a "torque sub". The WITS™ system records various drilling and operational parameters, and may include torque, tension, compression, turns, RPM, pressure, temperature, time, rotation, acceleration, gravity, heading, etc. The WITS™ system measures, records, stores, and transmits data. All data is encrypted using proprietary encryption technology to ensure data safety and data integrity.

The WITS™ systems can be updated remotely with an internet connection. This greatly simplifies adding and improving features and functions as they are developed and become available. When connected to the internet at the end of a job, the job information and updates are synchronized with the Cloud Server™ where the data can be remotely accessed. Regular synchronizing ensures the jobs are backed up, and that the WITS™ Firmware (FW), User Interface Software (UISW) and the Computer Module Assembly (MA) are updated and ready to go to work.

All WITS™ models are highly configurable to the customer's needs with different pipe end connections, number of thread recuts, box and pin orientations, and supporting documentation.

Please contact your COS sales representative for specific configurations and/or requests.

Please refer to section 1.4 below for the applicable user manuals.

1.3.1 WITS-1 Models

The WITS-1 models typically cover a load range of up to 500 ton (453.6 metric tons) and a connection size range of up to NC-50, NC-56, and API 6-5/8" REG.

Higher load ratings of up to 750 ton (680.4 metric tons) are possible.

Please contact your COS sales representative for specific load ratings, connection sizes and configurations.

1.3.2 WITS-2 Models

The WITS-2 models typically cover a load range equal to or greater than 750 ton (680.4 metric tons) and up to 1,250 ton (1134.0 metric tons) with connection sizes up to NC-70, NC-77, API 7-5/8" REG and API 8-5/8" REG.

Please contact your COS sales representative for specific load ratings, connection sizes and configurations.

1.3.3 WITS™ User Interface Software and Data Interface

The WITS™ User Interface (UI) Software provides for a user interface to the WITS™ Torque Sub through an Access Point (AP). Through the UI Software, the user can view, access, record, and monitor various operational data parameters and status information of the WITS™ system.

The WITS™ UI Software can output operational data to interface with 3rd party systems. The WITS™ data is written to a SQL table on the Tablet/PC where the data can be retrieved as input to other 3rd party systems.

1.3.4 WiFi Access Point (AP) and PC Tablet options

The WITS™ system must be used with an Access Point (AP) and WITS™ UI software. The WITS™ Torque Sub, AP, and UI software are configured to optimize communications integrity, reliability, and power consumption.

The system can be supplied with different access points and tablets depending on the customer's preferences and needs.

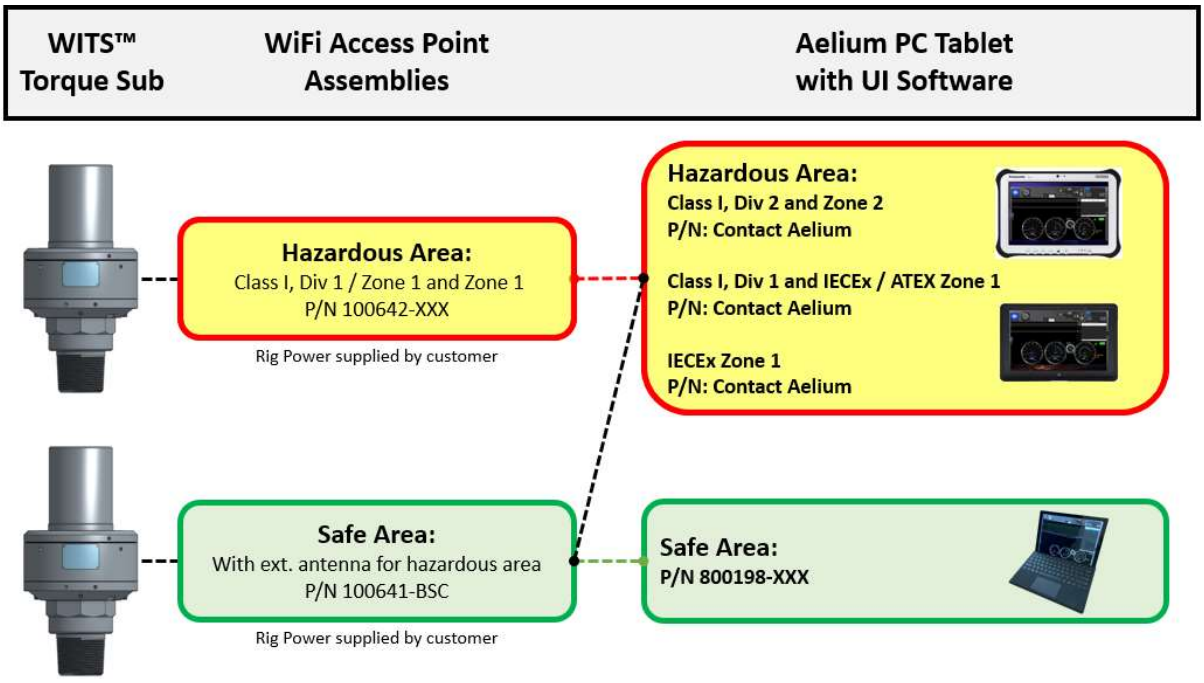

Figure 1: WITS™ wireless communication overview

- The hazardous area rated tablet can be used with either access point option.
- Various PC tablet options are available with pre-installed UISW and standard warranty.

1.4 Reference Documents

COS P/N	Description
700022	User Manual - WITS™ ACCESS POINT, SAFE AREA
700026	User Manual - WITS™ USER INTERFACE SOFTWARE
700033	User Manual - WITS™ TORQUE SUB

1.5 Specifications

Model	WITS 1C			WITS 3C		WITS 2C
Design Specifications						
Connection (default)	NC 50	6 5/8" API REG		7 5/8" API REG		8 5/8" API REG
Load Rating (per API 8C)	425 ton	500 ton	750 ton	750 ton	1000 ton	1250 ton
Torque Rating	55,000 ft lbs	65,000 ft lbs	85,000 ft lbs	85,000 ft lbs	105,000 ft lbs	125,000 ft lbs
Data Recording Accuracy						
Tension & Compression	0.5%					
Torque	0.5%					
Turns	2,000 pulses/revolution					
RPM	up to 300					
Pressure* & Temperature	0.5%					
Data Sampling Rate	Samples at 100 per second / records 10 times per second					
Wireless Signal Range	200 foot (61 meter) radius					
Other Specifications						
Ambient Operating Temperature	-40° F to 158° F (-40° C to 70 C°)					
Battery Life (casing running)	>180 days					
Data Transmission Type	WiFi 2.4 GHz, fully encrypted					

Table 2: WITS Specifications - imperial units

1.6 RPM accuracy

The WITS is designed for application in a vertical orientation. The RPM measurements are accurate for angles between 90-degree (vertical) to a 45-degree slant angle.

1.7 General identification and layout

1.7.1 WITS™ Model Numbering

The WITS™ product is highly configurable to suit your needs. The specific WITS™ model number is configurable and is determined by the base model assembly part number, ID, upper and lower pipe end connection types, the number of thread re-cuts on each pipe end connection, and the tool tension load rating.

WITS™ Model	Base Model #	ID [inch]	Upper Pipe End Connection and # of thread recuts	Lower Pipe End Connection and # of thread recuts	Tension Load Rating [ton]
WITS-XX	100XXX	X	XXX	XXX	XXXX

Aelium WITS™ Assembly Part Number Configurator

F-36 v09

Configuration Part Number:	100XXX-X-XXX-XXX-XXXX											
Base Model		Customization / Variant										
			ID	Upper Connection				Lower Connection				Load Rating
WITS Model	Base Model Assembly P/N	Config. #:	ID [inch]	Type	Thread type	# of recuts		Type	Thread type	# of recuts		[ton]
WITS-1C G2	100701	-0	1.00	BOX	4-1/2 REG	0		BOX	4-1/2 REG	0		XXXX
WITS-2C G2	100703	-1	1.50	PIN	5-1/2 REG	1		PIN	5-1/2 REG	1		XXXX
		-2	2.00		6-5/8 REG	2			6-5/8 REG	2		XXXX
		-3	2.50		7-5/8 REG	3			7-5/8 REG	3		XXXX
		-4	2.75		8-5/8 REG	4			8-5/8 REG	4		XXXX
		-5	3.00		5-1/2 FH	5			5-1/2 FH	5		XXXX
		-6	3.50		6-5/8 FH				6-5/8 FH			XXXX
		-7	3.75		NC50				NC50			XXXX
		-8	3.08		NC56				NC56			XXXX
		-9	4.00		NC61				NC61			XXXX
		-A			NC70				NC70			XXXX
		-B			NC77				NC77			XXXX
		-C			NC84				NC84			XXXX
		-D										XXXX
		-E										XXXX
		-F										XXXX
		-G										XXXX
												XXXX
		-S	Special	Special	Special	Special		Special	Special	Special		XXXX

Table 3: WITS™ Assembly Part Number Configurator F-36 (example only)

The WITS™ model numbers will be assigned after COS's review of the WITS™ configuration worksheet. The WITS™ configuration worksheet will be sent to the end user upon receipt of an enquiry for WITS™ units.

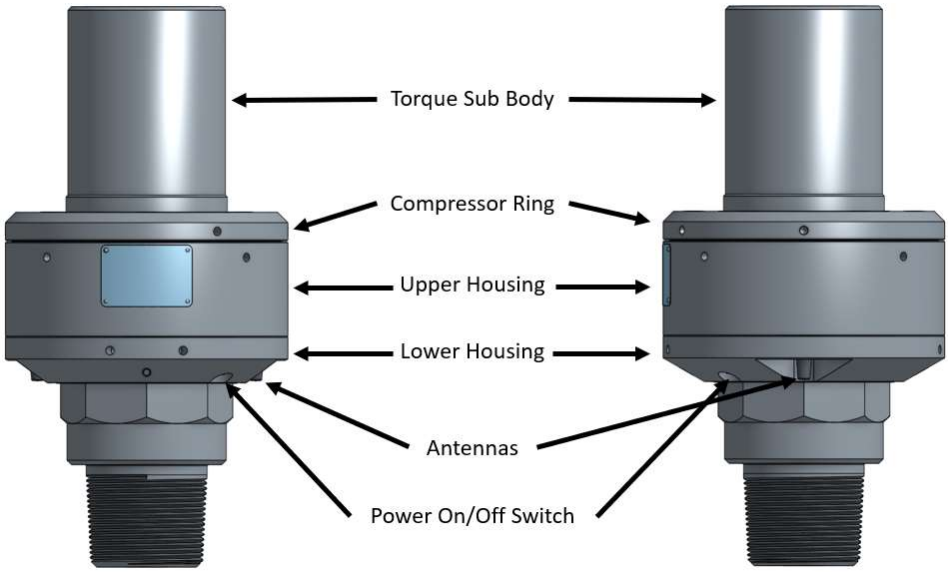

Figure 2: WITS™ main components

1.7.2 WITS™ Product Label

Example only. Actual label may vary depending on customer specifications.

