

Torque Monitoring Sub Product Manual



TMS

Original Instructions



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1 Introduction and Overview

1.1 Introduction to the Product Manual

This manual provides detailed instructions regarding the Volant® Torque Monitoring Sub (TMS) and its accompanying accessories.

The TMS tool is a wireless, battery-powered connection monitoring sub installed on a drilling rig below the top-drive. The sub measures torque, turns, rotational speed, and hook load during the make-up of a drilling string or connection to a Casing Running Tool (CRT).

The TMS tool wirelessly sends its collected data through a **Base Station** to a connected computer. Volant's TMS Translator software processes the data and allows a 3rd party torque monitoring system to collect the data for processing. This allows graphing connection torque-turns during casing and liner installation to visualize connection make-up in real-time.

Read applicable sections carefully before attempting to assemble, install, operate, or maintain the TMS. If any information is not clear or not covered in the manual, please contact Volant Customer Support at support@volantproducts.ca for assistance.

NOTE This manual is provided as part of the Data Book supplied with your TMS. Please refer to the Data Book for specific information regarding your TMS. The Data Book contains, as a minimum, the documentation API Specification 8C requires, which includes:

- Statement of compliance with API Specification 8C
- Equipment designation and serial number
- Nominal capacities and ratings
- Assembly drawings, including a Bill of Materials (BOM)
- Non-destructive testing records for Primary Load-carrying Components
- Load test records

1.2 Safety Precautions

1.2.1 Job Safety Analysis

Complete a job safety analysis risk assessment before starting the procedures outlined in this document.

1.2.2 Personal Protective Equipment

Always wear appropriate personal protective equipment (PPE) while completing the procedures outlined in this document.

The TMS's design features some sharp edges. Volant advises to wear, as a minimum, gloves, steel-toed boots, and safety glasses when working with the TMS, including during assembly, installation, operation, and maintenance.



1.2.3 Equipment Lifting

Always use appropriate lifting equipment and stands when moving and working with heavy items:

- Lifting nubbin that matches TMS box tool joint connection
- Lifting strap or chain rated to 1,000 lb.
- Overhead crane capable of 1,000 lb.
- TMS tool **Assembly Stump** or equivalent

1.2.4 Hazardous Materials

Refer to manufacturer SDS sheets for proper handling, personal protection, and disposal information for chemicals and lubricants used in the assembly and maintenance of the TMS.

1.2.5 Warnings

Safety warnings appear and are defined as:

DANGER

This identifies an extreme hazard of personal injury or death.

WARNING

This identifies a warning regarding potential injury or catastrophic equipment damage.

CAUTION

This identifies a caution regarding safe operation or potential of equipment damage.

1.2.6 Hazardous Location Protection Considerations

- Installation of the device shall be carried out by properly trained personnel and in accordance with regional laws.
- Repair of the tool should only be carried out by the manufacturer.
- There are no user serviceable parts, though the user can replace the **Battery Packs** and their fastening hardware.
- The battery modules should only be obtained from the manufacturer and no substitutions are allowed.

The following conditions, as determined from the standards used for the tool's markings, apply to the product:

WARNING

Do not charge the Battery Packs in a hazardous location.

Charge them in a non-hazardous area, and within a temperature range of 32°F (0°C) and 104°F (40°C), using only **Dual Battery Charger P/N 109242**.



1.2.7 Notes

Notes appear and are defined as:

NOTE Guidance provided to assist the user with the safe assembly, installation, operation, and maintenance of the TMS.

1.2.8 Images

Images presented in this manual are for illustrative purposes. Colours and configurations shown may not be representative of your TMS. Contact Volant Customer Support at support@volantproducts.ca if you have questions regarding the images in this manual.

1.2.9 Icons, and Approved Lubricants

Figures use these icons to indicate certain operations.

Table 1-1: Icons Used in This Manual's Figures

Icon	Description	Volant-Recommended Products to Use ²
A circular icon with a blue outer ring and a yellow center. Inside the yellow center is a stylized yellow oil drop.	Lubricate with grease.	Water-resistant NLGI #2 grease with calcium sulfonate thickener and a base oil compatible with Nitrile seals ³

² Substituting products may reduce the tool's service life. Contact Volant Customer Support at support@volantproducts.ca to discuss lubricant substitutions. Volant may need a sample of the substitution.

³ This is also known as "marine grease."



1.3 Units

Units presented in the manual are intended to be consistent with those used in the TMS's common application. Common units presented in the manual are:

Table 1-2: Common Units

Unit	Abbreviated	Useful Conversions		
Inch	in. or "	1 in. = 0.0254 m	1 in. = 25.4 mm	
Foot	ft. or '	1 ft. = 12 in.		
US gallon	US gal.	1 US gal. = 0.00379 m ³		
Pound force	lb.	1 lb. = 4.45 N	1 lb. = 0.454 kg*	
Pounds per square inch	psi	1 psi = 0.006895 MPa		
Thousands of pounds per square inch	ksi	1 ksi = 1,000 psi	1 ksi = 6.895 MPa	
Megapascal	MPa	1 MPa = 145 psi	1 MPa = 1,000,000 Pa (pascal)	
Pounds per foot	ppf	1 ppf = 1.488 kg/m*		
Inch pound	in.lb.	1 in.lb. = 0.083 ft.lb.	1 in.lb. = 0.112 N · m	
Foot pound	ft.lb.	1 ft.lb. = 1.355 N · m	1 ft.lb. = 12 in.lb.	
Newton metre	N · m	1 N · m = 0.738 ft.lb.	1 N · m = 8.856 in.lb.	
Short ton	short ton	1 short ton = 2,000 lb.	1 short ton = 0.889 kdaN	1 short ton = 0.907 tonnes*
Metre	m	1 m = 39.4 in.	1 m = 1,000 mm	
Millimetre	mm	1 mm = 0.0394 in.	1 mm = 0.001 m	
Cubic metre	m ³ or cubes	1 m ³ = 264 US gal.		
Kilogram	kg	1 kg = 9.81 N*	1 kg = 2.20 lb.*	
Kilogram per metre	kg/m	1 kg/m = 0.672 ppf*		
Metric ton	tonne	1 tonne = 1,000 kg	1 tonne = 1.10 short tons*	
Newton	N	1 N = 0.102 kg*	1 N = 0.225 lb.	1 N = 0.102 x 10 ⁻³ tonnes*
Kilonewton	kN	1 kN = 1,000 N	1 kN = 225 lb.	1 kN = 0.102 tonnes*

*Assuming acceleration due to gravity of 9.81 m/s²

NOTE Table 1-2 is only intended to provide clarity as to the units used in this manual. Volant is not liable for any errors in conversions due to rounding or otherwise.

NOTE Converted metric values in this manual will sometimes be rounded either up or down based on the application (e.g., rounding a hole size down to not give the wrong impression of what pin diameter can fit through it).

WARNING

Always ensure correct units are being used in any calculation and correct conversion factors are used when converting between units. User is solely liable for any calculations made based upon Table 1-2.

1.4 Introduction to the TMS

The Volant⁴ TMS Torque Monitoring Sub is a wireless, battery-powered connection monitoring sub installed on a drilling rig below the top-drive. The TMS measures torque, turns, rotational speed, and hook load during the make-up of a drilling string or connection to a Casing Running Tool (CRT).

The two **Battery Packs** in the TMS provide redundancy, can keep up with any extended field deployment, and can be safely changed on the rig floor due to the intrinsically safe design of the electronics.

The sub is available in various torque ratings and tool joints.

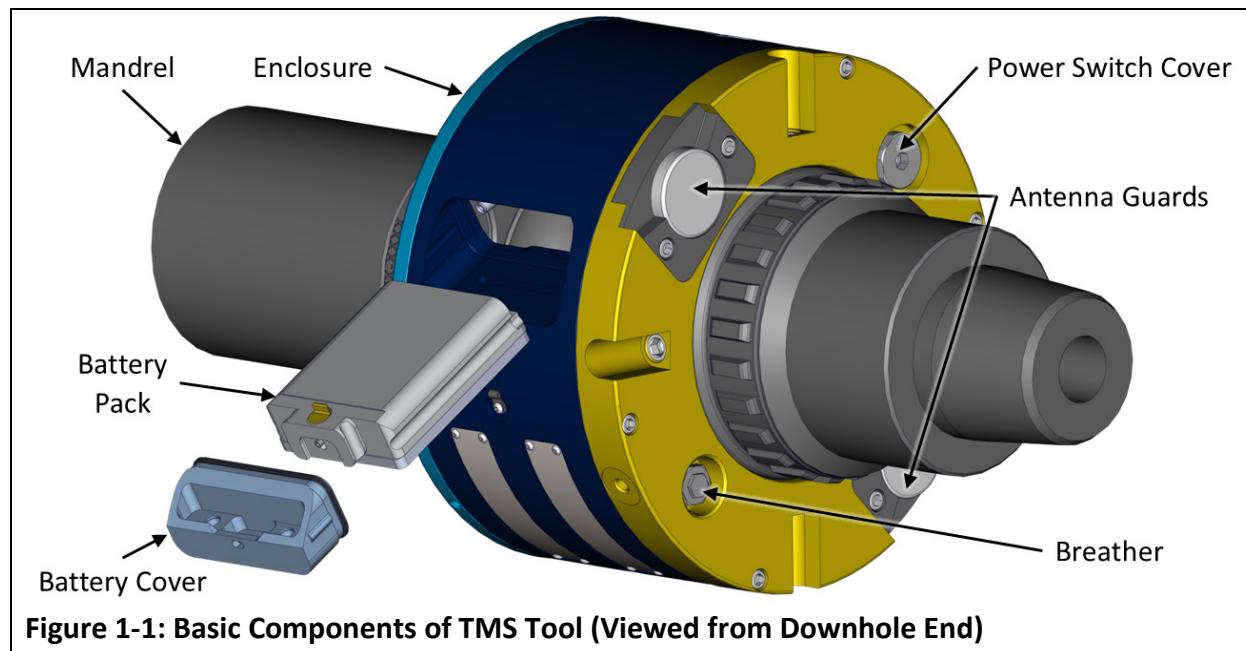


Figure 1-1: Basic Components of TMS Tool (Viewed from Downhole End)

⁴ Volant® and VolantRED™ are trademarks of Volant Products Inc.
V-LOK® is a registered trademark of Noetic Technologies Inc.



1.4.1 Complete TMS System

The TMS tool wirelessly sends its collected data through a **Base Station** to a connected computer. Volant's TMS Translator software processes the data and allows a 3rd party torque monitoring system to collect the data for processing. This allows graphing connection torque-turns during casing and liner installation to visualize connection make-up in real-time.

The sub can also provide the high-resolution data required to inform the VolantRED™ system.