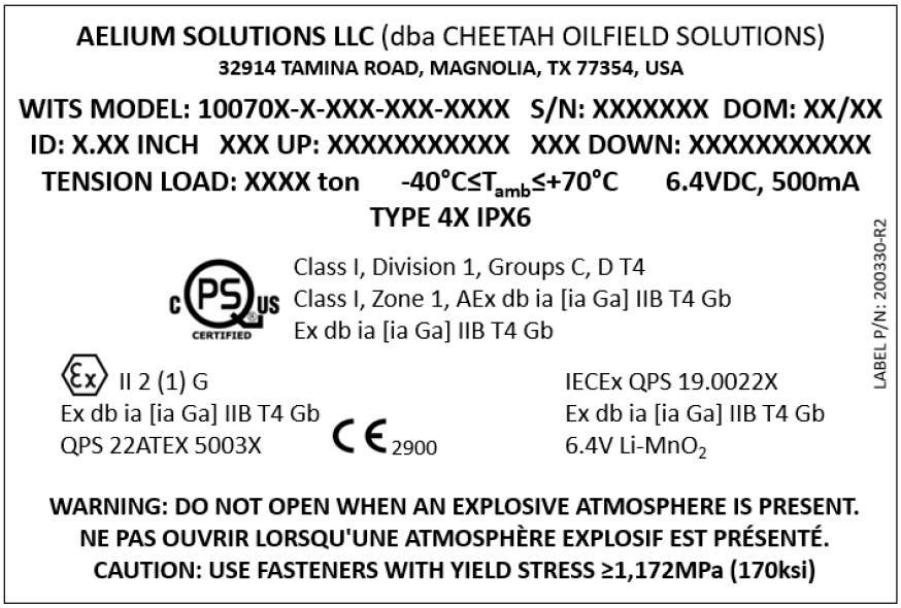

Figure 3: WITS™ Product Label Example, P/N 200330

2 Important Safety Information

2.1 Identification of warnings

This is a safety alert symbol.
It is used to alert you to potential physical injury hazards.
Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠DANGER

INDICATES A HAZARDOUS SITUATION, THAT, IF NOT AVOIDED, WILL RESULT IN DEATH OR SERIOUS INJURY.

⚠WARNING

INDICATES A HAZARDOUS SITUATION, THAT, IF NOT AVOIDED, COULD RESULT IN DEATH OR SERIOUS INJURY.

⚠CAUTION

INDICATES A HAZARDOUS SITUATION, THAT, IF NOT AVOIDED, COULD RESULT IN MODERATE OR MINOR INJURY.

NOTICE

Indicates information considered important, but not related to physical injury.

2.2 General safety

- Read and understand the contents of this document.
- Do not perform maintenance, inspection, or repairs during operation.
- The steps given in this document are guidelines.
- Always follow applicable on-site safety instructions and procedures where applicable.
- Wear appropriate PPE (Personal Protective Equipment).

2.2.1 Intended personnel

This document is intended for installation, commissioning, operation, maintenance, and inspection personnel.

2.2.2 Maintenance

The equipment shall be maintained according to the guidelines in this document.
Only COS OEM parts shall be used.
Aftermarket parts may not be suitable or safe and void product certifications and warranty.

2.2.3 Misuse

The equipment is designed for specific functions and applications and should be used only for its intended purpose.

2.2.4 Product and warning labels

Product and warning labels must be present on the equipment and shall be replaced when damaged or missing.

2.3 Specific conditions of use

1. USE ONLY FASTENERS WITH YIELD STRESS ≥ 1.172 MPa (170 ksi).
2. NEVER USE OTHER WASHERS WITH OR INSTEAD OF THE SPECIFIED NORD-LOCK WASHERS. NORD-LOCK WASHERS CAN ONLY BE USED ONE TIME.
3. BOLT TIGHTENING SEQUENCE AND TORQUE SPECIFICATIONS GIVEN THROUGH THE TECHNICAL DOCUMENTATION HAS TO BE RESPECTED.
4. SUBSTITUTION OF COMPONENTS MAY IMPAIR CERTIFICATION, OEM PARTS ONLY.
5. THE FLAMEPROOF JOINTS ARE NOT INTENDED TO BE REPAIRED.

1. N'UTILISER QUE DES FIXATIONS AVEC LIMITE D'ÉLASTICITÉ ≥ 1.172 MPa (170 ksi).
2. N'UTILISEZ JAMAIS D'AUTRES RONDELLES AVEC OU À LA PLACE DES RONDELLES NORD-LOCK SPÉCIFIÉES. LES RONDELLES NORD-LOCK NE PEUVENT ÊTRE UTILISÉES QU'UNE SEULE FOIS.
3. LA SÉQUENCE DE SERRAGE DES BOULONS ET LES SPÉCIFICATIONS DE COUPLE DONNÉES PAR LA DOCUMENTATION TECHNIQUE DOIVENT ÊTRE RESPECTÉES.
4. LA SUBSTITUTION DE COMPOSANTS PEUT NUIRE À LA CERTIFICATION, PIÈCES OEM UNIQUEMENT.
5. LES JOINTS ANTIDÉFLAGRANTS NE SONT PAS DESTINÉS À ÊTRE RÉPARÉS

3 Installation

3.1 Visual inspection

NOTICE

Your WITS™ system has been thoroughly tested, calibrated, and inspected at the factory prior to shipment. Inspect your WITS™ system for shipping damage upon receipt.

- Suspected impact or shipping damage shall be reported to the shipping company immediately.
- Perform a visual inspection following removal of all packaging material.
- Consult COS before proceeding if damage of the WITS™ system is detected.

3.2 Pre-Installation check

NOTICE

Perform a pre-installation check of the WITS™ using the checklist in section 14 WITS™ Pre-Use Checks.

Always perform the check with 2 persons, checker 1 and checker 2.

If unclear or in doubt – ask.

3.3 Maintaining flameproof performance

⚠DANGER

DO NOT MODIFY OR ALTER ANY COMPONENT OR ASSEMBLY OF THE WITS™.

⚠WARNING

FIRE, EXPLOSION, AND SEVERE BURN HAZARD.

DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT.

DO NOT REMOVE ANY PARTS WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT.

Proper handing is an essential component of maintaining the explosion-proof / flameproof integrity of your WITS™ system. Follow the guidelines in this section.

- Always use proper lifting and handling techniques and tools.
- Transport or lift the WITS™ sub in the vertical position using a properly sized and rated lift nubbin.
- Store the WITS™ sub vertically and restrain it to avoid toppling while in storage.
- Do not allow the WITS™ to impact any object. Use caution when hoisting or moving.

- Dents or scores to the WITS™ housing may be indicative of heavy impact to or clamping of a tong to the housing. This may cause the housing to lose its shape and the ability to properly seal. A poor seal may jeopardize the explosion-proof / flameproof integrity of the WITS™ system.

3.4 Handling the WITS™

⚠CAUTION

ALWAYS USE A PROPERLY RATED AND CERTIFIED LIFT NUBBIN OR LIFTING DEVICE.

ENSURE THE LIFT NUBBIN HAS THE CORRECT, MATCHING THREAD CONNECTION OF THE WITS™ AND THAT IT IS COMPLETELY THREADED-IN.

⚠CAUTION

ALWAYS INSPECT THE WITS AFTER RIG UP AND RIG DOWN FOR DAMAGE AND IMPACT.

3.4.1 Nubbin for box-up connection

Remove the box-end thread protector and install the lift nubbin.
Leave the bottom thread protector in place until ready to mate to equipment.

Part number 800201-connection type
(i.e., 800201-NC50)

3.4.2 Nubbin for pin-up connection

Remove the pin-end thread protector and install the lift nubbin.
Leave the bottom thread protector in place until ready to mate to equipment.

Part number 800200-connection type
(i.e., 800200-NC50)

⚠CAUTION

CAREFULLY HOIST THE WITS™ SUB FROM THE SHIPPING CONTAINER USING THE LIFTING NUBBIN ONLY.

NOTICE

Prepare the WITS™ sub threads and all connection contact surfaces with proper pipe dope before threading.

3.5 Battery Packs

The WITS™ is shipped with the COS OEM battery packs installed and connected.

There is no need to open the WITS™ to connect the battery packs prior to operation.

⚠WARNING

FIRE, EXPLOSION, AND SEVERE BURN HAZARD.

DO NOT TAMPER WITH OR ATTEMPT TO OPEN A BATTERY PACK.

DO NOT CUT, REMOVE OR REPLACE THE BATTERY CABLE OR CONNECTOR.

DO NOT SHORT CIRCUIT.

DO NOT CRUSH, RE-CHARGE OR DISASSEMBLE.

DO NOT HEAT ABOVE 100°C (212°F) OR INCINERATE.

The battery cells are primary Lithium-Ion cells and cannot be re-charged. The battery packs are enclosed in a protective and fully encapsulated housing to provide a high level of protection. The battery packs are equipped with specially designed internal safety devices and with a cable mounted connector.

⚠WARNING

USE OF AFTERMARKET PARTS, BATTERIES OR UNAUTHORIZED POWER SOURCES WILL INVALIDATE THE HAZARDOUS LOCATION CERTIFICATION OF THE SYSTEM.

IT MAY CAUSE MALFUNCTION, EXPENSIVE REPAIRS AND WILL VOID YOUR WARRANTY

NOTICE

All battery ratings are at 25°C (77°F). Ambient temperatures below 0°C (32°F) decrease battery performance.

3.6 Installing the WITS™ on a casing running tool

⚠DANGER

DO NOT PERFORM ANY WORK OR MAINTENANCE ON THE WITS™ IN AN EXPLOSIVE ATMOSPHERE.

⚠WARNING

SNAGGING HAZARD WITH ANTENNA WHEN TOOL STARTS TO ROTATE. ENSURE PROPER LOCK-OUT / TAG-OUT PRIOR TO PERFORMING ANY WORK ON THE WITS™.

3.6.1 Using a Make/Break device in a shop

⚠WARNING

ALWAYS FOLLOW THE CRT OEM AND SERVICE SHOP'S AUTHORIZED PROCEDURES FOR INSTALLING AND REMOVING THE WITS™ SUB ONTO A CRT.

1. Secure WITS™ and casing running tool (CRT) in the Make/Break device.
2. Remove thread protection caps.
3. Apply proper pipe dope to both mating threaded connections.
4. Slowly spin in WITS™ onto the CRT.
5. Depending on the connection type, make-up the connection to required torque value and record it.
6. Inspect the WITS™ sub for external damage.
7. Inspect the antennas for damage.
8. Remove from Make/Break device.
9. Prepare for shipment to rig location.

3.6.2 On rig location

⚠WARNING

ALWAYS FOLLOW THE CRT AND TOP DRIVE OEM'S, DRILLING CONTRACTOR'S AND TUBULAR RUNNING SERVICES COMPANY'S AUTHORIZED PROCEDURES FOR INSTALLING AND REMOVING THE WITS™ SUB ONTO A CRT.

3.7 Removing the WITS™ from a casing running tool

3.7.1 In shop using Make/Break device

⚠WARNING

ALWAYS FOLLOW THE CRT OEM AND SERVICE SHOP'S AUTHORIZED PROCEDURES FOR INSTALLING AND REMOVING THE WITS™ SUB ONTO A CRT.

1. Secure WITS™ and CRT in the Make/Break device.
2. Break the connection between CRT and WITS™ sub and record it.
3. Slowly spin out WITS™ from CRT.
4. Inspect WITS™ sub and the connection threads for damage.
5. Inspect the antennas for damage.
6. Remove from Make/Break device.
7. Apply proper grease to the threaded connections and install protection caps.

3.7.2 On rig location

⚠WARNING

ALWAYS FOLLOW THE CRT AND TOP DRIVE OEM'S, DRILLING CONTRACTOR'S AND TUBULAR RUNNING SERVICES COMPANY'S AUTHORIZED PROCEDURES FOR INSTALLING AND REMOVING THE WITS™ SUB ONTO A CRT.

3.8 Tong placement for make-up / break-out

⚠CAUTION

NEVER USE A MAKE/BREAK DEVICE OR TONG ON THE HOUSING OF THE WITS™.

NOTICE

The standard tong space is 8.0" (203mm).

Figure 4: Allowable positions for tongs on WITS™ subs highlighted in green.

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4 Operation

4.1 General

Cheetah Oilfield Solutions ("COS") has made every effort to ensure that all information in this document is as accurate and current as possible. Some graphic or visual differences from this manual to the actual product are possible.

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4.2 Aelium WiFi Network

At the core of COS's reliable communications is the WiFi Access Point (AP). The AP uses state of the art technology to protect your data.

All communications are optimized for signal quality, signal strength, continuity, interference, data integrity, and low power usage.

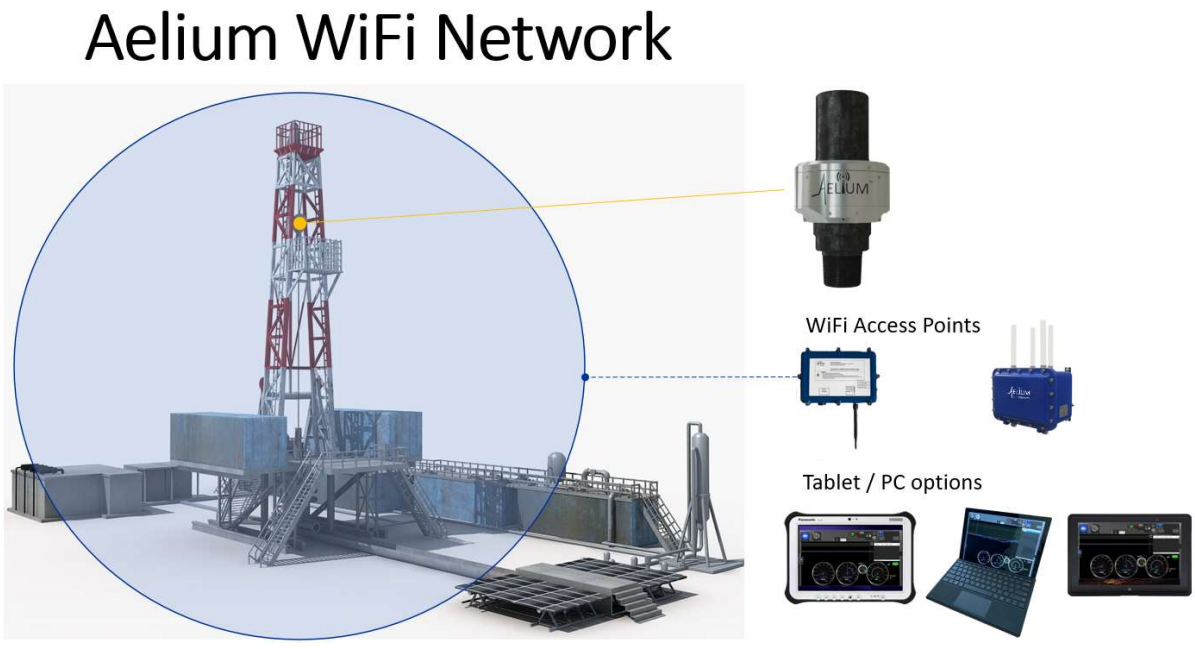


Figure 5: Aelium WiFi Network.

4.3 WiFi Access Points

- The AP assemblies require a US 120VAC/60Hz power source provided by the customer (rig power).
- The supply must use a 2-conductor plus ground conductor for proper operation and safety.

⚠CAUTION

A CONTINUOUS AND CLEAN GROUND CONNECTION IS REQUIRED TO ACHIEVE AND MAINTAIN THE COS WIRELESS ACCESS POINT HAZARDOUS AREA LOCATION RATINGS.

Please refer to the documents of the COS Wireless Access Points listed below:

COS Part Number	Title
700022	User Manual - WITS™ ACCESS POINT, SAFE AREA

Table 4: Wireless Access Point documents

4.3.1 Safe area access point

The Safe Area Access Point is easily moved between rigs and is for use in safe areas only, i.e., a driller's cabin.

All components are conveniently packaged in a rugged suitcase for secure and easy transportation. It can be set up in just a couple of minutes.

The Safe Area AP is equipped with an internal antenna for high signal strength near the AP and an intrinsically safe external antenna with a 25ft coaxial antenna cable and mounting bracket.

The external antenna mounting bracket is equipped with a strong magnet for fast and simple installation near the drill floor for optimal line of sight connection to the WITS Torque Sub.

The approximate dimensions are 9" x 6" (23 cm x 15 cm), 5 lbs (2.3 kg)

Please refer to Document 700022 USER MANUAL, ACCESS POINT, SAFE AREA for details on setup, operation, and maintenance

The Safe Area Access Point (COS P/N 100641-XXX) must be installed and used in accordance with the information provided in document P/N 700022.

4.3.2 Hazardous area access point

The Hazardous Area Access Point is for use in hazardous area classified applications. The AP is certified for:
Class 1, Division 1 and Class 1, Zone 1
IECEx and ATEX Zone 1

The AP is protected inside a rugged explosion proof / flameproof enclosure with intrinsically safe outputs. It is provided with a pre-installed 25ft power cable pigtail which can easily be wired into an existing rig power supply.

Power supply options are 120VAC/60Hz (standard) and 230VAC/50Hz.

The approximate dimensions are 16.3” x 13.3” x 9.8” (42 cm x 34 cm x 25 cm, 154 lbs (70kg).

Please refer to Document 700023 USER MANUAL, ACCESS POINT, SAFE AREA for details on setup, operation, and maintenance

The hazardous area location rated wireless access point assembly (COS P/N 100642-XXX) must be installed and used in accordance with the information provided by the manufacturer and the document P/N 700023.

⚠WARNING

FIRE, EXPLOSION, AND SEVERE BURN HAZARD.

DO NOT INSTALL, REMOVE, MAINTAIN OR OPEN WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT.

DO NOT REMOVE ANY PARTS WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT.

ALWAYS HAVE QUALIFIED PERSONNEL INSTALL, REMOVE, MAINTAIN AND CONNECT POWER TO THE ACCESS POINT TO ENSURE SAFETY ACCORDING TO ALL APPLICABLE REGULATIONS AND HAZARDOUS LOCATION RATINGS AT THE AREA OF INSTALLATION.

4.4 WITS™ Torque Sub System setup

4.4.1 WITS™ Torque Sub

The WITS™ Torque Sub is factory pre-configured in a ready-to-use condition.

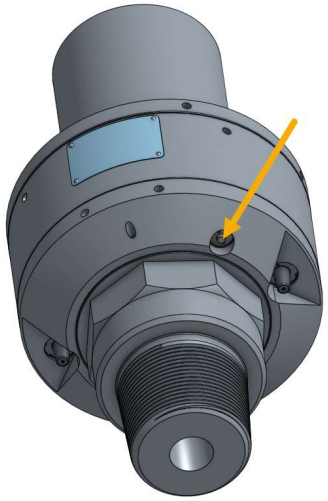
The WITS™ Torque Sub is configured for communicating through a WiFi Access Point (AP) to the UI Software (UISW).

For installation of the WITS™ Torque Sub please refer to section 3 above.

Ensure line-of-sight between the WITS™ Torque Sub and the WiFi Access Point antennas, distance shall be ≤200 ft.

4.4.2 Power On/Off Switch

To power on the WITS™ Torque Sub, press the Power On/Off Button on the bottom of the WITS™ Torque Sub **ONCE**. The WITS™ Torque Sub will power on and complete a self-checking cycle to ensure all electronics on the WITS™ Torque Sub are in good working order. The self-check cycle completes in approximately 5-10 seconds.



NOTICE

The Power On/Off Button does not have a position indicator for On or Off. Firmly press the Button ONCE to turn the sub On or Off. Check the User Interface Software for status.

Figure 6: WITS Power On/Off Button.

In the "OFF" state, the WITS™ is completely powered off to maximize battery life.

4.4.3 WiFi Access Point setup

The user shall install the WiFi Access Point in a location that enables communications to the WITS™ Torque Sub and the PC tablet with the UI software.

For WiFi Access Point installation, mounting, and connection details, please refer to the applicable user manuals as listed in section 4.3 above.

4.4.4 Tablet with UI software setup

The user shall position the tablet in a location that enables communications to the wireless access point.

Ensure line-of-sight between the tablet and the WiFi Access Point, distance shall be ≤200 ft.

For operation details, please refer to the applicable tablet OEM user manuals 4.5 below supplied with the tablet and/or available on the tablet OEM's websites.

4.5 COS Tablets with UI software

- The COS tablets require a US 120VAC/60Hz power supply.
- To download the latest version of the COS User Interface Software, contact COS at info@cheetahoilfield.com

4.5.1 Safe area tablets

COS configures Microsoft Surface Pro tablets (COS P/N 800198-XXX) for your specific account data. The tablet comes with pre-installed and tested COS User Interface Software (UISW) and the applicable product documentation. The tablet must only be used in a safe area.

⚠WARNING

THE SAFE AREA RATED TABLET MUST ONLY BE USED IN A SAFE AREA.

DO NOT USE IN A HAZARDOUS AREA OR WHEN A HAZARDOUS ATMOSPHERE MAY BE PRESENT.

4.5.2 Hazardous area tablets

COS offers various options for custom configured tablets for use in hazardous locations. The tablets come with pre-installed and tested COS User Interface Software and the applicable product documentation.

⚠WARNING

ONLY USE TABLETS IN ACCORDANCE WITH THE OEM MANUFACTURER'S SPECIFICATIONS TO MAINTAIN THE HAZARDOUS AREA LOCATION RATINGS.

4.6 User Interface Software

Please refer to P/N 700026 USER MANUAL, WITS UI SOFTWARE on how to operate the UI Software.

4.7 Pre-operation check

NOTICE

Always perform a pre-operation check of the WITS™ System using the below checklist.

#	ITEM	PASS / FAIL	Tech 1	Tech 2
1	INSTALL AND POWER UP THE WIFI ACCESS POINT. CHECK ALL CONNECTIONS AND LINE OF SIGHT TO THE WITS™ SUB.			
2	INSPECT THE WITS™ TORQUE SUB FOR SIGNS OF DAMAGE, IMPACT, DEFORMATION, CORROSION AND WEAR.			
3	CHECK THE WITS™ TORQUE SUB ANTENNAS P/N 300370 AND POWER ON/OFF SWITCH P/N 300417 FOR SIGNS OF DAMAGE, IMPACT AND WEAR.			
4	CHECK ALL RETAINER CUPS FOR PROPER SEATING.			
5	CHECK ALL INTERNAL RETAINING RINGS FOR PROPER SEATING.			
6	VISUALLY CHECK THE INSTALLATION OF THE SOCKET-HEAD SET-SCREWS ON THE LOWER HOUSING.			
7	VISUALLY CHECK THE INSTALLATION OF THE 6 SOCKET-HEAD CAP-SCREWS AND NORD-LOCK WASHERS ON TOP OF THE WITS™ TORQUE SUB.			
8	CHECK THE PROPER INSTALLATION OF THE SQUARE PACKING GASKET P/N 900006 ON TOP OF THE COMPRESSOR RING.			
9	POWER UP THE PC TABLET WITH THE AELIUM USER INTERFACE SOFTWARE. CHECK FOR AND INSTALL AVAILABLE WINDOWS UPDATES TO THE TABLET PRIOR TO THE JOB.			
10	OPEN THE AELIUM USER INTERFACE SOFTWARE. CHECK FOR AND INSTALL AVAILABLE SOFTWARE AND FIRMWARE UPDATES PRIOR TO THE JOB.			
11	CONNECT THE AELIUM USER INTERFACE SOFTWARE TO THE WITS™ SUB.			
12	CHECK THE COMMUNICATION FROM THE WITS™ SUB TO THE ACCESS POINT.			
13	CHECK THE COMMUNICATION FROM THE WITS™ SUB TO THE TABLET WITH THE AELIUM USER INTERFACE SOFTWARE.			

IF INSPECTION AND CHECKS DO NOT PASS, PLEASE CONTACT COS FOR INSTRUCTIONS.

4.8 WITS™ Operation

Following the above steps, the WITS™ Torque Sub System is now ready to be used.

The WITS™ Torque Sub is optimized for reliable performance and long battery life. In normal operation with temperatures above 68°F (20°C), the batteries are expected to perform for ~180 days.

Temperatures below 68°F (20°C) will adversely impact battery life and performance. Under those conditions, battery performance may be reduced.

The WITS™ Torque Sub is equipped with 2 battery packs, providing 100% redundancy of the power supply to ensure reliability and longevity.