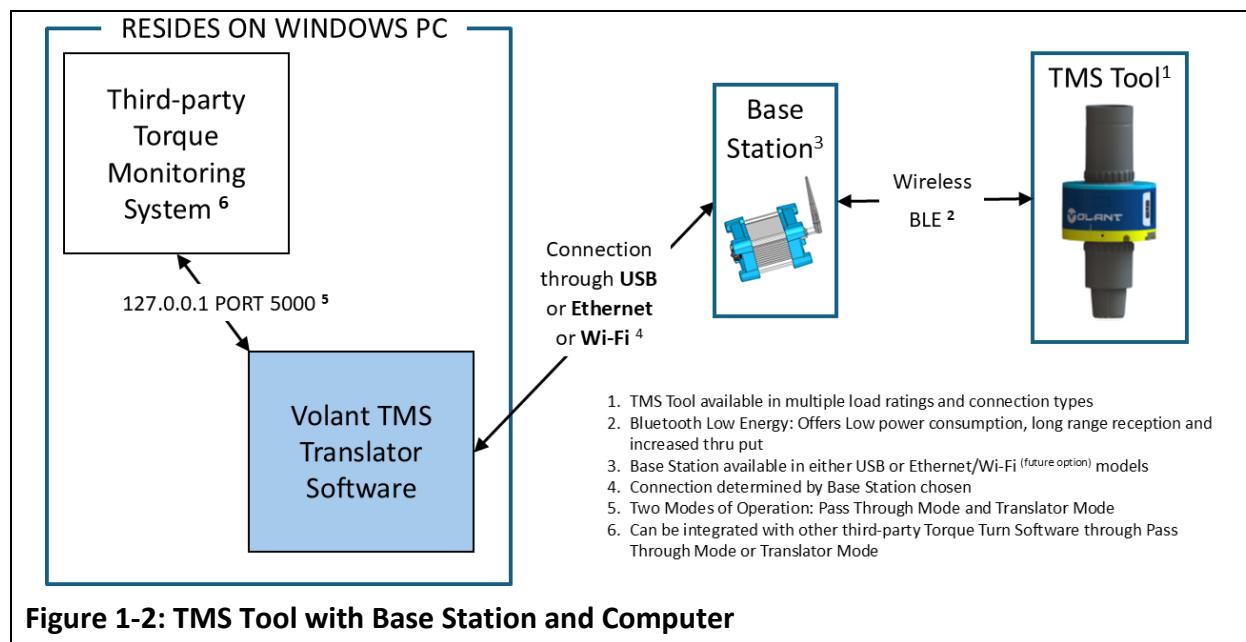


Figure 1-2: TMS Tool with Base Station and Computer

1.5 Training Disclaimer

Volant recommends that all persons who will operate the TMS tool, or the supervisor of such persons, first complete the Volant training program. For more information about the training program, contact Volant Customer Support at support@volantproducts.ca.



1.6 Maintenance Disclaimer

Maintaining the TMS requires proper tools, drawings, and documentation.

DANGER

Owners of the TMS tool are **only** intended to perform the maintenance detailed in Section 8. The **only** disassembly this involves is that of the **Battery Covers** and **Battery Packs**; there are **no** other user repairable or serviceable parts on the TMS tool or its accessories.

All other repairs and services **must** be performed by a trained Volant technician.

WARNING

Volant recommends that all technicians who will maintain the TMS tool first complete the Volant training program. For more information about the training program, contact Volant Customer Support at support@volantproducts.ca.

DANGER

Always ensure electrical circuits are de-energized prior to performing maintenance. Only perform maintenance in a non-hazardous environment.

Following the maintenance activity, only reconnect electrical circuits while in a non-hazardous location.

1.6.1 Replacement Parts

Do not replace electrical components on your TMS or any accessories (**Base Station**, **Dual Battery Charger**) without express consent from Volant Products.

WARNING

Do not modify or alter the tool assemblies.

Do not replace components with non-OEM ones.

1.7 Certifications

1.7.1 Federal Communications Commission (FCC)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference; and
2. This device must accept any interference received, including interference that may cause undesired operation.

To comply with FCC exposure limits for general population / uncontrolled exposure, this device should be installed at a distance of 20 cm from all persons and must not be co-located or operating in conjunction with any other transmitter.



Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

1.7.2 Innovation, Science and Economic Development Canada (ISED)

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

This device should be installed and operated with a minimum distance of 0.2 m from human bodies.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

1. L'appareil ne doit pas produire de brouillage.
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Cet appareil doit être installé et utilisé à une distance minimale de 0.2 m du corps humain.



1.7.3 Hazardous Location Operating Regions

The equipment was assessed against the following standards for operations in different regions of the world:

Table 1-3: Certification Ratings

Area	Standard	Subject
IEC	IEC 61010-1:2012	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements
IECEx	IEC 60079-0:2017, Ed. 7	Part 0: Equipment – General requirements
	IEC 60079-11:2023, Ed. 7	Part 11: Equipment protection by intrinsic safety "i"
ATEX	IEC EN 60079-0:2018	Part 0: Equipment – General requirements
	EN 60079-1:2012	Part 11: Equipment protection by intrinsic safety "i"
US/CA	UL 60079-0:2019	Part 0: Equipment – General requirements
	CSA C22.2 No. 60079-0:2019	
	UL 60079-11:2013	Part 11: Equipment protection by intrinsic safety "i"
	CSA C22.2 No. 60079-11:2014	

NOTE Where applicable, any references in this manual to IEC standards may also be taken as referring to the equivalent version of the CSA and UL standards and vice versa.

1.7.4 Markings

Based on these Assessments, the following equipment ratings and hazardous location markings were determined:

Table 1-4: TMS Name Plate Marking Details

Item	Detail			
Equipment Name / Model Numbers	Torque Monitoring Sub / TMS 60, TMS 100			
Manufacturer's Name	Volant Oil Tools Inc. 4110 56 Avenue NW Edmonton AB T6B 3R8 Canada			
Hazardous Location Markings	ATEX  II 1G Ex ia IIB T4 Ga	IECEx Ex ia IIB T4 Ga	US/CA Class I, Zone 0, AEx ia IIB T4 Ga Ex ia IIB T4 Ga Class I, Division 1, Groups C,D; T4 (Ex ia)	
Electrical Ratings	Battery Type	Part Number	Capacity	Uo (Vmax)
	NiMH	WT60D6000P	6,000 mA	1.55V
Five NiMH cells arranged in series with 7.75V max.				
Ambient Temperature Range	Ta: -40°C to 60°C			
Warnings	WARNING: DO NOT CHARGE IN HAZARDOUS AREAS.			



NOTE North American certification requires warnings in both English and French.

WARNING

Do not operate the TMS if any marking shown in Table 1-4 is missing.

The hoist and torque ratings are also marked on one of the **Name Plates**. See Figure 1-3.

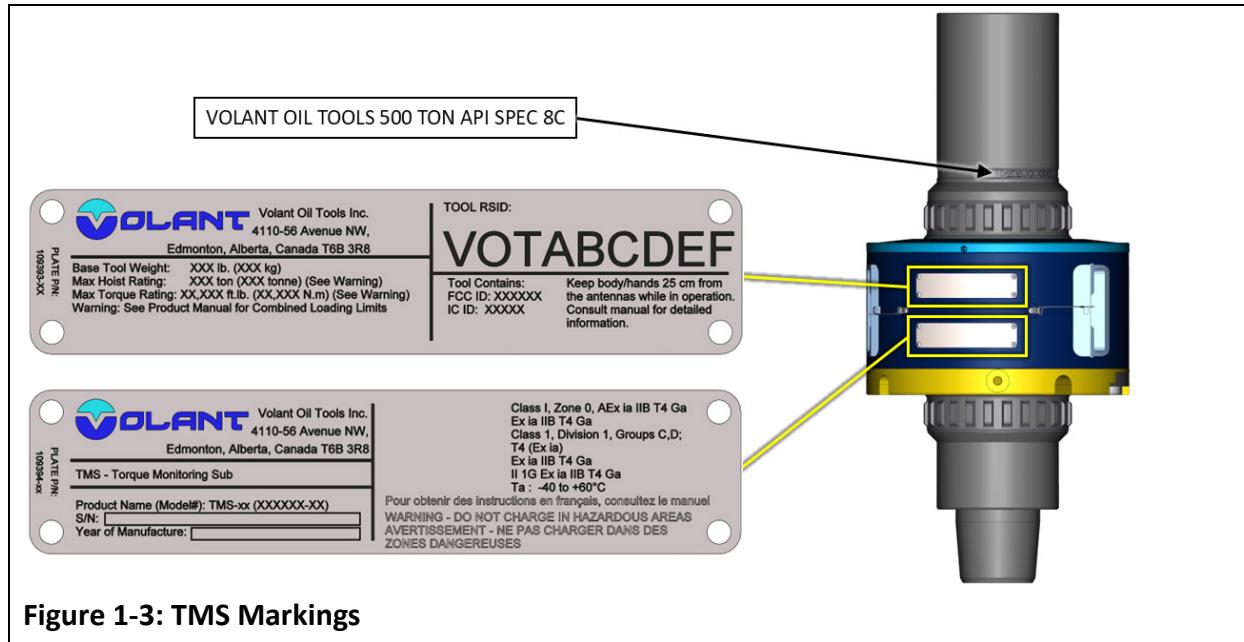


Figure 1-3: TMS Markings

1.8 Company Information

Head Office

Volant Oil Tools Inc.
4110 56 Avenue NW
Edmonton AB T6B 3R8 Canada
+1 780.490.5185

US Office

Volant Oil Tools (US) Inc.
23571 Clay Road
Katy, TX 77449 USA
+1 281.371.3210

Website

www.volantproducts.ca

Volant Customer Support Email

support@volantproducts.ca

Sales Email

sales@volantproducts.ca

2 Tool Information

2.1 Models

Figure 2-1 shows the two TMS tool models: TMS 60 and TMS 100. Both models share identical **Battery Packs**.

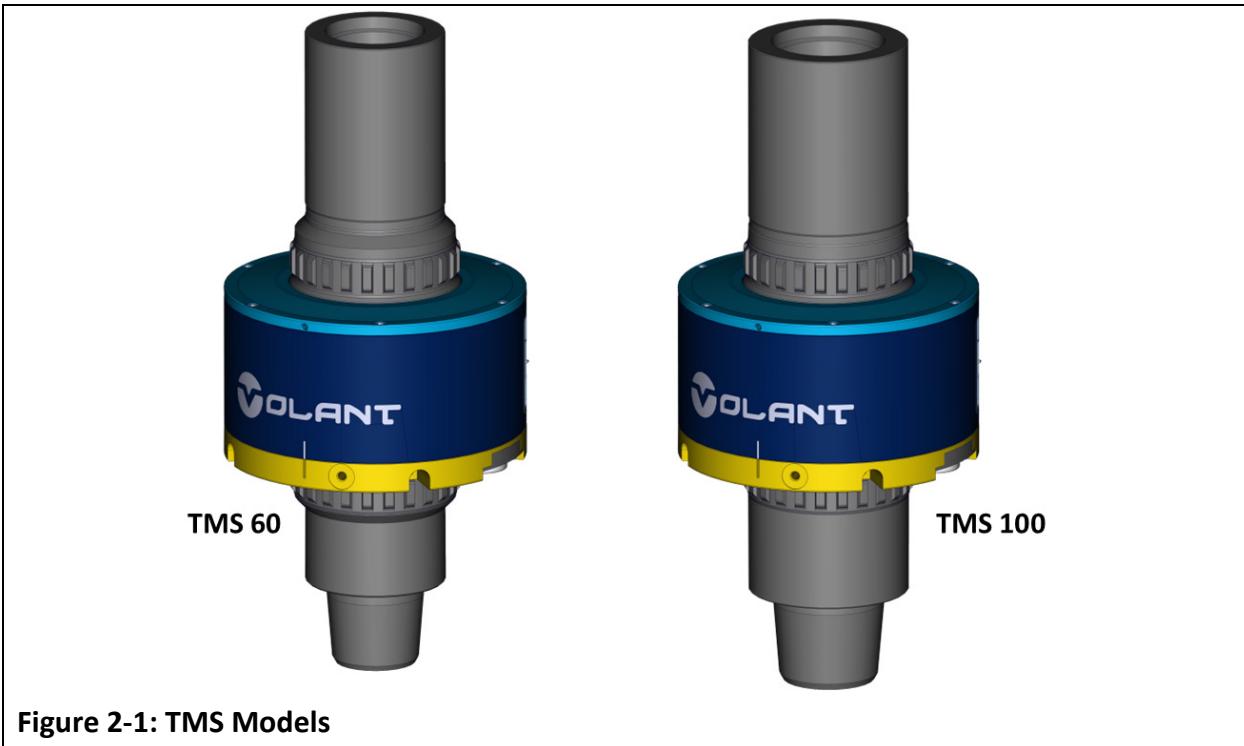


Figure 2-1: TMS Models

2.2 Hardware

The TMS hardware consists of two components: the TMS tool and the **Base Station**. Using the TMS tool also requires a **Dual Battery Charger**.