NOTICE

DURING OPERATION, THE USER INTERFACES WITH THE WITS™ TORQUE SUB USING THE UI SOFTWARE ON THE TABLET OR PC TO OBTAIN DATA FROM THE WITS™.

PLEASE REFER TO UI SOFTWARE MANUAL P/N 700026.

⚠WARNING

IF AT ANY TIME THE WITS™ TORQUE SUB IS KNOWN OR SUSPECTED OF BEING OVER-LOADED, IMMEDIATELY STOP USING THE WITS™ TORQUE SUB AND CONTACT COS FOR INSTRUCTIONS.

4.8.1 WITS System Power Up

4.8.1.1 WiFi Access Point Power Up

Refer to User Manual P/N 700022 and follow the Installation, Operation, and Power Up instructions.

4.8.1.2 Tablet and User Interface Software Power Up

Refer to User Manual P/N 700026 and follow the Installation, Operation, and Power Up instructions.

4.8.1.3 WITS Power Up

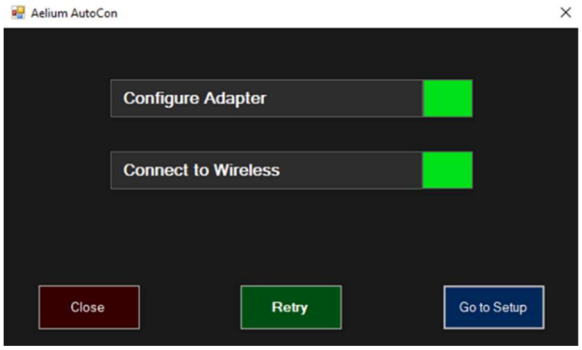
To power on the WITS Torque Sub, press the Power On/OFF button **ONCE**. The WITS Torque Sub will run through an internal power up sequence and automatically connect to the WiFi Network named “TorqueSub”.

4.8.2 Starting a Job

Refer to User Manual P/N 700026 and follow the Job Creation instructions. Customer Best Practices are creating a job prior to going to a rig location or job. Once on location, select the job you prepared and start the job.

4.8.2.1 Tablet to WiFi Access Point Connectivity

During the job start up sequence, the blow screen indicates proper connection from the tablet to the WiFi Access Point:



If the connection is not established on the first attempt, click “Retry”.
If after 4-5 attempts connectivity is not established successfully, refer to the “Troubleshooting” section in User Manual P/N 700026 to resolve.

4.8.2.2 WiFi Access Point to WITS Torque Sub Connectivity

1. Turn the job “On”.
2. The WiFi indicator, and the battery indicator show green status.
   The temperature reads a value other than 0°C (32°F).

With the connectivity from the tablet to the WITS torque sub established, the job is ready to start.

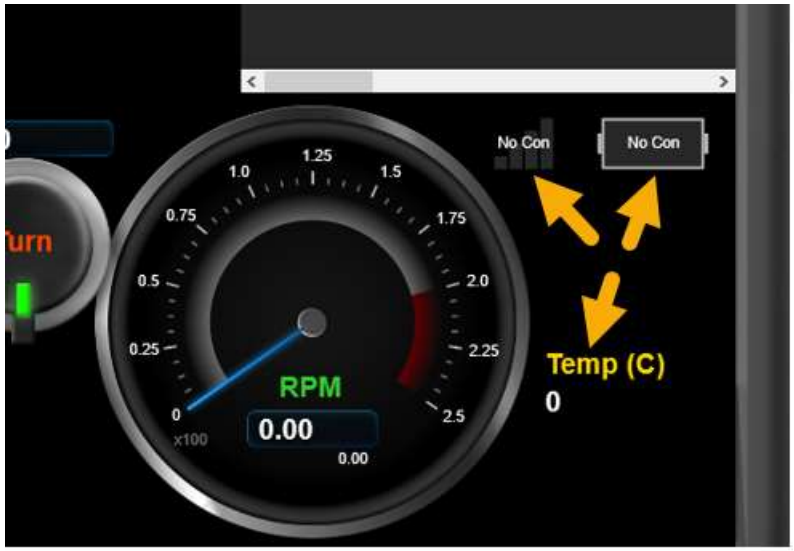
4.8.2.3 Running a Job

Follow the instructions of User Manual P/N 700026 "User Interface Software" to run the job.

4.8.3 WITS System Power Down

Complete the job per User Manual P/N 700026 "User Interface Software". Before exiting the job, press the WITS Torque Sub Power On/Off button **ONCE** to power down the WITS Torque Sub.

1) Turn the job OFF.
2) Turn the job back ON, to confirm that the WITS Torque Sub is powered down.
3) The WiFi indicator, and the battery indicator show "No conn" status when the WITS Torque Sub is powered down.
4) The temperature reads 0°C (32°F).



5) Turn the job OFF.
6) Exit the job.
7) Close the job per User Manual P/N 700026 "User Interface Software".

4.8.3.1 Power Off the AP

1) Exit the job.
2) Complete and Release the job (reference Aelium Document 700026 User Interface Manual).
3) Unplug the AP power cord from the power supply and follow the instructions of User Manual P/N 700022 "Access Point, Safe Area".

4.9 Post-Operation Check

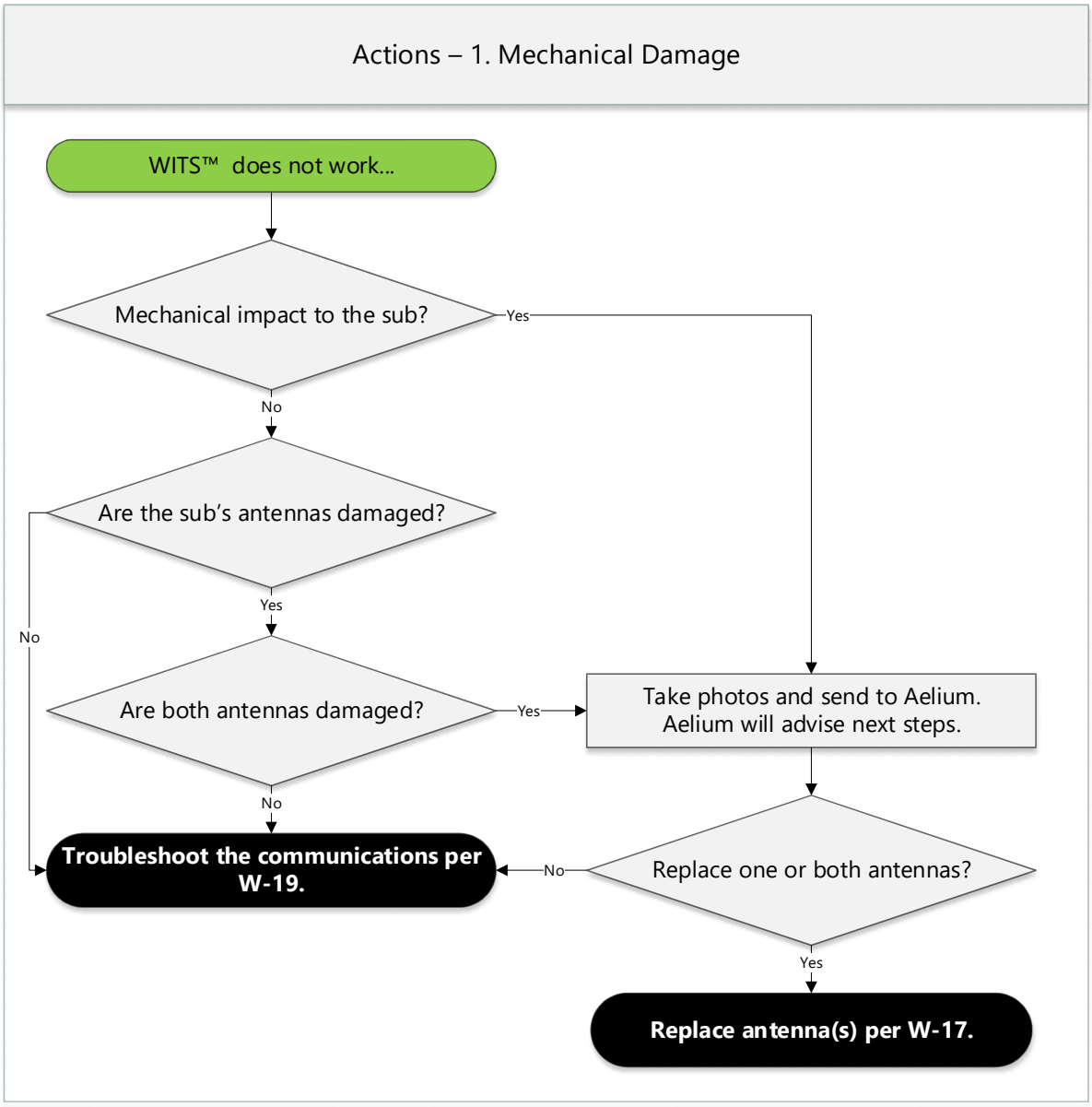
- Inspect the WITS™ Torque Sub for any signs of damage.
- In case of damage of the WITS™ Torque Sub beyond normal make-up and break-out wear (die markings), contact COS for further instructions.

5 Trouble Shooting

Problem	Possible Solutions
Cannot login to the User Interface (UI) Software.	1. Ensure the correct company is selected. 2. Ensure to use a valid username and password **as configured by YOUR company's administrator**. 3. Ensure the login username and password is using the correct CAPITAL letters, spaces, or any other symbols. The username and password are CASE sensitive and punctuation sensitive.  4. If you have trouble logging in, **please contact YOUR company's administrator**.
Tablet does not display WITS™ data or does not connect to the WiFi Access Point or Torque Sub.	Follow Work Instruction **W-18 WITS™ Troubleshooting**. Check your COS provided ASN-XXX Customer File. A copy of COS Work Instruction W-18 WITS™ Troubleshooting has been provided to you in the "User Documentation" section.

5.1 Troubleshooting Flowcharts

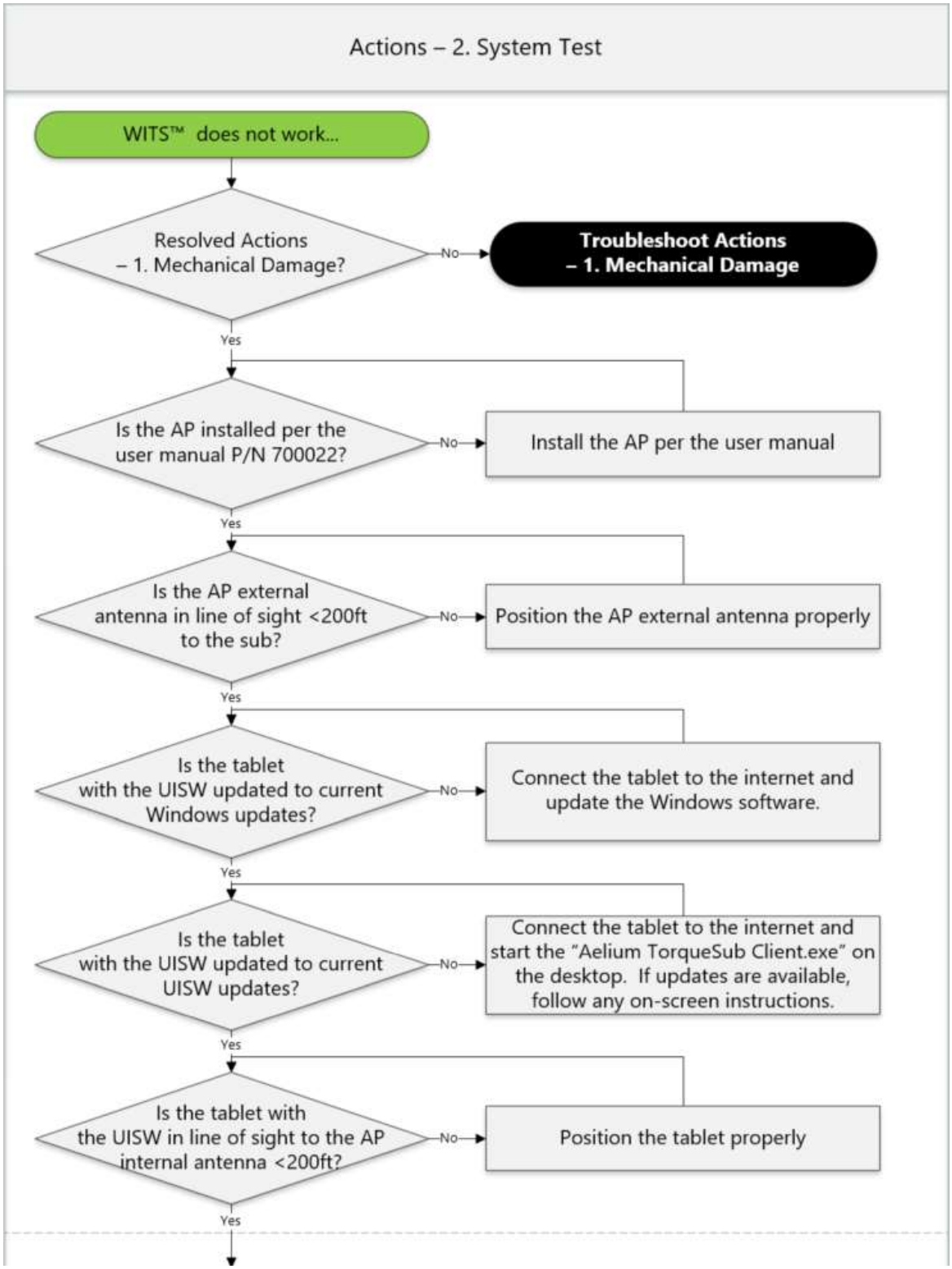
5.1.1 Mechanical (W-18)