2.2.1 TMS Tool

The TMS tool is intended for installation in Zone 0 hazardous gas environments.

Typically operated on drilling or completions rigs, the TMS tool can operate in general-purpose areas; Zones 0, 1, and 2 regions; and Division 1 and 2 Areas. It is not permanently affixed but is present during drilling rig operations.



2.2.2 Base Station

The **Base Station** detects the TMS tool's Long-Range Bluetooth® (LR-BT) signal and transmits it to the TMS Translator software. The Base Station is available in three models based on the operating zone and the physical connection used:

Table 2-1: Base Station Models

Operating Zone	Physical Connection	Base Station P/N
General Purpose	USB	109207
General Purpose	Wi-Fi or Ethernet Cable	109749
Hazardous Zones	Wi-Fi	109971

2.2.3 Dual Battery Charger (P/N 109242)

The **Dual Battery Charger** charges the TMS tool's two **Battery Packs** before operation.

Volant® supplies an **AC/DC Adaptor** that connects to the Charger's DC power supply connection and a **Power Cord** for connecting the Adaptor to mains AC power.

AC/DC Adaptor P/N	109283
Adaptor Input Connection	IEC 320-C14
Input Power Cord P/N (for North America use)	109284
Adaptor Input Power Requirements	90–246VAC, 47–63 Hz, Single Phase
Adaptor Output Power	12VDC, 1.6 A

NOTE Input connection is IEC 320-C14; any mating power cord must be approved for the power source and compatible with the input voltage of this device.

NOTE Power Cord P/N **109284** is for the North American region. Please consult with Volant for power cables for other regions.

2.3 Software

Since the various available 3rd party torque monitoring software packages do not follow any specific communication standard, the TMS Translator software is designed to handle communication between the torque monitoring software and the TMS tool. The TMS Translator software also provides the ability to view the following information about the TMS system:

- System information
- Calibration data
- Diagnostic data
- Base Station connection data

The software uses a Volant-defined communication protocol to transmit all information gathered from a TMS tool to the connected torque monitoring software. This protocol also allows the torque monitoring software to interact with the TMS Translator software as well as with the TMS tool itself. Consult the product manual P/N **109908** for the TMS Translator software for refined details on how the software works.



2.4 TMS System Properties

2.4.1 Measurement Accuracy

Torque Accuracy	< 1.0% full scale
Hook Load Accuracy	< 1.0% full scale
Turns Accuracy	< 0.002 rotations over 1 turn
Turns Resolution	0.001 rotations

NOTE Turns accuracy and resolution apply to both clockwise and counterclockwise rotation, though accuracy and resolution may decrease at speeds greater than 21 rpm.

2.4.2 Battery Specifications

The TMS is a battery-powered device that uses two internal removable, rechargeable **Battery Packs**, listed below.

WARNING

Do not charge the Battery Packs in a hazardous location.

Charge them in a non-hazardous area, and within a temperature range of 32°F (0°C) and 104°F (40°C), using only **Dual Battery Charger P/N 109242**.

Table 2-2: Properties for Each Battery Pack

Type	Nickel-metal hydride (NiMH)
Cells	Five in series
Ambient temperature range	-40°F to 140°F (-40°C to 60°C)
Current capacity	6,000 mA
Nominal voltage rating	1.3V
Battery life ⁵	7 days continuous operation

NOTE Use the Battery Packs within their specified ambient temperature range only.

WARNING

Handle the Battery Packs carefully to prevent damaging them.

Dispose of spent Battery Packs following proper regulations.

Battery cell materials and encapsulation materials are health and environmental hazards.

⁵ 7 days at 20°C. Battery life depends on operating temperature.



2.4.3 TMS Operating Limits

Minimum Ambient Temperature	-40°F (-40°C)
Maximum Ambient Temperature	140°F (60°C)
Standard Operating Pressure Limit	5,000 psi (34.4 MPa)
Maximum Flow Rate	1,161 US gal./min. (4.40 m³/min.)

WARNING

Ensure drilling fluid solids controls are in place to prevent excessive **Mandrel** bore erosion.

The maximum flow rate is based on typical fluids. Erosion rates will vary based on the fluid contents. Inspect TMS tool bore regularly.

CAUTION

For operating temperatures below -4°F (-20°C) ensure all Primary Load-carrying Components' (the Mandrel) markings display "SR2" and a minimum test-temperature lower than their expected operating temperature. Refer to Section 4.10, Cold Weather Considerations.

WARNING

Steaming through the bore of the TMS is permitted where there is no risk of an explosive atmosphere. Hot surfaces pose a risk in explosive atmospheres.

Steam only through the bore of the Mandrel. Never steam the **Enclosure** as this can severely damage its interior components, harming tool function.

Only steam when the TMS is operating so that you can monitor the temperature using the TMS Translator software.

Ensure the TMS stays below 140°F (60°C).

Do not overheat since this may damage seals.

2.4.4 Dimensions and Weights

Table 2-3: TMS Models Dimensions and Weights

	TMS 60	TMS 100
Tool Joint	NC50 (4-1/2" IF), 6-5/8" REG	6-5/8" REG, 6-5/8" FH
Shoulder-to-Shoulder Tool Length ⁶	30.0 in. (765 mm)	30.0 in. (765 mm)
Tool Weight	490 lb. (223 kg)	554 lb. (252 kg)
Maximum Tool Diameter	15.95 in. (405.5 mm)	15.95 in. (405.5 mm)
Tool Through-Hole Diameter	2.00 in. (50.5 mm)	2.00 in. (50.5 mm)
Box Tool Joint Outer Diameter	7.40 in. (188.0 mm)	8.50 in. (216.0 mm)

⁶ Tool length may vary. Consult the drawings in your Data Book to confirm your TMS tool's dimensions.



2.4.5 Hoist and Torque Capacities

2.4.5.1 TMS 60

Hoist Capacity	500 short tons @ 0 ft.lb. Torque	(453 tonnes @ 0 N · m)
Torque Capacity	60,000 ft.lb. @ 0 short tons Hoist	(81,300 N · m @ 0 tonnes)
Combined Load Capacity	See Section 2.6.1, Combined Load Rating.	

2.4.5.2 TMS 100

Hoist Capacity	750 short tons @ 0 ft.lb. Torque	(680 tonnes @ 0 N · m)
Torque Capacity	100,000 ft.lb. @ 0 short tons Hoist	(135,500 N · m @ 0 tonnes)
Combined Load Capacity	See Section 2.6.1, Combined Load Rating.	

DANGER

Hoist and torque capacities decrease when the TMS tool is loaded simultaneously in hoist and torque. See the Combined Load Operation Curve in Section 2.6.1 if the TMS tool is loaded in this way.

2.5 Recommended Make-up Torques

To determine the TMS box tool joint's make-up torque for your job:

1. Identify the yield strength and internal diameter of the pin to be made up to the TMS box tool joint.
2. Using the ID of the pin connection, trace vertically up the tool joint's graph to the line corresponding to the pin yield strength. Trace horizontally to determine the recommended make-up torque.

DANGER

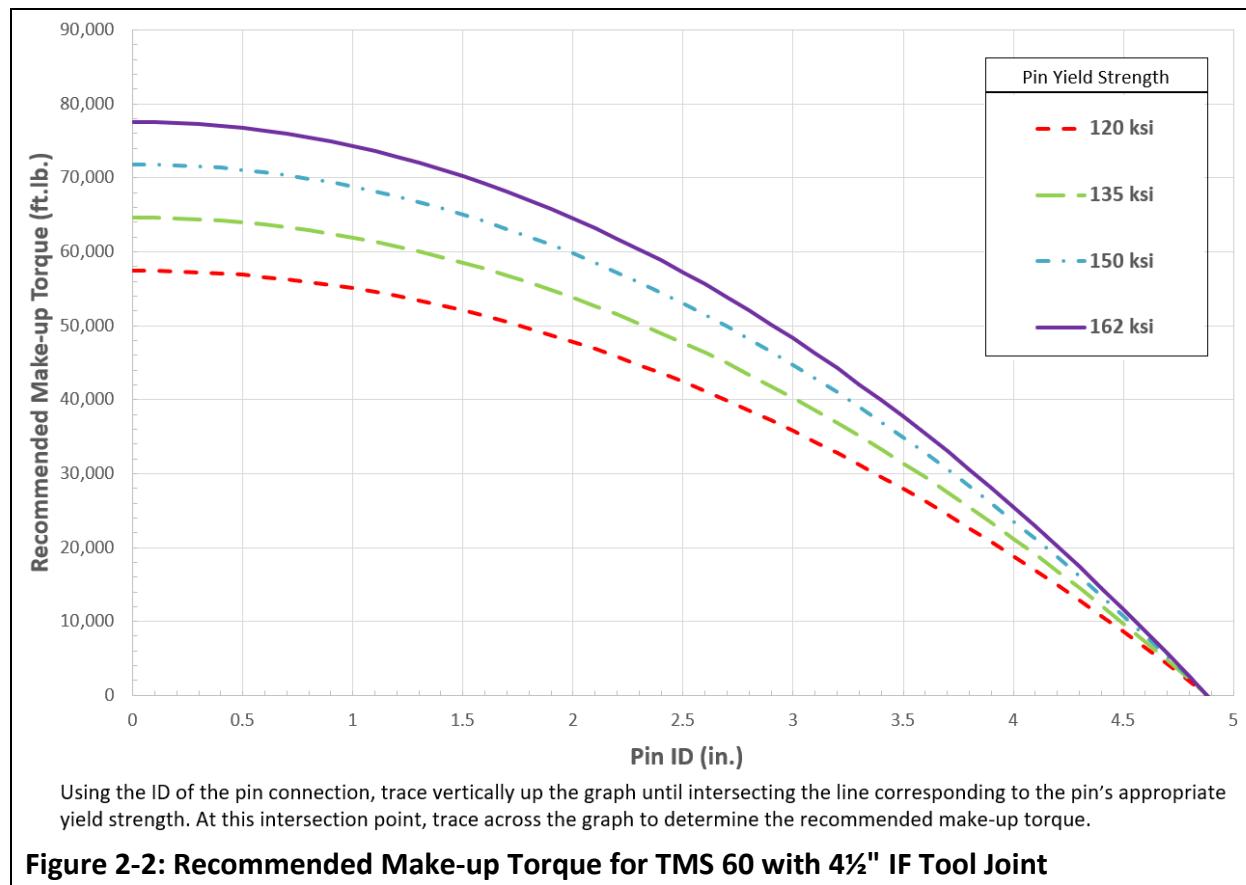
These charts do **not** give operating limits. The pin used in the connection may limit the allowable hoist, torque, and pressure to values less than the TMS ratings. Only use the connection within operating limits defined within API Specification 8C.

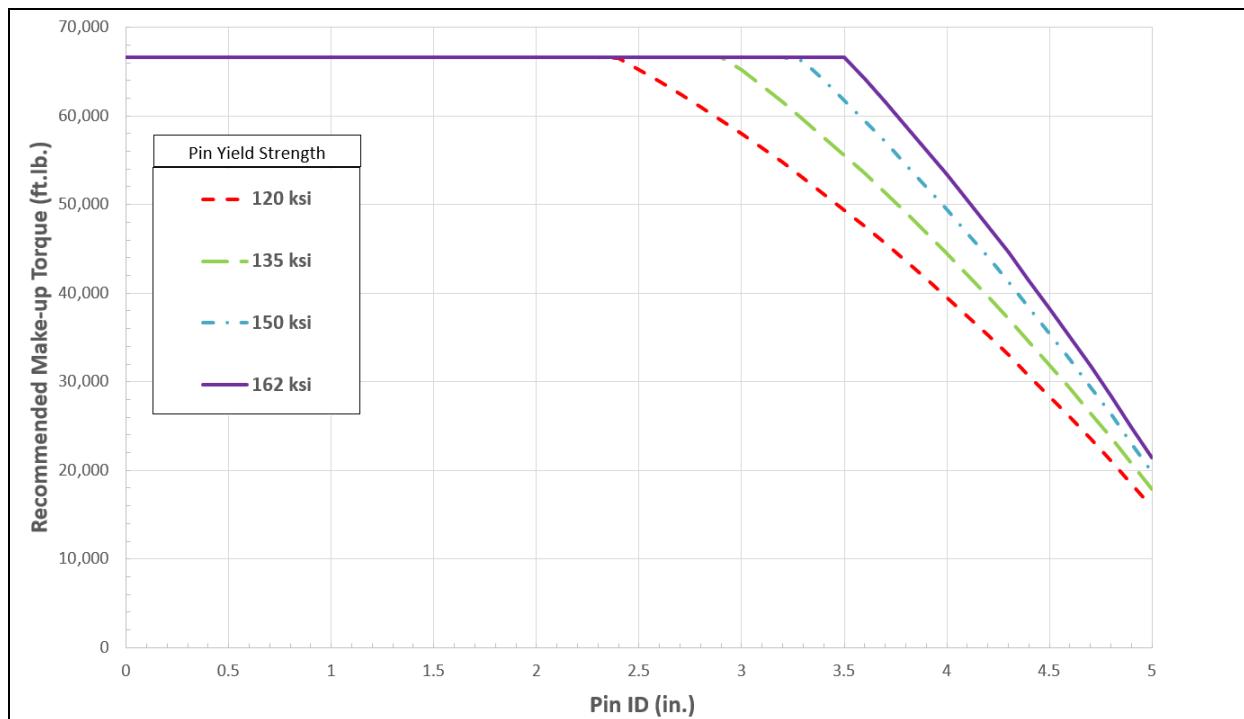
NOTE Make-up torques in the graphs below are calculated according to API Recommended Practice 7G. These values consider the limiting case between the TMS tool's box and the mating pin threads.

NOTE For the TMS pin tool joint's make-up torque, ensure you follow the make-up torque guidelines for what it will thread into, such as a casing running tool.

Also consider:

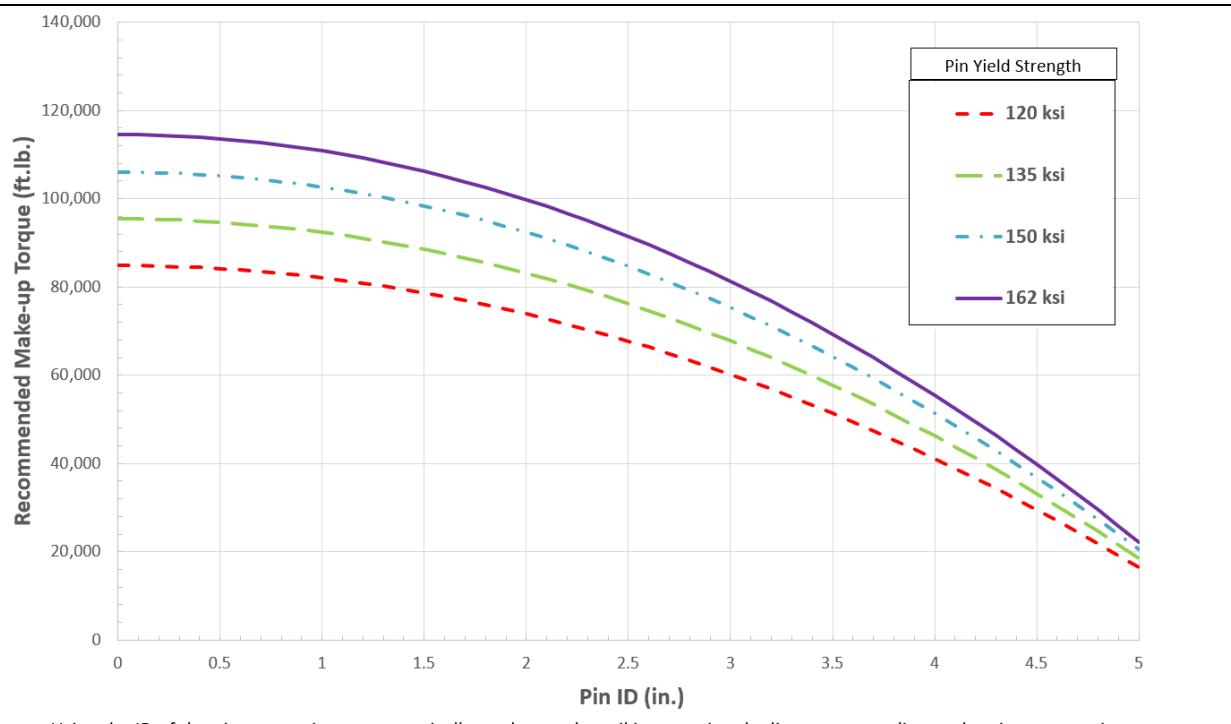
- the material strength of the TMS tool's **Mandrel**: 162 ksi (1,117 MPa)
- the TMS Tool Through-Hole Diameter: See Table 2-3.





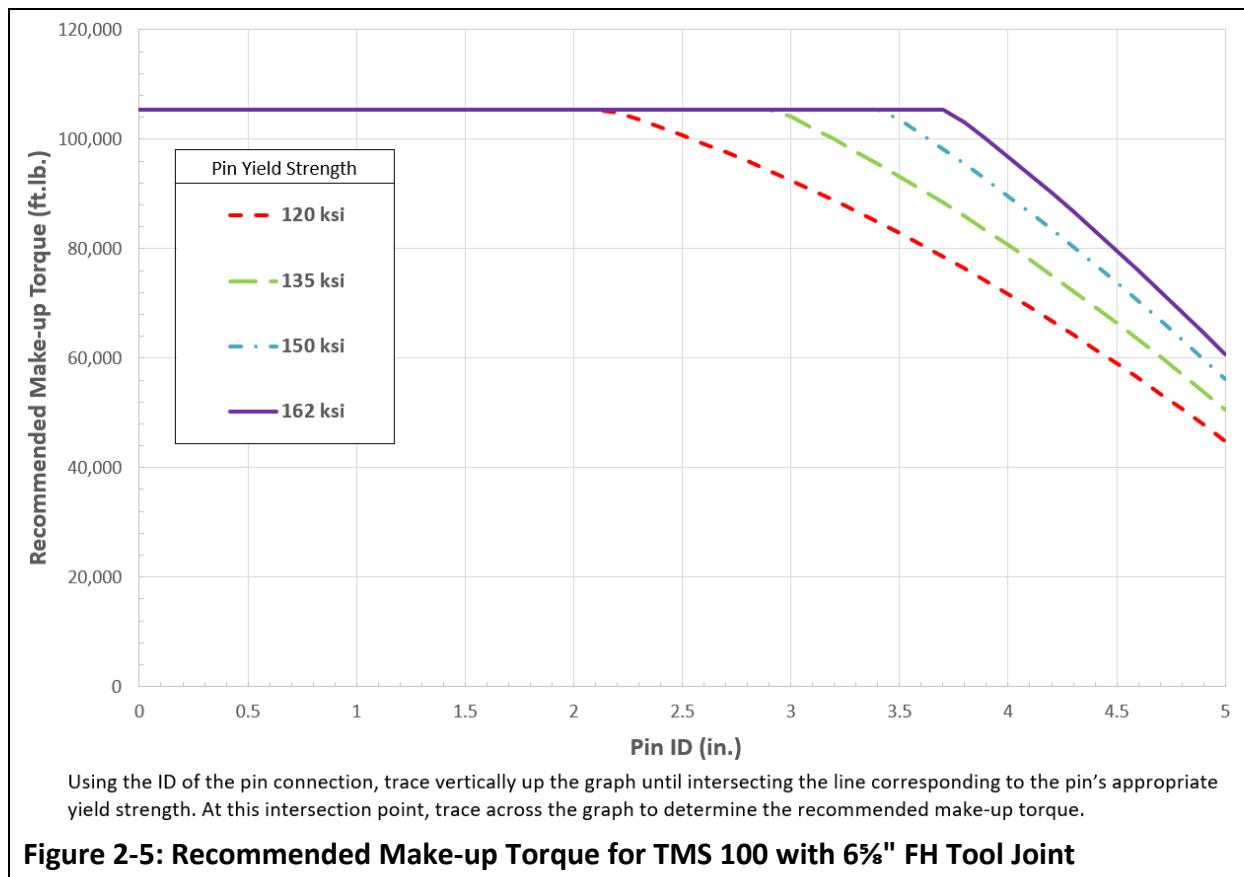
Using the ID of the pin connection, trace vertically up the graph until intersecting the line corresponding to the pin's appropriate yield strength. At this intersection point, trace across the graph to determine the recommended make-up torque.

Figure 2-3: Recommended Make-up Torque for TMS 60 with 6 1/8" REG Tool Joint



Using the ID of the pin connection, trace vertically up the graph until intersecting the line corresponding to the pin's appropriate yield strength. At this intersection point, trace across the graph to determine the recommended make-up torque.

Figure 2-4: Recommended Make-up Torque for TMS 100 with 6 1/8" REG Tool Joint



2.6 Calculations and Data Concerning TMS

2.6.1 Combined Load Rating

Figure 2-6 shows the combined load operation curve for the TMS configurations. These curves illustrate the operating limits of the TMS when simultaneously loaded in hoist and torque.