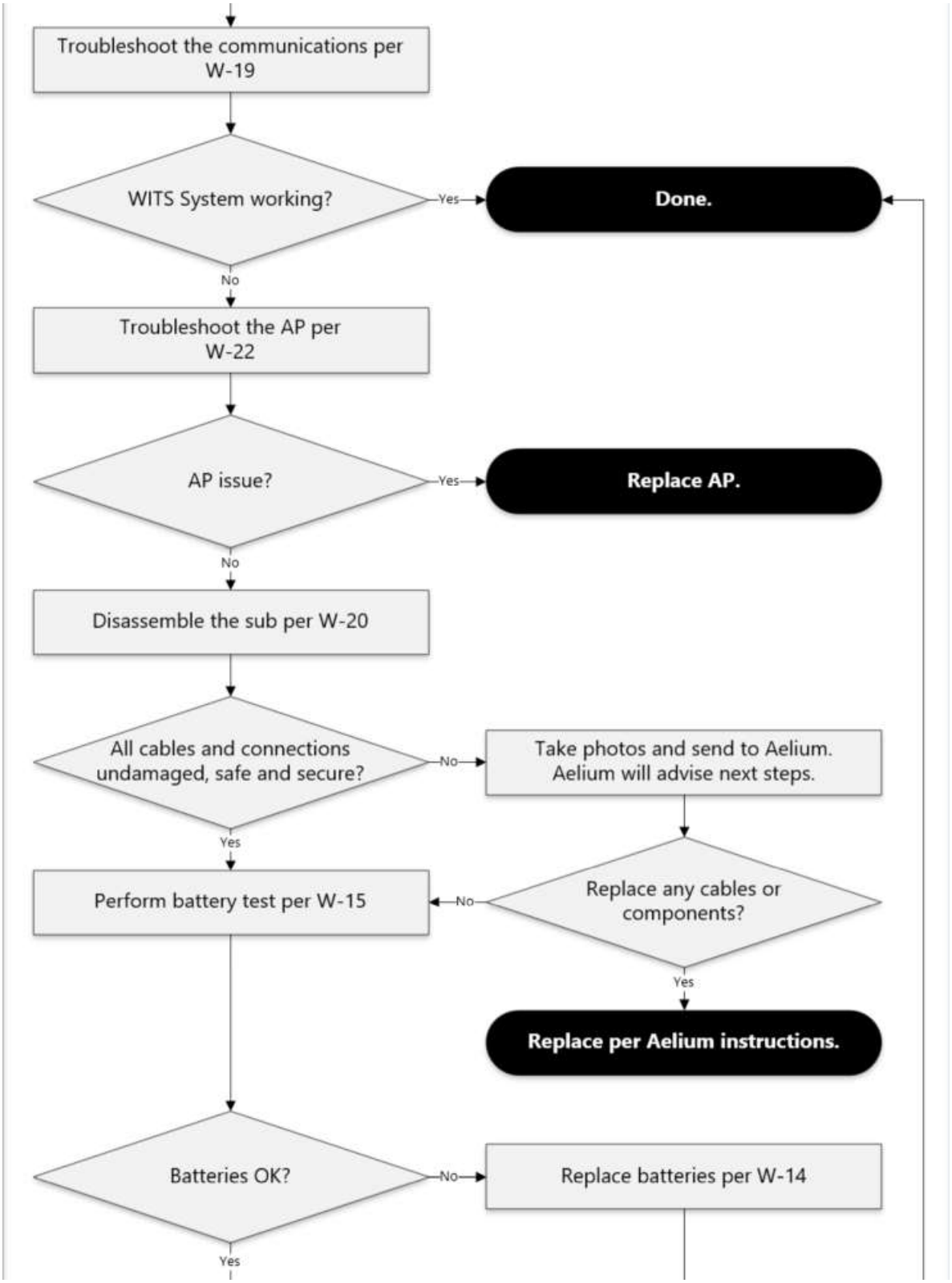


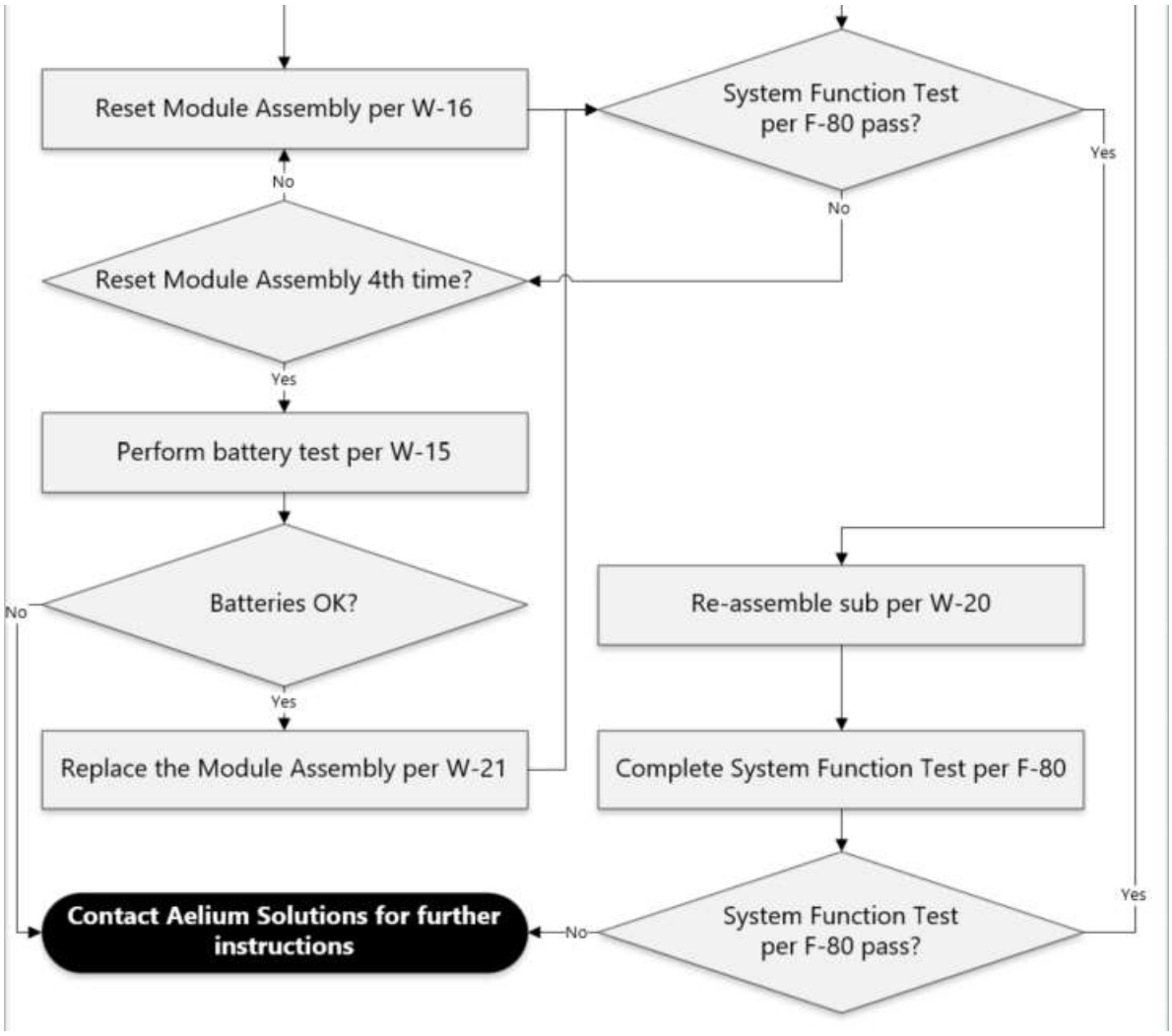
Please contact Cheetah Oilfield Solutions Service & Technical Support at:

+1-936-525-7366 (CUSTOMER SERVICE & SUPPORT)
+1-780-863-0686 (SOFTWARE SUPPORT)
+1-346-703-3080 (MAIN OFFICE)

5.1.2 Communications (W-18)




Troubleshoot the communications per W-19
WITS System working?
Yes
Done.
No
Troubleshoot the AP per W-22
AP issue?
Yes
Replace AP.
No
Disassemble the sub per W-20
All cables and connections undamaged, safe and secure?
No
Take photos and send to Aelium. Aelium will advise next steps.
Yes
Perform battery test per W-15
No
Replace any cables or components?
Yes
Replace per Aelium instructions.
Batteries OK?
No
Replace batteries per W-14
Yes



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+1-346-703-3080 (MAIN OFFICE)

NOTICE

WORK INSTRUCTIONS FOR TROUBLESHOOTING ARE LOCATED IN THE "USER DOCUMENTS" FOLDER ON THE DESKTOP OF THE COS PROVIDED TABLET OR PC.

6 Maintenance

COS recognizes that some maintenance may be required to maintain peak operating conditions of your equipment. Examples:

1. Software and/or firmware updates.
2. Gasket replacement.
3. Battery replacement.

⚠DANGER

FIRE, EXPLOSION, AND SEVERE BURN HAZARD.

DO NOT PERFORM ANY WORK OR MAINTENANCE ON THE WITS™ SYSTEM IF AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT.

⚠DANGER

DO NOT ALTER, MODIFY OR REPAIR ANY PARTS OF THE WITS™.

⚠WARNING

USE OEM PARTS ONLY.

NON-OEM PARTS MAY COMPROMISE THE SAFETY, STRUCTURAL INTEGRITY, PERFORMANCE AND/OR CERTIFICATION OF THE SYSTEM.

ALWAYS FOLLOW ALL APPLICABLE SAFETY AND ASSEMBLY PROCEDURES.

ALWAYS WEAR PROPER PERSONAL PROTECTIVE EQUIPMENT (PPE).

6.1 Software updates

6.1.1 Windows Operating System

The user shall regularly check for available Windows Operating System (OS) updates and install them according to the Microsoft provided instructions.

Please refer to COS Document 700026 User Manual - WITS™ USER INTERFACE SOFTWARE for details on how to update the Windows Operating System.

6.1.2 WITS™ Torque Sub Firmware and UI Software

The user shall regularly check for available updates and install them according to the provided on-screen instructions.

Please refer to COS Document 700026 User Manual - WITS™ USER INTERFACE SOFTWARE for details on how to update the COS WITS™ Torque Sub firmware and UI Software.

6.2 General

Prior to performing any maintenance work on the WITS™ Torque Sub, ensure that the WITS™ Torque Sub is disconnected from any tablet with COS UI software and WiFi Access Point.

6.2.1 Cleaning

Wash down the WITS™ with a hose and clean, fresh water. Do not use a high-pressure washer closer than 3 feet (1.0 m) from the WITS™ and ensure the washer nozzle is set to “fan spray”.

⚠WARNING

CLEAN WITH DAMP CLOTH ONLY TO AVOID STATIC ELECTRICITY BUILD UP.

6.2.2 Wedge Lock Washers (Nord-Lock)

⚠WARNING

USE OEM PARTS ONLY.

NORD-LOCK WASHERS CAN ONLY BE USED ONE TIME.

DO NOT RE-USE THE NORD-LOCK WASHERS.

DISCARD THE NORD-LOCK WASHERS IMMEDIATELY AFTER DISASSEMBLY.

NEVER USE ANY OTHER WASHERS WITH, UNDER, OR INSTEAD OF THE COS SPECIFIED NORD-LOCK WASHERS.

These washers are used for semi-permanent fixing of the fasteners. They only work if installed correctly. It may be necessary to replace or tighten a fastener and therefore the correct use of the washer is imperative.

- **Orientation of the two-piece washer is critical. The larger notches face each other, and the finer teeth surfaces face outwards to contact the bolt head and piece being fastened.**
- **It will take more effort to loosen the bolt than it does to tighten it up. This is normal and means the Nord-Lock washer is working correctly.**
- **Use Nord-Lock washers for all bolted connections ONLY once.**

Figure 7: Nord-Lock washer

6.2.3 Di-electric grease, P/N 900013

NOVAGARD G 624 dielectric silicone grease compound. Meets SAE AS-8660.
Use on all O-ring gaskets and packing and all antenna connections to prevent moisture buildup and corrosion

Figure 8: NOVAGARD G624

6.2.4 LOCTITE 222 (Purple), P/N 900042

For application on:

1. Connector transit M20 threaded connections.
2. On/Off switch threaded connection.
3. Antenna N-type threaded connections.
4. Antenna cable sma connectors.
5. Set screws lower housing.

Figure 9: Loctite 222 thread locker

6.2.5 LOCTITE LB 8009 HEAVY DUTY anti-seize, P/N 900014

For all threaded connections on the sub body, lower housing, upper housing, and SHCS.
DO NOT USE on the connections listed above for LOCTITE 222 (Loctite purple)

Figure 10: Loctite 8009 heavy-duty anti-seize.

6.2.6 General maintenance tools

6.2.6.1 Machine handles, P/N 900007

Machine handles with 1/2-13 connection to aid in the handling and installation and disassembly of the compressor ring, upper housing, and lower housing.

⚠WARNING

ALL MACHINE HANDLES MUST BE REMOVED PRIOR TO USING THE WITS™.

Figure 11: Machine handle

⚠CAUTION

MACHINE HANDLES ARE ASSEMBLY AND DISASSEMBLY TOOLS ONLY AND ARE NOT PART OF THE PRODUCT.

THE MACHINE HANDLES MAY CREATE PINCH POINTS WHEN HANDLING THE WITS™ COMPONENTS.

ALWAYS WEAR PROPER PPE.

6.2.6.2 Internal retaining ring pliers, P/N 900050

With 90-degree angle tip. Tip diameter 0.07 inch (1.78 mm).

Figure 12: Internal retaining ring pliers

6.2.6.3 Hex Bit Sockets

- 3/16" Size, P/N 900053, 3/8" Square Drive,
- 1/4" Size, P/N 900054, 3/8" Square Drive,
- 1/2" Size, P/N 900055, 1/2" Square Drive

Figure 13: Allen wrench

6.2.6.4 Calibrated Torque wrenches

- 30-150 lbs-ft, calibrated, P/N 900051

- 60-250 lbs-in, calibrated, P/N 900052

Figure 14: Torque wrenches

6.2.6.5 Wrench 26 mm, P/N 900043

- for use with RF connector transit P/N 300369 and antenna replacement

Figure 15: Wrench for RF connector transit

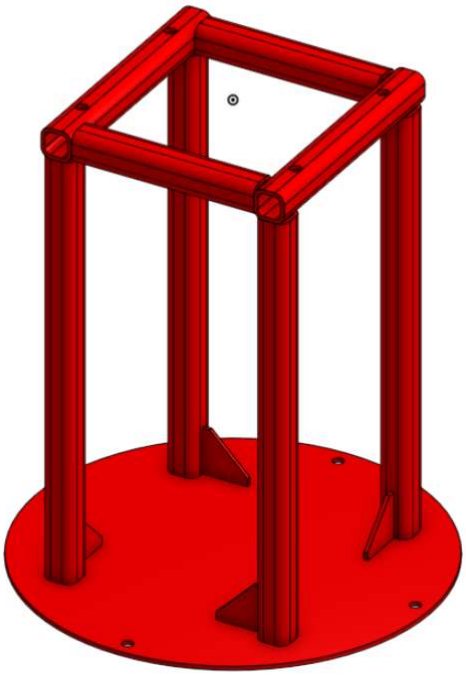
6.2.6.6 Deep Socket Wrench, 9/16”, P/N 900062

- for use with Power On/Off switch, P/N 300417

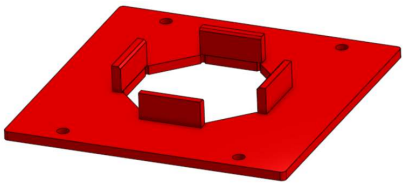
Figure 16: Long Socket Wrench for On/Off Switch

6.2.6.7 Assembly Stand, Weldment, P/N 100634

Manufacturing drawings are available upon request.



6.2.6.7.1 WITS Assembly Table, P/N 100634



6.2.6.7.2 Tabletop, Assembly Table, WITS-1, P/N 100713

6.3 Disassembly of the WITS™ housing

⚠DANGER

FIRE, EXPLOSION, AND SEVERE BURN HAZARD.

DO NOT PERFORM ANY WORK OR MAINTENANCE ON THE WITS™ IF AN EXPLOSIVE ATMOSPHERE IS PRESENT.

⚠WARNING

REMOVE THE WITS TORQUE SUB FROM THE CRT, TOP DRIVE SYSTEM, OR SAVER/CROSS-OVER SUBS AND PLACE IN A SAFE AND STABLE ENVIRONMENT PRIOR TO PERFROMING ANY MAINTENANCE WORK.

ALWAYS FOLLOW THE CRT OR TOP DRIVE OEM INSTRUCTIONS TO REMOVE THE WITS™.

PLACE THE SUB ON A LEVEL SURFACE IN A SECURE, VERTICAL POSITION.

ENSURE THE SUB IS PROPERLY SUPPORTED TO PREVENT MOVEMENT OR TIPPING OVER.

⚠CAUTION

SOME PARTS WEIGH MORE THAN 25LBS (11kg). USE PROPER LIFTING TECHNIQUES AND TOOLS.

ALWAYS PERFORM WORK ON A LEVEL AND VERTICAL MOUNTED WITS™.

NOTICE

COS recommends the use of the WITS™ assembly stand, COS P/N 100634, to aid in the safe maintenance and assembly/disassembly of the WITS™.
Use the applicable tabletop with the assembly stand:

1. Tabletop, Assembly Table, WITS-1, P/N 100713
2. Tabletop, Assembly Table, WITS-2, P/N 200299

COS recommends that 2 technicians perform any assembly work.

- To disassemble the WITS Torque Sub, follow document W-20 “WITS™ Torque Sub Dis- and Re-assembly Work Instruction”.

6.4 Inspection and maintenance

6.4.1 Inspecting the internal components

Inspect the internal assembly and its components for corrosion, damage, moisture build up, loose, or damaged wires or cables, proper connector seating, lose connectors, or lose brackets.

- Document any adverse findings and contact COS with any adverse results and to determine the next steps.
- Clean with a soft damp cloth. Be careful not to damage any components.

6.4.2 Inspecting the lower housing assembly

⚠WARNING

NEVER REMOVE THE LOWER HOUSING FROM THE SUB BODY.

REMOVING THE LOWER HOUSING FROM THE SUB BODY CAN DAMAGE CRITICAL COMPONENTS AND WILL VOID THE WARRANTY OF YOUR PRODUCT.

ONLY TRAINED COS PERSONNEL ARE PERMITTED TO REMOVE THE LOWER HOUSING FROM THE SUB BODY.

- Inspect the lower housing assembly for corrosion, damage, moisture build up, and any loose components.
- Inspect the Lower Housing external threads for wear and damage.
- Document any adverse findings and contact COS with any adverse results and to determine the next steps.
- Clean with a soft damp cloth.
- Be careful not to damage any wires or components.

6.4.2.1 Inspecting the antenna and connector transit

- Inspect the RF antenna cable, antennas and connector transits for damage, corrosion, or loose connections.
- Document any adverse findings and contact COS with any adverse results and to determine the next steps.

To replace antennas, follow document W-17 “WITS™ Antenna Replacement Work Instruction”.

6.4.3 Inspecting the sub body

- Inspect the sub body for damage and corrosion.

- Inspect the locking element seating surface for corrosion or damage.

- Document any adverse findings and contact COS with any adverse results and to determine the next steps.
- Clean the locking element seating surface with a soft damp cloth.
- Be careful not to scratch or damage the surface.

6.4.4 Sensor assembly visual inspection

⚠WARNING

NEVER ATTEMPT TO OPEN THE SENSOR ASSEMBLY, CUT OR MODIFY THE CONNECTING CABLE ASSEMBLY OR THE CABLE MOUNTED CONNECTOR.

ATTEMPTING TO DO SO WILL DESTROY THE SENSOR ASSEMBLY IRREPARABLY AND WILL CAUSE THE WITS™ TO STOP FUNCTIONING.

IT WILL VOID YOUR WARRANTY AND LEAD TO EXPENSIVE REPAIRS.

Figure 17: Sensor Assembly

The sensors are protected under a special coating that provides structural integrity, hermetic sealing, and EMC protection. The integrity of the protective coating is critical for the proper functioning of the WITS™ sub. The protective coating cannot be removed without destroying the sensor assembly.

- **DO NOT DAMAGE THE PROTECTIVE COATING.**
- **DO NOT OPEN OR REMOVE THE PROTECTIVE COATING.**
- **DO NOT MODIFY OR DAMAGE THE CONNECTING CABLES OR THE CABLE MOUNTED CONNECTOR.**
- Visually inspect the protective coating for damage or any signs of structural issues like cracking, bubbling or delamination.
- Document any adverse findings and contact COS with any adverse results and to determine the next steps.

6.5 Specific Maintenance

⚠WARNING

ALL WITS ASSEMBLIES, SUB-ASSEMBLIES, AND COMPONENTS ARE MODULAR AND DESIGNED TO BE REPLACEABLE.

ANY MODIFICATIONS OR REPAIR ATTEMPTS MAY INVALIDATE THE PRODUCT CERTIFICATIONS AND WILL VOID YOUR WARRANTY.

DO NOT MAKE ANY MODIFICATIONS TO ANY WITS COMPONENTS OR ASSEMBLIES.

DO NOT ATTEMPT TO REPAIR ANY WITS COMPONENTS OR ASSEMBLIES.

NOTICE

Use only COS provided OEM parts.

6.5.1 Sub end connection thread inspections

- Inspect sub end connection threads according to industry recognized standards.