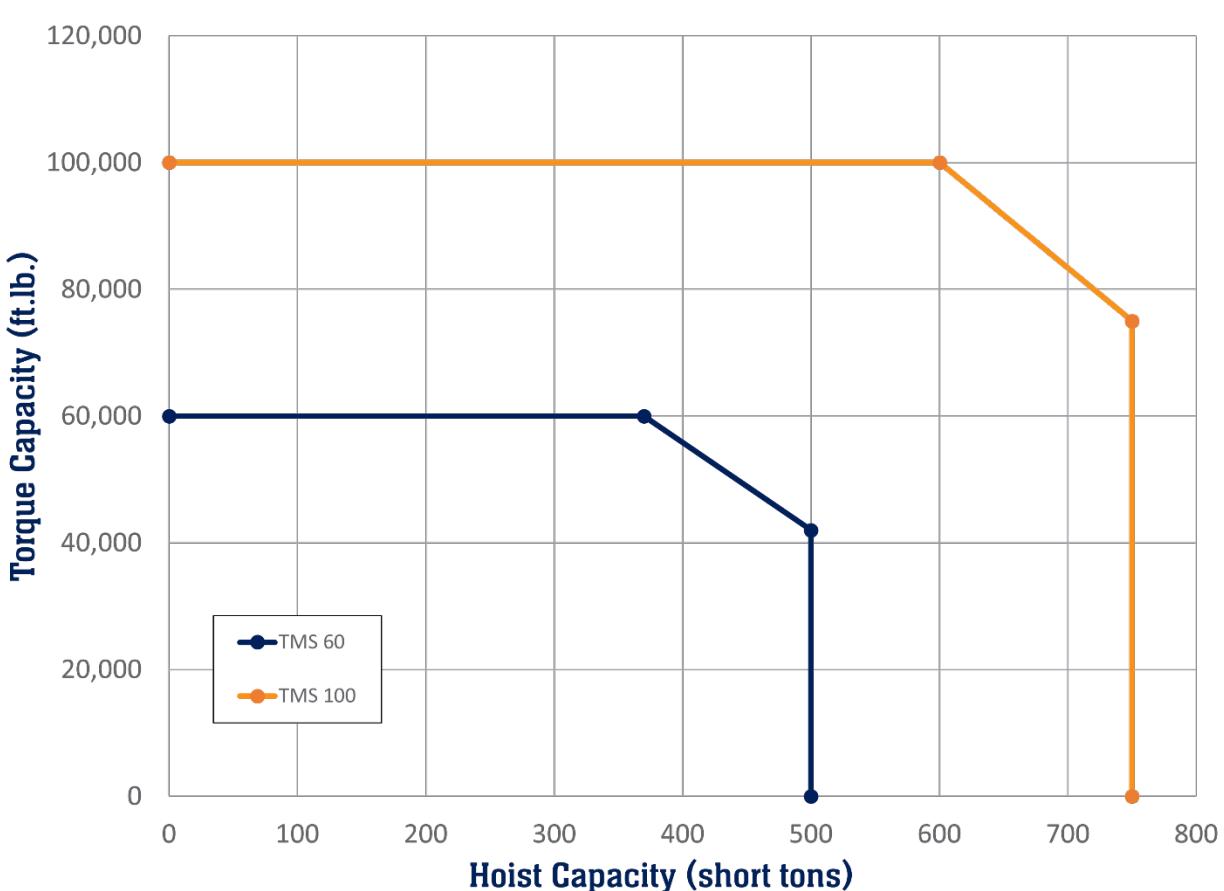


Figure 2-6: TMS Combined Load Rating at Standard Operating Pressure Limit

 **WARNING**

Figure 2-6 does not include the fatigue load limits for the TMS joint connections. Limits of the rotary pin connections will depend on the geometry and material properties of the specific connections to be made up with the tool joints. Refer to API Specification 8C for limits of rotary shoulder connections subject to hoisting loads.



 **WARNING**

The TMS tool is designed to operate within a combined hoist, torque, and pressure load envelope (as per Figure 2-6, which plots hoist and torque capacities at the Standard Operating Pressure Limit of 5,000 psi). While it is understood that rig conditions can result in bending loads being applied to the tool (intentionally or unintentionally), the resulting bending stresses are not accounted for in the combined load envelope.

It is especially critical to avoid bending loads when operating near the limits of the combined load envelope as this can result in tool damage, including damage to the instrumentation and loss of calibration.

 **WARNING**

When torque and pressure loads are applied to the TMS, there is an effect on the error in hook load measurements. This effect is relatively minor. However, this may result in readings outside of the stated hook load accuracy, and Volant advises caution in these instances.

 **WARNING**

Cyclic hoist and torque loads experienced during casing drilling operations may require reducing the TMS capacity in order to maintain the 20-year fatigue life. Contact Volant Customer Support at support@volantproducts.ca for TMS and casing capacity considerations when casing drilling.



3 Setup and Battery Packs Service

3.1 Pre-Job Checks

3.1.1 Pre-Ship Checks

Before shipping a TMS, ensure that:

- A Category 2 inspection was performed as detailed in Section 8.4.2. This includes:
 - Verifying that the **Battery Packs** are freshly charged (though not installed). See Section 3.4.1.
 - Active, valid proof of TMS system calibration is available.
- **Battery Covers** are both tethered to the TMS tool with a **Tether Cable**.
- Critical spares and tooling are available. See Section 3.2.

3.1.2 On-Site Checks

Before beginning a job with the TMS, ensure that:

- Damage was not incurred during transit.
- Thread protectors are removed.
- A Category 2 inspection was performed as detailed in Section 8.4.2. This includes:
 - Verifying that the Battery Packs are freshly charged and installed. See Section 3.4.1.
 - Active, valid proof of TMS system calibration is available.
- Battery Covers are both tethered to the TMS tool with a Tether Cable, and the Tether Cable is free of damage.
- All of the **Enclosure**'s SHCS and all of the Battery Covers' **Locking Lugs** are tightly fastened.
- All 4x **Retaining Rings** are installed on the 2x Battery Covers to retain their Locking Lugs.
- **Base Station** is available and rated for the operating conditions.
- Latest version of the TMS Translator software is installed on a computer available for use at the rig.
- TMS powers on and connects to the Base Station and TMS Translator software successfully. See Section 3.5.
- Hoist and torque capacities determined according to Section 2.4.5 and the **Name Plates** are greater than the maximum anticipated hoist and torque.
- Casing string top connection type is confirmed as compatible with this TMS tool's pin tool joint.
- Top-drive connection types are confirmed as compatible with this TMS tool's box tool joint.
- **Antenna Guards** and **Power Switch Cover** are securely installed.
- **Antenna Guards** and **Breather** are wiped clean of obstructions. See Figure 1-1.



3.2 Critical Spares and Required Tools

Send critical spares and required tools to site with the TMS:

Table 3-1: Critical Spares

Description	Qty	Description	Qty
Battery Pack	2	Locking Lug	4
Battery Cover	2	Tether Cable	2
238 Nitrile O-Ring	2	0.512" Internal Spiral Retaining Ring	4

NOTE Refer to the Bill of Materials, found in the Data Book, for part numbers.

NOTE Item quantities depend on specific situations. Contact Volant® Customer Support at support@volantproducts.ca for further information.

Table 3-2: Tool Assembly Equipment and Hand Tools

Description	Qty	Description	Qty
Tool Lift Nubbin	1	Dual Battery Charger	1
AC/DC Adaptor	1	Input Power Cord	1
Overhead crane: 1/2 short ton capacity	1	9/16" ASME B18.3 Hex Socket Gauge	1
Assembly Stump	1	Nylon web slings: 1/2 short ton capacity	2
Chain wrench / strap wrench*	1	Flashlight c/w batteries*	1
Pick-up magnet	1	1/4" SAE Allen key	1
Compressed air supply	-	Torque wrench: 50 ft.lb. capacity	1
Rubber tip blow-gun*	1	Ratchet set	1
Wrench extension set	1	Socket drive set	1
Bore gauge	1	O-Ring pick and hook set*	1
Borescope	1	Paint pen*	1
Rags	-	Plastic wrap	-

* Items marked with an asterisk are not required but are recommended to reduce assembly time and labour.

Table 3-3: Assembly Lubricants

Description	Referred to as
Water-resistant NLGI #2 grease with calcium sulfonate thickener and a base oil compatible with Nitrile seals	Grease

NOTE To lubricate O-Rings, first lightly grease them and their grooves, and then lightly reapply grease around the O-Rings after installing them.

NOTE To install an O-Ring on an OD groove, loop a separate, large, expendable O-Ring through it and tug it into the groove, working around the circumference.

NOTE Ensure parts are clean and free of debris prior to installation.



3.2.1 Installing Threaded Fasteners

NOTE Do not use an air or impact driver to install fasteners. Use a calibrated torque wrench and apply the specified installation torque.

3.2.1.1 Torqued Fasteners

To ensure TMS performance and safety all fasteners must be torqued according to the specifications and techniques in this manual's instructions.

- Ensure torque wrench is calibrated and has the appropriate torque range.
- Use a short socket to prevent bending and slippage.
- Apply a slow and constant force when torquing fasteners.
- Minimize friction between the torquing components and other stationary objects.

NOTE Apply grease, as listed in Table 3-3, to all threaded fasteners upon installation. The tolerance for all torque values given is $\pm 10\%$.

3.2.2 Shop Requirements

Working with the TMS requires a proper workspace.

3.2.2.1 **Clean and isolated workspace:** The presence of dirt, sand, and airborne particles must be minimized when working on your TMS. These particles can easily become embedded in the lubricant on tool parts and can cause wear and damage to internal working parts during operation.

3.2.2.2 **Crane or hoist:** Refer to Section 2.4.4 for overall TMS length and weight. Volant recommends a floor-to-hoist clearance of 12 ft. (3.7 m) to service any Volant TMS. Refer to the weight displayed on one of the tool's **Name Plates** to determine the lifting capacity of the crane and any slinging used.

3.3 Hoisting and Handling

To hoist a TMS horizontally, choke equal length slings at both ends of the **Mandrel**. Attach both free ends of the sling to the hoisting equipment.

To hoist a TMS vertically, attach the hoisting equipment to a **Tool Lift Nubbin** screwed into the box tool joint.

DANGER

Verify tool weight does not exceed the capacity of the hoisting equipment. See Section 2.4.4.

WARNING

Ensure Tool Lift Nubbin is fully engaged when installed. Monitor engagement for unintended back-off during hoisting.

DANGER

Other than the Tool Lift Nubbin, do not lift the TMS using lifting hardware connected to its components' threaded holes.



3.4 Battery Packs Service

NOTE Only Volant will assemble the **Enclosure** and install it on the **Mandrel**.

This section will only cover servicing the **TMS Battery Packs**.

3.4.1 Battery Packs Charging

NOTE If the TMS Translator software indicates that a Battery Pack's charge level is below 50%, remove it and recharge it.

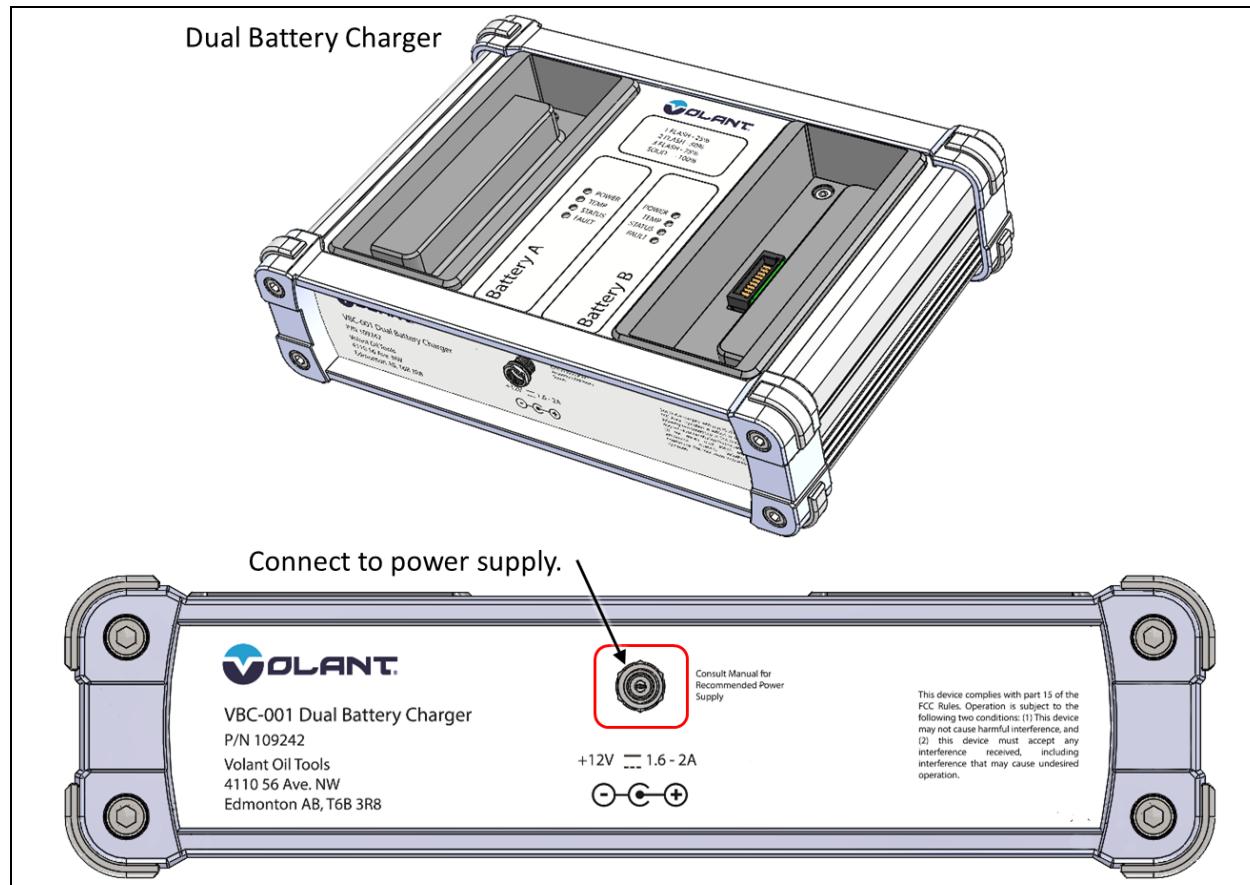
WARNING

Do not charge the Battery Packs in a hazardous location.