6.5.2 Sub body inspections

- In case of an overload condition or a suspected overload condition from exceeding the operating parameters of the WITS™, stop using the WITS™ immediately and contact COS Solutions for further instructions and required inspections and analysis.
- In case of other damage or corrosion of the sub body beyond surface corrosion, contact COS Solutions for further instructions and required inspections and analysis.

6.5.3 Replacing mounting hardware, packing and gaskets

- Use only COS OEM parts to replace any mounting hardware (i.e., SHCS, Nord-Lock washers, etc.), packing and/or O-ring gaskets.

6.5.4 Replacing battery packs

To replace batteries. Follow document W-14 "WITS™ Battery Replacement Work Instruction".

⚠WARNING

FIRE, EXPLOSION, AND SEVERE BURN HAZARD.

DO NOT TAMPER WITH OR ATTEMPT TO OPEN A BATTERY PACK.

DO NOT CUT, REMOVE OR REPLACE THE BATTERY CABLE OR CONNECTOR.

DO NOT SHORT CIRCUIT.

DO NOT CRUSH, RE-CHARGE OR DISASSEMBLE.

DO NOT HEAT ABOVE 100°C (212°F) OR INCINERATE.

ALWAYS REPLACE BATTERIES PACKS IN PAIRS.

6.5.5 Testing batteries

If advised by COS to test the batteries, refer to COS Document W-15 WITS™ Battery Test Work Instruction.

6.5.6 Disposal of battery packs

NOTICE

Laws and regulations for the disposal of Lithium batteries (LiMnO2) vary by country, state, and county/province. Always consult your local authorities regarding the safe and proper disposal of Lithium batteries (LiMnO2) batteries.

Do not return used batteries to COS unless advised to do so in writing by COS.

Consult your local authorities regarding the safe and proper disposal of LiMnO2 cells and battery packs.

6.5.7 Replacing an RF antenna cable, retainer cups, antenna, connector transit, and/or power On/Off switch

Please refer to COS Document W-17 "WITS™ Antenna Replacement Work Instruction".

6.5.8 Replacing the module assembly

Please refer to COS Document W-21 "WITS™ Module Assembly Replacement Work Instruction".

6.6 Re-assembly of the WITS™ Torque Sub

To re-assemble the WITS Torque Sub, follow document W-20 "WITS™ Torque Sub Dis- and Re-assembly Work Instruction".

7 Torque Specifications:

Recommended Torque Values (With use of thread lubricant Loctite LB 8009 anti-seize in WITS™ products)		
Item	**Imperial**	**ISO**
#6: RF connector transit, M20, P/N 300639	65 lbs-in	7.3 Nm
#7: Antenna, P/N 300370	5.3 lbs-in	0.6 Nm
#11: SHCS 5/8-11 x 1 1/2”	120 lbs-ft	163 Nm
#18: SHSS, 3/8-16 x 1/2” Inner set screw	150 lbs-in	17.0 Nm
#18: SHSS, 3/8-16 x 1/2” Outer set screw	100 lbs-in	11.3 Nm
#25: SHCS 1/4 -20 x 3/8”	70 lbs-in	7.9 Nm
#26: SHCS 5/16-18 x 3/4”	100 lbs-in	11.3 Nm
#31: SWITCH, ON/OFF,	36 lbs-in	4.0 Nm
RF cable splitter, Y-type, P/N 300376 & 300377 From items #6 to Module Assembly, item #19	9.0 lbs-in	1.0 Nm

Table 5: Recommended torque values

For reference:

- “Finger tight” of a screwed connection is tightening using 2 fingers and no tools. It produces a torque of approximately 15 to 20 lbs-in (1.7 to 2.3 Nm)
- “Hand tight” produces a torque of approximately 2 to 3 lbs-ft or 24 to 36 lbs-in (2.7 to 4.1 Nm)

8 Spare parts:

8.1 1-Year recommended spares kit

Item / Part Number	WITS-1	WITS-2
1-Year Recommended Spare Parts Kit	**700000**	**700010**
Includes:		
O-Ring & Packing Kit	700001	700011
Retainer Kit	700018	700018
Antenna Kit	700003	700013
Battery Kit	700004	700014
Assembly Kit	700005	700005
Power Switch Kit	700017	700017

8.2 O-Ring & Packing Kit

Item / Part Number	WITS-1	WITS-2
O-Ring & Packing Kit	**700001**	**700011**
Includes:		
1x NOVAGARD G624 Dielectric silicone grease compound	900013	900013
1x Packing, 3 ft, item 12	900006	900006
1x O-ring item 13	900023	900024
1x O-ring item 14	900002	900001
1x O-ring item 16	900044	900037
1x O-ring item 17	900032	900036

8.3 Retainer Kit

Item / Part Number	WITS-1 and WITS-2
Retainer Kit	**700018**
Includes:	
1x LOCTITE LB8009 Anti-seize	900014
6x Nord-Lock, item 10	900003
2x Nord-Lock, item 26	900010
7x Nord-Lock, item 24	900040
6x SHCS, item 11	900020
2x SHCS, item 27	900065
7x SHCS, item 25	900061

8.4 Antenna Kit

Item / Part Number	WITS-1	WITS-2
Antenna Kit	**700003**	**700013**
Includes:		
1x LOCTITE 222 Thread Locker	900042	900042
1x RF cable splitter, Y-type	300376	300377
2x Connector transit, item 6	300369	300369
2x Antenna, item 7	300370	300370
2x Cup, retainer, antenna, WITS, item 8	200326	200326
2x Internal retainer ring, item 9	900031	900031
1x Wrench, Deep Socket	900043	900043

8.5 Battery Kit

Item / Part Number	WITS-1	WITS-2
Antenna Kit	**700004**	**700014**
Includes:		
2x BATTERY PACK, UNIVERSAL	300418	300418
1x Vapor Capsule	800211	800211
6x Nord-Lock, item 24	900040	900040

8.6 Assembly Kit

Item / Part Number	WITS-1 and WITS-2
Assembly Kit	**700005**
Includes:	
4x Machine Handle	900007

8.7 Power Switch Kit – WITS

Item / Part Number	WITS-1 & WITS-2
Power Switch Kit, WITS	**700017**
Includes:	
1x Switch, On/Off, item 31	300417
1x Cup, retainer, Switch, WITS G2, item 31	200327
1x Washer, isolation, item 34	900063
1x Internal retainer ring, item 33	900059
1x Wrench, Deep Socket 3/8” square drive	900043
2x Hex L-key (Allen wrench) 0.050” tip	900066

9 BOMs and exploded views

9.1.1 Bill of Materials – WITS-1

(ASSEMBLY P/N 100701-X-XXX-XXX-XXXX)

Item	Qty	COS Part Number	Description
1	1	200701 -X-XXX-XXX-XXXX	BODY, SUB, WITS-1C, (ALL MODELS AND CONFIGURATIONS)
2	1	200340	HOUSING, LOWER
3	1	200341	HOUSING, UPPER
4	1	200322 or 200292	RING, COMPRESSOR
5	1	900016	LOCKING ELEMENT
6	2	300369	ANTENNA RF CONNECTOR
7	2	300370	ANTENNA
8	2	200326	CUP, RETAINER, ANTENNA
9	2	900031	RING, RETAINING, INTERNAL, 1-1/2”, SS
10	6	900003	WASHER, NORDLOCK, 5/8”
11	6	900020	SHCS, 5/8-11, 170KSIY
12	1	900006	PACKING, SQUARE
13	1	900023	O-RING, UHI
14	1	900002	O-RING, UHO
15	1	900032	O-RING, LHI
16	1	900044	O-RING, LHO
17	1	900032	O-RING, CR
18	4	900064	SHSS, 3/8”-16 X 1/2"
19	1	300371	ASSEMBLY, MODULE
20	N/A	N/A	N/A
21	2	300418	BATTERY PACK, WITS, UNIVERSAL
22	1	200328	BRACKET, BATTERY, INNER
23	2	200296	BRACKET, BATTERY, OUTER
24	7	900040	WASHER, NORD-LOCK, 1/4”
25	7	900061	SHCS, 1/4-20 X 1/2", 18-8 SS
26	2	900065	SHCS, 5/16-18 X 3/4, 18-8 SS
27	2	900010	WASHER, NORD-LOCK, 5/16”
28	2	900056	WASHER, TAB LOCK, 5/16"
29	1	200330	LABEL, PRODUCT, WITS
30	4	900015	RIVET, HAMMER-IN
31	1	300417	SWITCH, ON/OFF, 3/8”-16
32	1	200327	CUP, RETAINER, ON/OFF SWITCH, WITS G2
33	1	900059	RING, RETAINING, INTERNAL 1-1/8", SS
34	1	900063	WASHER, ISOLATION, FOR ITEM 31

9.1.2 Exploded views 10070X-X-XXX-XXX-XXXX

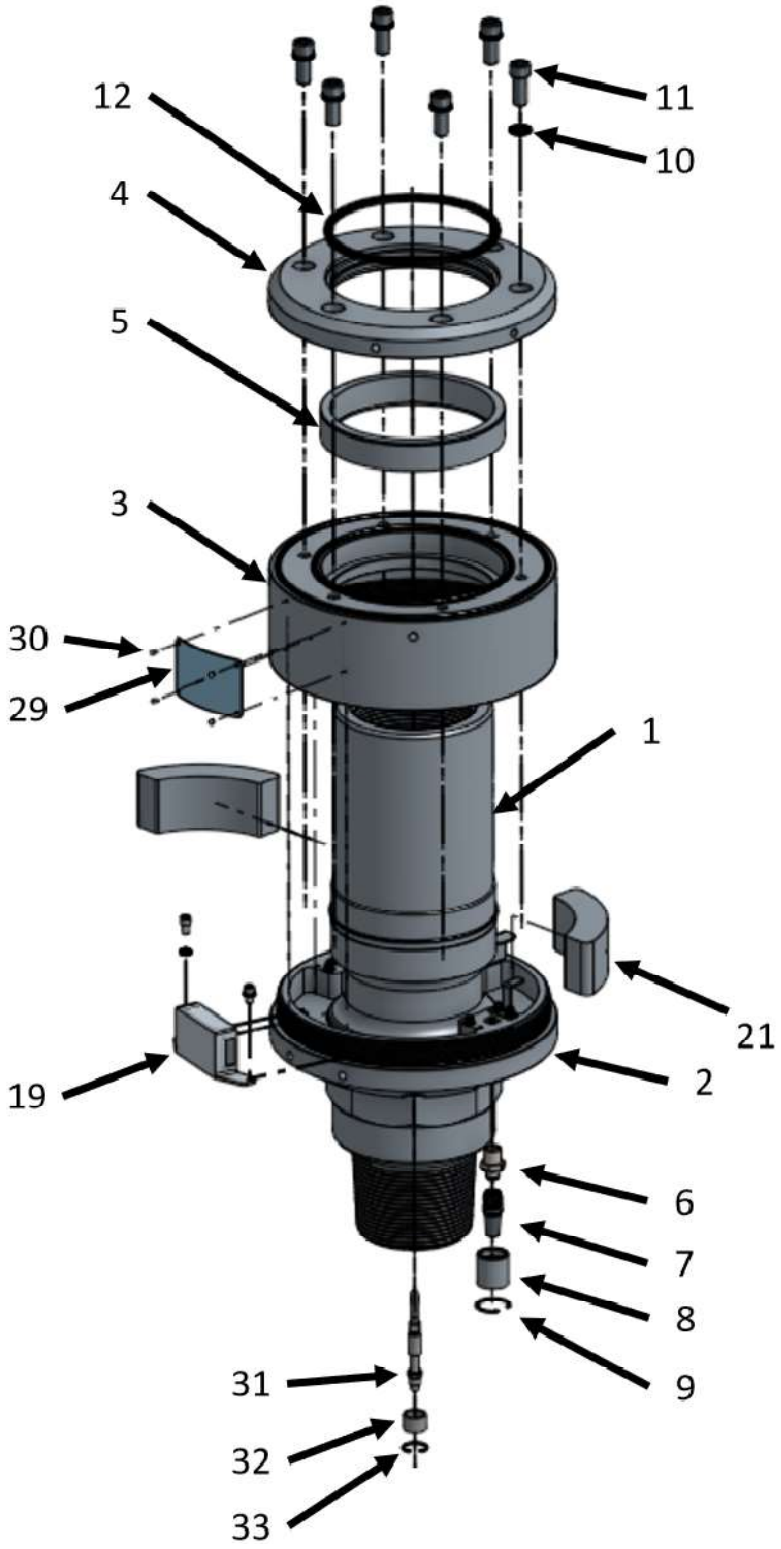


Figure 18: WITS™ exploded view.