Charge them in a non-hazardous area, and within a temperature range of 32°F (0°C) and 104°F (40°C), using only **Dual Battery Charger P/N 109242**.

The Battery Packs **must** be fully charged at least every 60–90 days. Otherwise, their charge life will degrade, and this will affect TMS tool performance.

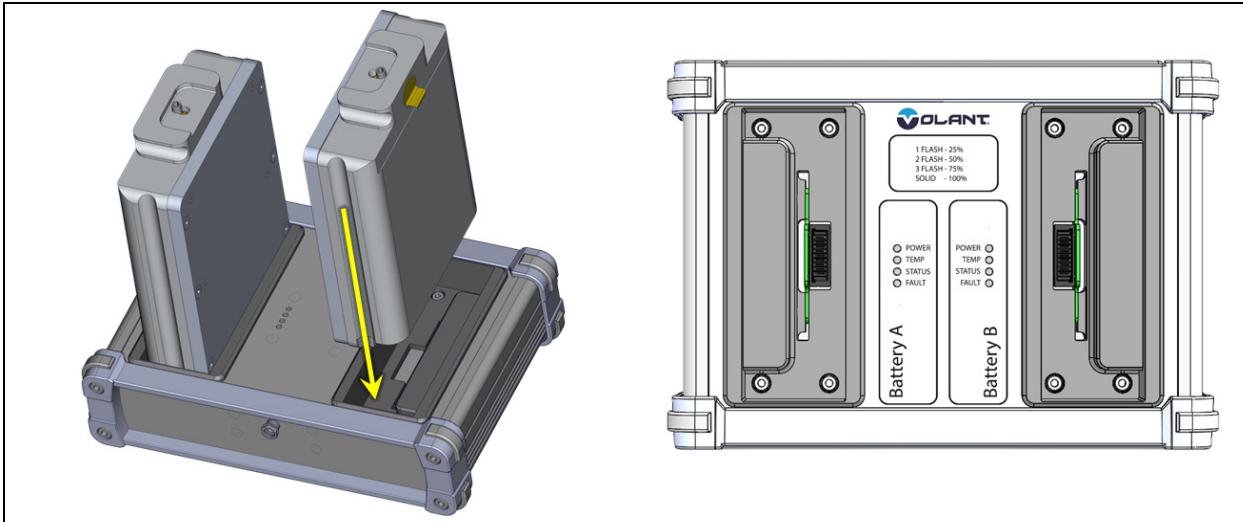
3.4.1.1 Remove the Dual Battery Charger and its power cube from their carrying case. Place the Charger on a flat surface and connect it to a power supply. (See Section 2.2.3.)



3.4.1.2 Remove 2x **Battery Packs** from their carrying case and insert them in the **Dual Battery Charger**.

NOTE The Dual Battery Charger will monitor each Battery Pack's temperature before charging begins to ensure it is in the acceptable temperature range.

3.4.1.3 Verify that the 2x Battery Packs begin to charge. Allow them to fully charge. This can take 12–16 hours, though the Charger's **STATUS** LEDs display each Battery Pack's charge status. See Section 3.4.1.4.



3.4.1.4 **Dual Battery Charger** LED indicators outputs:

1. **POWER**: always on when the device is powered.
2. **TEMP**: the temperature indication:
 - a. If the Battery Pack temperature is outside the safe charge range, this will glow orange.
 - b. The Battery Pack will not charge until the temperature has come within the charge range.
3. **STATUS**:
 - a. This LED indicator's flashing indicates the Battery Pack's charge status:
 - 1 flash: 25% charged
 - 2 flashes: 50% charged
 - 3 flashes: 75% charged
 - Solid: 100% charged
4. **FAULT**: There is something wrong with the Battery Pack or its Charger port.
 - a. Replace the Battery Pack and see if this LED indicator stops turning on. If it does not, it is possible that the Charger needs service. Consult Volant Customer Support at support@volantproducts.ca.

NOTE On power-up, **ALL** LED indicators will turn on for 1 second. If some indicators do not turn on then, the Charger needs service (which Volant should perform).

3.4.2 Battery Packs Removal and Reinstallation (Ref. Dwg. #s 108890, 108891)

The Data Book provides an assembly drawing, complete with a Bill of Materials (BOM). Part names in this section of the manual correspond to those in that drawing and BOM.

NOTE Orient and secure the TMS tool in the **Assembly Stump** as shown in Figure 3-1, though this work may also be done with the TMS tool rigged into the top-drive. Note the instructions and capacities marked on the Assembly Stump.

The software distinguishes **Battery Pack A** and **B**. Battery Pack A is on the left side of the **Name Plates** and Battery Pack B is on the right side of them.

 **WARNING**

Volant recommends that all persons who will perform this disassembly and assembly work first complete the Volant training program. For more information about the training program contact Volant Customer Support at support@volantproducts.ca.

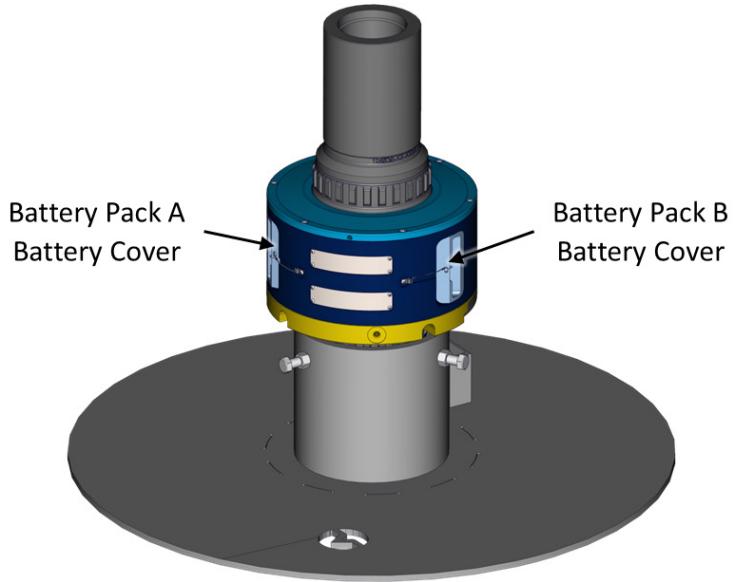


Figure 3-1: TMS Tool in Assembly Stump; Battery Designations

3.4.2.1 Battery Pack Removal

3.4.2.1.1 Wipe down the TMS tool in the area around the **Battery Cover** to prevent contaminants entering.

 **WARNING**

If the TMS tool is still rigged into the top-drive:

- Do not clean the TMS tool when in a hazardous location.
- Discharge any human body charge before opening the Battery Covers or removing the Battery Packs.
- Do not touch the TMS tool with a statically charged object such as plastic materials or tools.

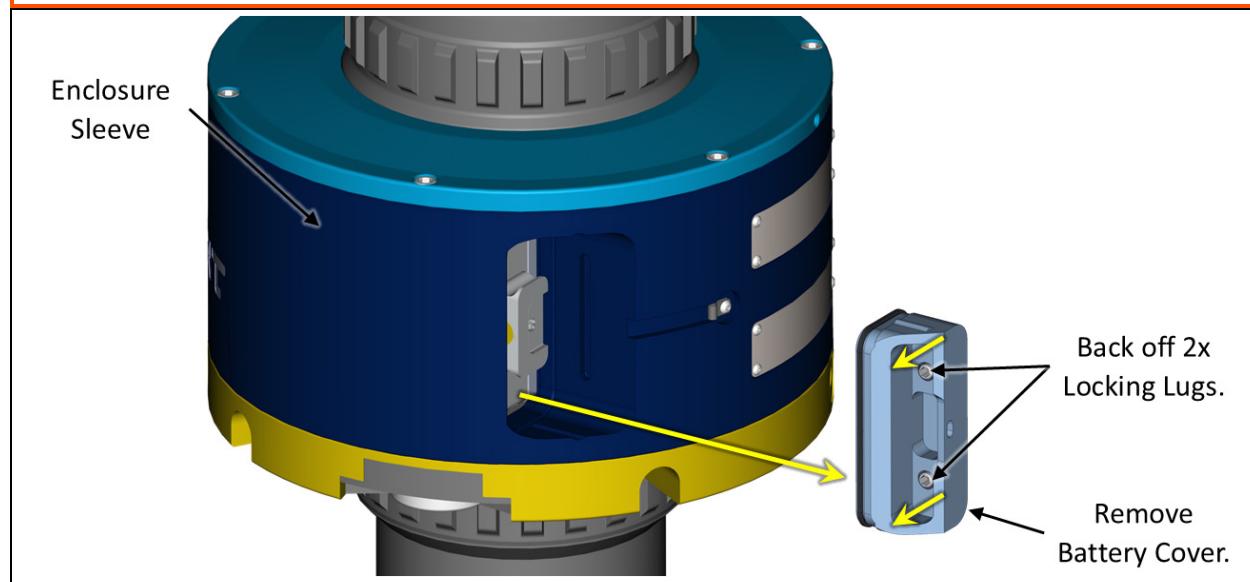
3.4.2.1.2 Back off the 2x **Locking Lugs** (using a $\frac{1}{4}$ " SAE Allen key) and remove the Battery Cover from the slot for a Battery Pack on the **Enclosure Sleeve**.

NOTE Each Battery Cover is pre-fastened to the TMS tool using a **Tether Cable**, which ensures the Cover stays paired with the tool. Several of these assembly images hide the Tether Cables for simplicity.

 **WARNING**

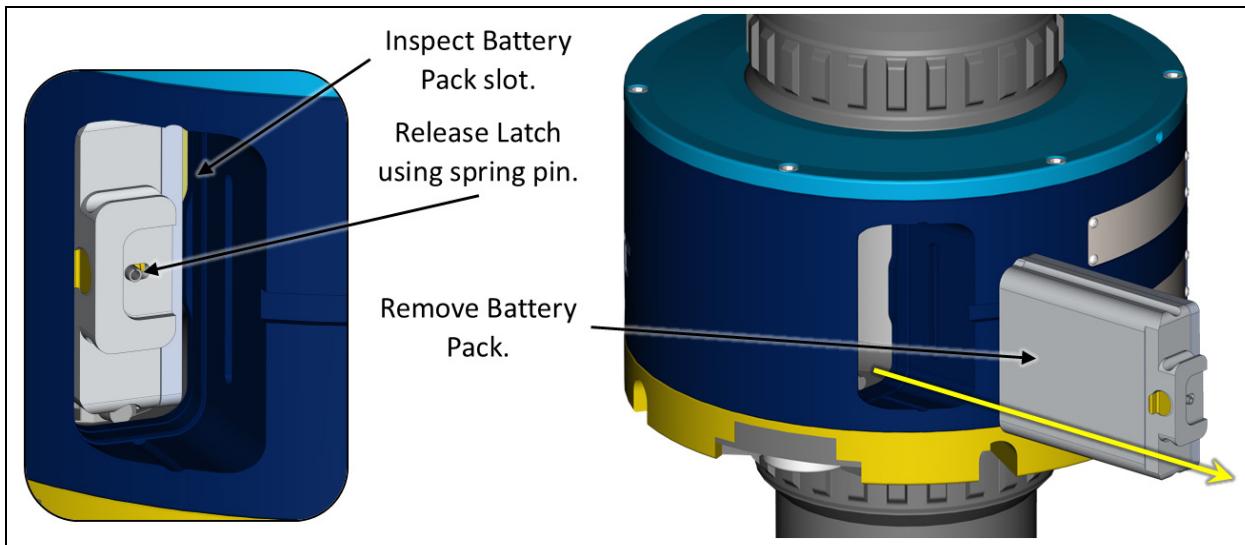
Wear appropriate gloves when removing the Battery Cover to protect against sharp edges.

Some force may be required to overcome the Battery Cover's O-Ring.



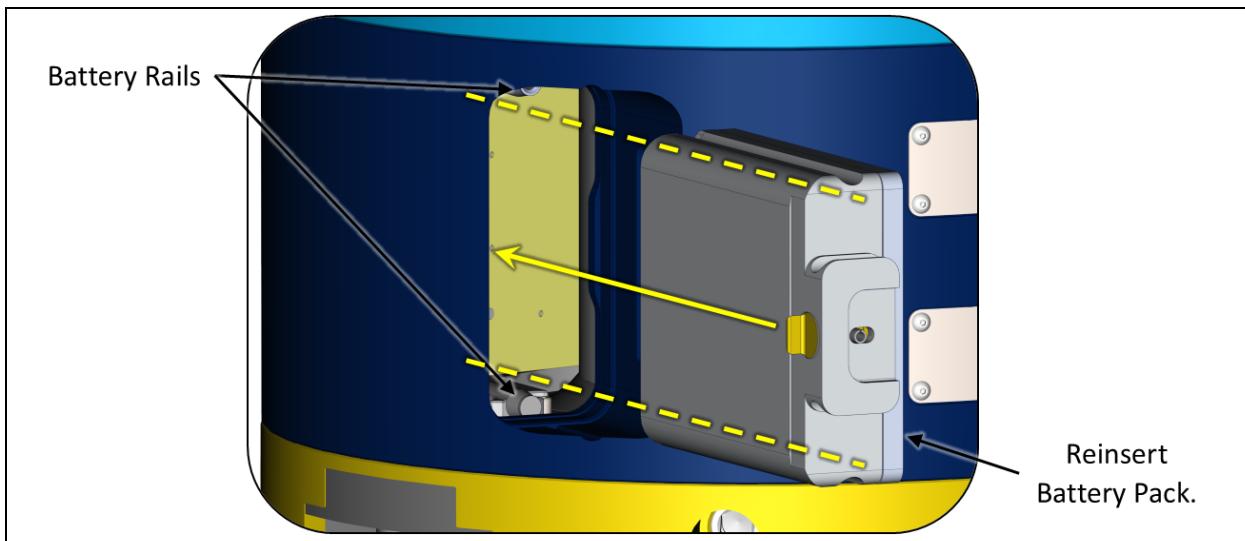
3.4.2.1.3 Visually inspect the **Battery Pack** slot on the **Enclosure Sleeve** for debris. Clean if necessary.

3.4.2.1.4 Depress the Battery Pack's integral spring pin to release its latch, and then gently guide it out of the **Enclosure**.

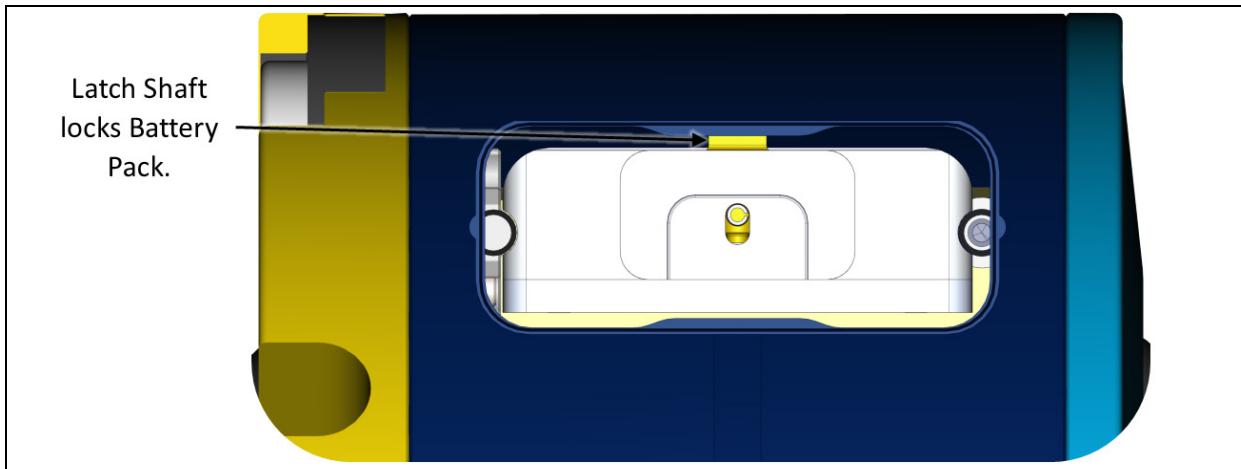


3.4.2.2 Battery Pack Reinstallation

3.4.2.2.1 Fit a fully charged Battery Pack into the open Enclosure Sleeve slot in the noted orientation, guiding it onto the 2x **Battery Rails** in that slot.



3.4.2.2.2 Gently push the **Battery Pack** the remaining distance into the **Enclosure** until the Battery Pack's **Latch Shaft** automatically locks the Battery Pack in place.

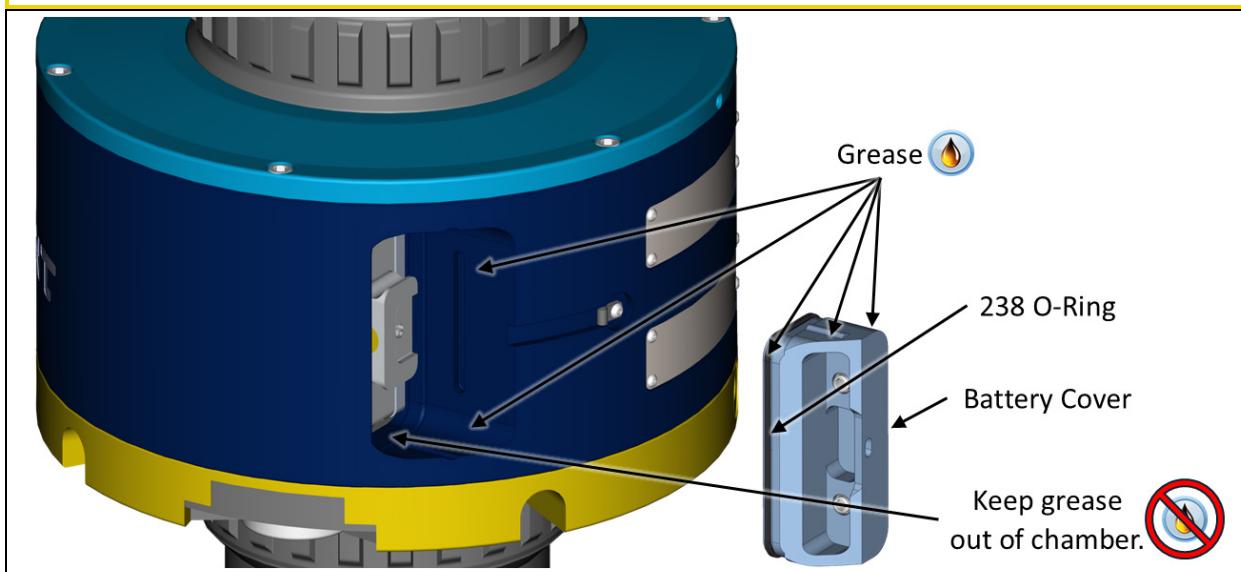


3.4.2.2.3 Inspect the **Battery Cover's 238 Nitrile O-Ring** for wear and cracks, and replace it if any are found. Regrease the installed O-Ring and wipe away excess grease.

3.4.2.2.4 Grease the mating surfaces between the Battery Cover and the Battery Pack slot opening.

 **CAUTION**

Keep grease out of the Battery Pack chamber; do not allow grease to pass the O-Ring groove. Grease can damage the Enclosure's interior components, harming tool function.



NOTE Images will now show the **Battery Cover's** fastening **Tether Cable**, which the Battery Cover should always remain fastened to.

3.4.2.2.5 Fit the Battery Cover onto the **Battery Pack** slot opening. Re-torque the 2x **Locking Lugs** to **15 ft.lb.**

 **WARNING**

Be aware of pinch points between the Battery Cover and the **Enclosure Sleeve**.

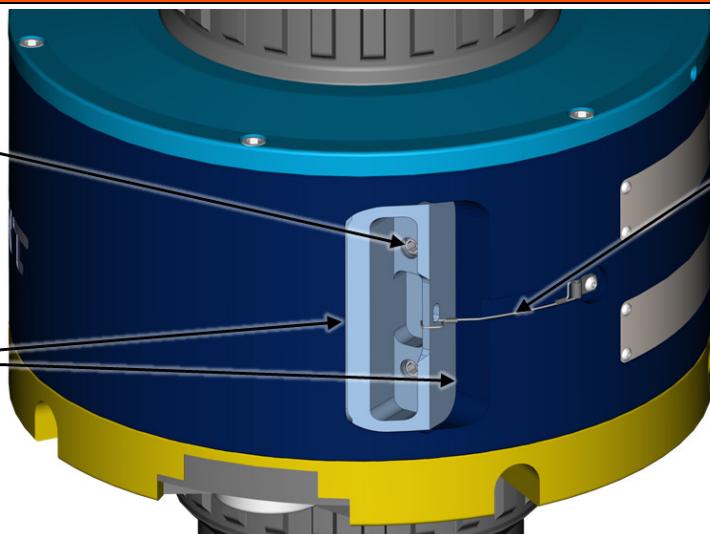
 **WARNING**

If the Locking Lugs are under-torqued, fluids could leak into and severely damage the **Enclosure**.

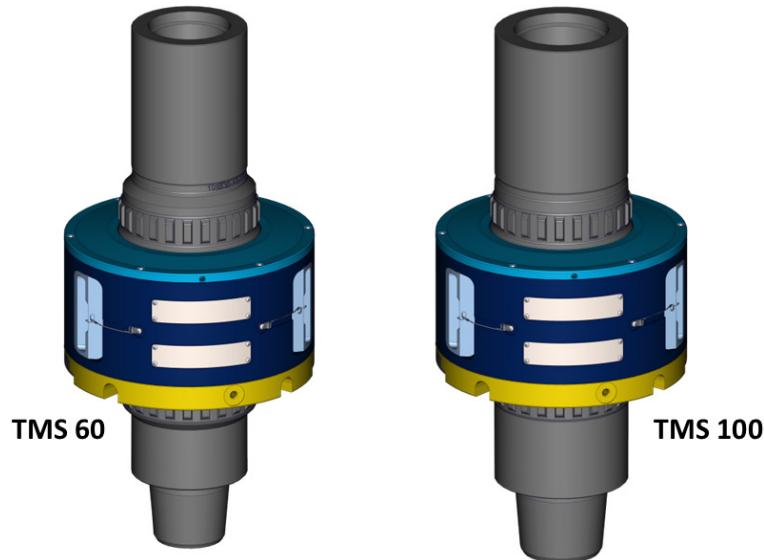
Re-torque 2x Locking Lugs.
15 ft.lb.