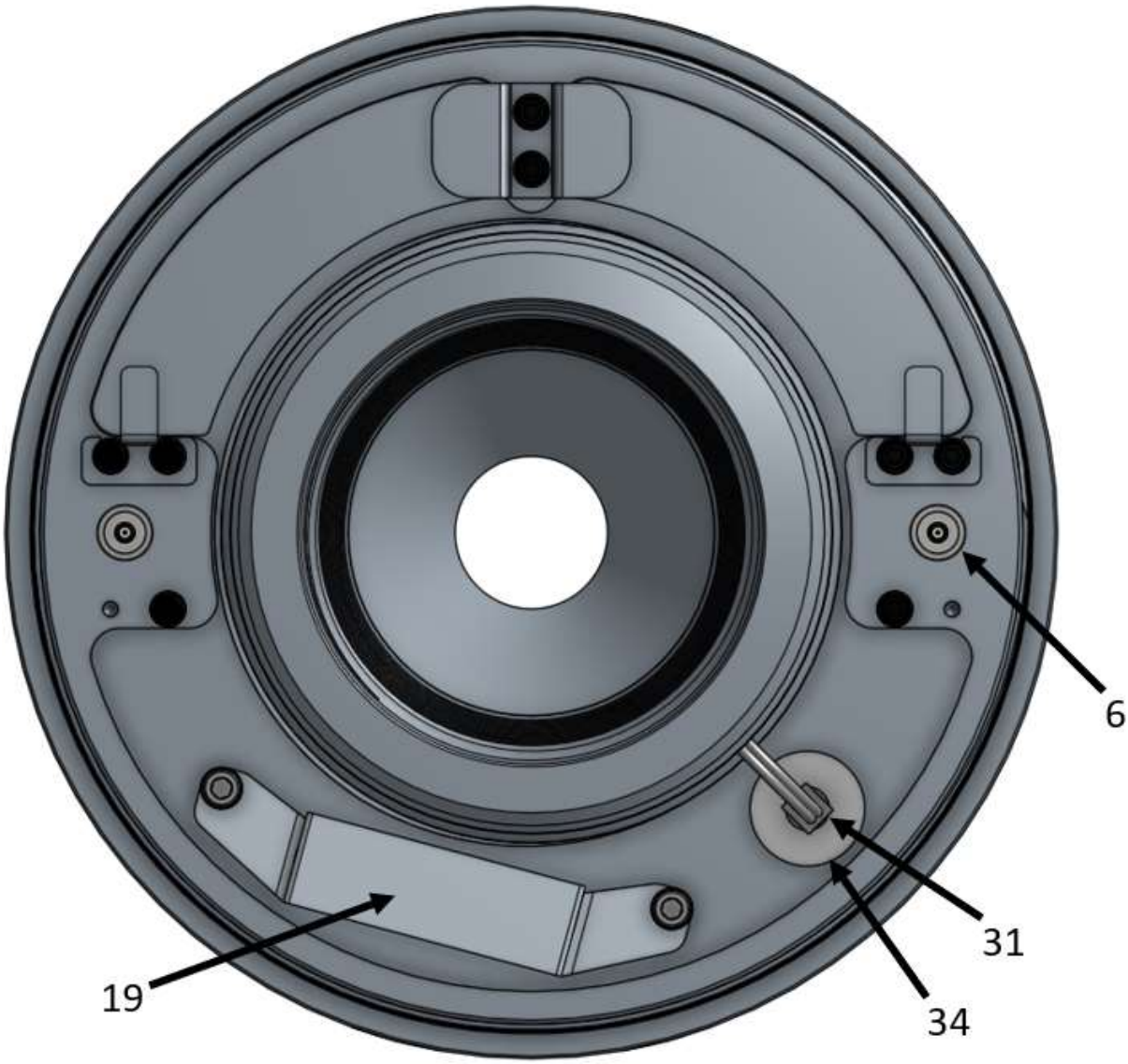


Figure 19: Lower Housing and Power Switch

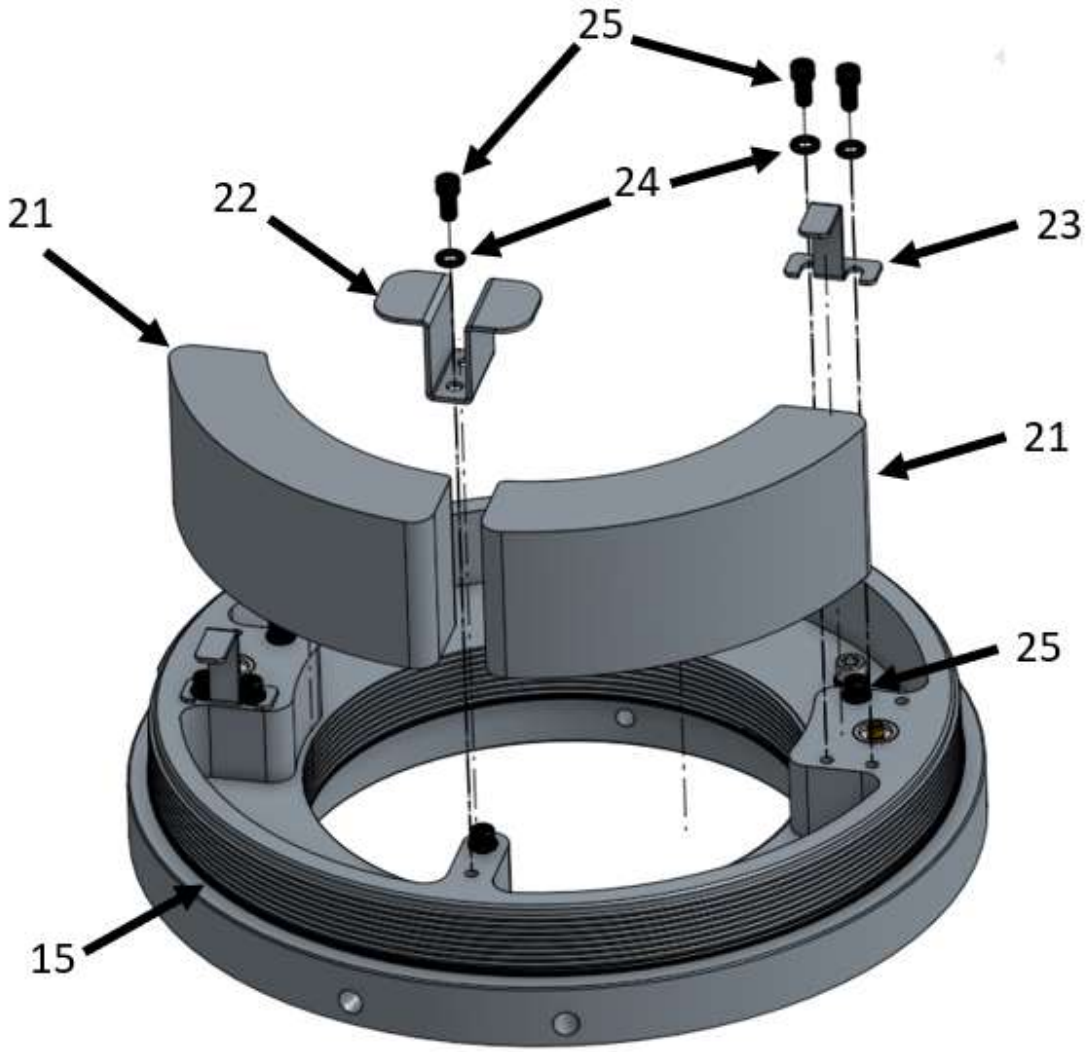


Figure 20: Battery mounting

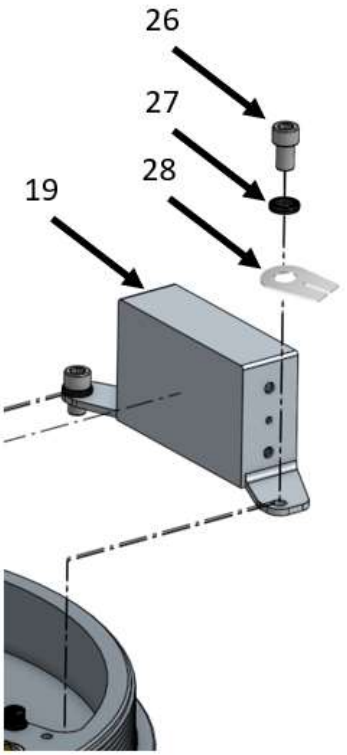


Figure 21: Module Assembly

Figure 22: Upper housing gaskets

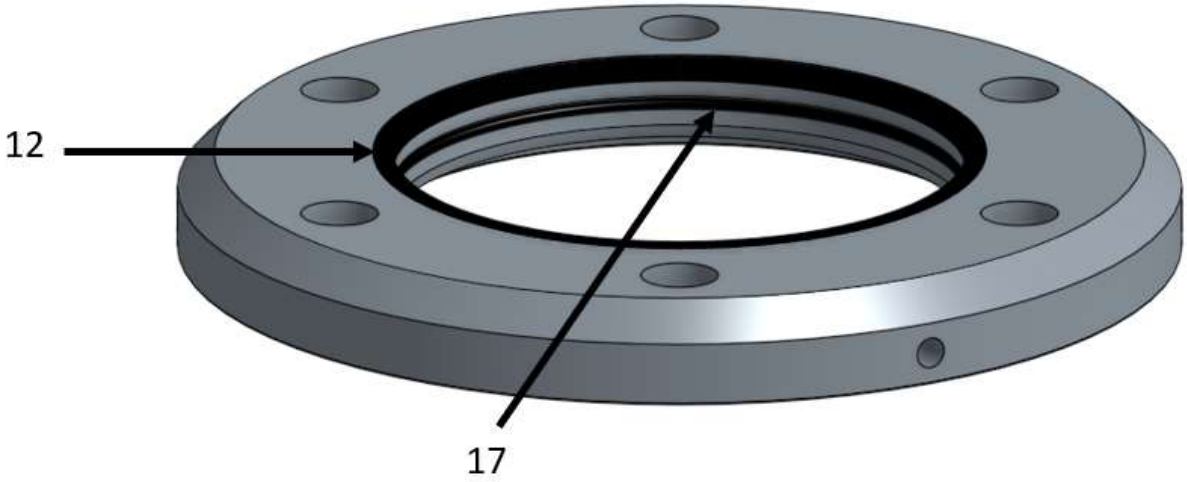


Figure 23: Compressor ring gaskets

Figure 24: Lower housing outer gasket

10 List of Tables

11 List of Figures

12 Contact information:

INTERPLANETARY HEADQUARTERS:
Cheetah Oilfield Solutions
32914 Tamina Road, Suite A
Magnolia, TX 77354
USA
Tel: +1 (346) 703-3080
E-Mail: info@cheetahoilfield.com
www.cheetahoilfield.com

CANADA:
Cheetah Oilfield Supply Ltd.
Attn.: Carl Cole
11216 - 143 Street NW
Edmonton, AB T5M 1V5
Canada
Tel: +1 (780) 900-0932
E-Mail: info@cheetahoilfield.com
www.cheetahoilfield.com

WITS™ Wireless Information Technology System