 Pinch hazards

Tether Cable



3.4.2.2.6 Battery Pack reinstallation for the TMS tool is complete.



3.5 Connection Verifications

Verify the components of the TMS System can connect their data signals to each other.

3.5.1 Prepare Base Station

1. Remove the **Base Station** and its antenna from their carrying case.
2. Remove the dust caps from the Base Station's antenna and physical connection ports.
3. Install the antenna on the Base Station.
4. Place the Base Station where the antenna has line of sight to the rig's top-drive.
5. Connect the Base Station's cable to the computer that has the TMS Translator software installed. The Base Station's physical connection port varies between models.

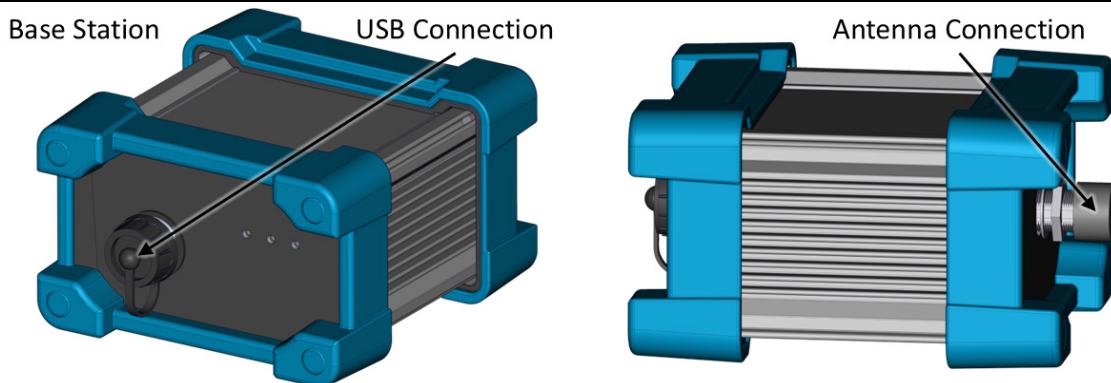
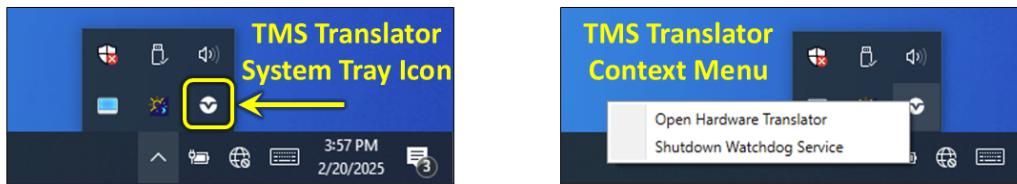


Figure 3-2: General Purpose, USB-Connection Base Station

3.5.2 Start up TMS Translator Software

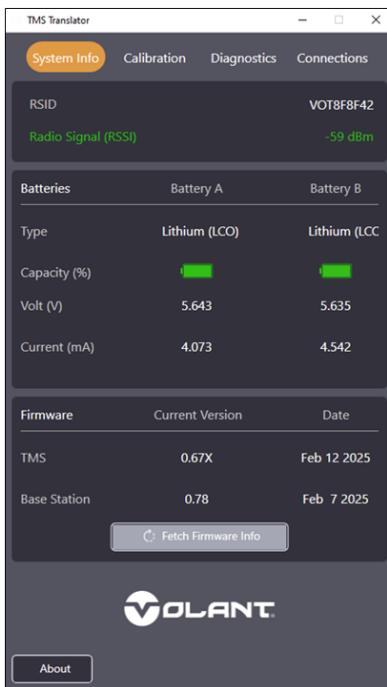
Consult the product manual P/N **109908** for the TMS Translator software for refined details on how the software works.

1. Power up the computer that has the TMS Translator software installed. This software will start automatically, and its icon (the Volant logo) will appear in the Windows system tray.
2. Open the TMS Translator: Either left-click on the Volant icon or right-click and select “**Open Hardware Translator.**”





3. Select the “System Info” tab.



3.5.3 Power Up TMS Tool

1. Remove the **Power Switch Cover** using a **9/16" ASME B18.3 Hex Socket Gauge**.
2. Press the **Power Switch** to activate the TMS tool. Replace and tighten the Cover.
3. Verify that the software is receiving an RSID code from the **Base Station** and that the Base Station is measuring a strong RSSI signal from the TMS tool. This wireless connection can take 2–10 seconds to create. See Section 5 for further details on operating the software.

The RSSI strength value will change colour based on signal strength: green is good, yellow is acceptable, and red is considered a weak signal. If the software indicates a weak signal strength, relocate the Base Station and reposition its antenna until the signal strength increases.

4. Verify the **Battery Packs** installed in the TMS tool are at full capacity.

NOTE This successful wireless connection indicates that the Base Station is receiving power from the computer through the cable and that the computer can communicate with the TMS tool. After establishing these connections, the user has no physical interaction with the Base Station during operations.

NOTE Keep metal objects out of the Base Station’s line of sight to the TMS tool, as they can interfere with the RSSI signal.

WARNING

Keep hands out of the Base Station’s line of sight to the TMS tool, as this can expose the hands to microwave radiation and interfere with the RSSI signal.



4 TMS Tool Hardware Operations

4.1 General Safety

WARNING

Always follow your company's safe operating procedures specific to your equipment and operations.

- Hoist and torque capacities decrease when the TMS is loaded simultaneously in hoist and torque. Refer to Section 2.6.1 if the TMS is loaded in this way.
- The operator and essential personnel **must** be located a safe distance from the hole during the TMS's operation and running; they must **only** be on the rig floor if they need to manipulate or configure the TMS.
- Ensuring top-drive and rotary table alignment minimizes inducing side-load and bending moments, and this aids in TMS rig-in, improves casing connection make-up accuracy, and reduces the risk of damaging the TMS.
- Keep hands out of the **Base Station**'s line of sight to the TMS tool, as this can expose the hands to microwave radiation and interfere with the RSSI signal.
- Isolate power source prior to performing minor maintenance such as changing Battery Packs.
- Never leave the TMS unattended while engaged in casing, in case of rig malfunction.
- Use caution if deciding to override the Top-drive Floor Saver.

4.2 Operational Maintenance

Do **NOT** perform maintenance with the TMS connected to the top-drive.

DANGER

However, Volant® recognizes the need to change the **Battery Packs** and clean the **Antenna Guards** while the TMS tool is connected to the top-drive. In this case, isolate top-drive before performing maintenance. However, due to static electricity concerns, do not clean the tool in this scenario, always discharge human body charge, and do not touch the tool with a statically charged object.

NOTE Refer to Section 3.4.2.1 for Battery Pack removal instructions.

WARNING

Volant recommends that all technicians who will maintain the TMS tool first complete the Volant training program. For more information about the training program, contact Volant Customer Support at support@volantproducts.ca.

CAUTION

Be aware of the potential for fasteners or tools falling downhole while performing maintenance.



4.3 Set Up the TMS Tool

Before rig operations, perform all the setup steps of Sections 3.4 and 3.5 to ensure the **Battery Packs** are charged and installed and the TMS tool can connect to the **Base Station** and TMS Translator software.

4.4 Basic Operation

The TMS's operation involves the following steps:

1. **Rig in** the tool to the tool joint connections on the top-drive quill (using crossovers, saver subs, or other adaptors as needed) and the casing string.
2. **Connect** to the TMS Translator software.
3. Transmit data to the software during **Operation**.
4. **Rig out** the tool from the tool joint connection on the top-drive quill and from the casing string.

4.5 Rigging In

1. Hoist TMS to rig floor. See Section 3.3, Hoisting and Handling.
2. Place on TMS stump or grip tool **Mandrel** with iron roughneck.
3. Present tool joint box to top-drive quill, ensuring thread axis alignment, and make up the upper tool joint connection to the required torque. See Section 2.5.
4. Lower top-drive and stab TMS tool into casing string below, ensuring thread axis alignment, and make up the lower tool joint connection to the required torque. See Section 2.5.
5. Mark the alignment of each connection after it has been made up to the required torque.

DANGER

To prevent unanticipated tool joint back-off, make up TMS tool joint connections according to Section 2.5. In some cases, the recommended make-up torques in Section 2.5 may not be achievable due to limits of the drilling rig. In **no** case should the make-up torque be less than 1.25 times the maximum anticipated operational torque (usually the maximum make-up torque of the casing connection) or the minimum make-up torque specified in API Recommended Practice 7G.

Tool joint back-off can cause dropped equipment, leading to serious injury, death, or major equipment damage. It can also make drilling fluid leak, creating slip and environmental hazards.

Regularly inspect tool joint threads as detailed in Sections 8.4.2.6 and 8.4.4.2.1.

 **DANGER**

Mark and monitor tool joints for back-off throughout operation. If the grabber box covers the crossover or TMS tool joint connection, verify make-up torques regularly and re-torque the connection if applying break-out torque equal to or greater than the tool joint torque.

Consider using a Volant V-LOK® tool joint lock to mitigate the risk of tool joint back-off. If tool joint make-up torque needs to be verified or re-applied this should be done only when the tool is at floor level.

 **CAUTION**

Only grip the TMS on the **Mandrel** top OD surface. Do **not** grip by the **Enclosure**, Mandrel calibration splines, or Mandrel lower OD surface.

 **WARNING**

Be aware of pinch points between the tool and top-drive.

4.6 Connect to TMS Translator Software

1. Lower TMS to rig floor. Remove the **Power Switch Cover** using a **9/16" ASME B18.3 Hex Socket Gauge**.
2. Press the **Power Switch** to activate the TMS tool.
3. Verify that the software is receiving an RSID code from the **Base Station** and that the Base Station is measuring a strong RSSI signal from the TMS tool. This wireless connection can take 2–10 seconds to create. See Section 5 for further details on operating the software.

The RSSI strength value will change colour based on signal strength: green is good, yellow is acceptable, and red is considered a weak signal. If the software indicates a weak signal strength, relocate the Base Station and reposition its antenna until the signal strength increases.

4. Replace the Power Switch Cover and tighten it **wrench-tight** with the Hex Socket.
5. Perform a Shunt Calibration. See Section 5.2.2.3.

NOTE Keep metal objects out of the Base Station's line of sight to the TMS tool, as they can interfere with the RSSI signal.

 **WARNING**

Keep hands out of the Base Station's line of sight to the TMS tool, as this can expose the hands to microwave radiation and interfere with the RSSI signal.



4.7 TMS Tool Operation

During rig operation the TMS tool works with the **Base Station** and the TMS Translator software to collect torque, turns, rotational speed, and hook load data in real-time. See Section 5 for details on operating the TMS Translator software during rig operations.

Besides activating the TMS tool, no other physical interaction with it or the Base Station is required during operation. However, performing a Shunt Calibration regularly during operation is a good practice. See Section 5.2.2.3.

4.8 Rigging Out

DANGER

Before releasing tool, make sure pumps are turned off and pressure has been bled down.

NOTE Ensure sufficient axial travel is available to allow pins to advance out of boxes.

1. Lower TMS to rig floor. Remove the **Power Switch Cover** using a **9/16" ASME B18.3 Hex Socket Gauge**.
2. Press the **Power Switch** to deactivate the TMS.
3. Replace the Power Switch Cover and tighten it **wrench-tight** with the Hex Socket.
4. Apply break-out torque and back out the TMS tool from the casing string.
5. Install thread protectors, as needed, onto the bottom of the tool.
6. Set the tool in the rig floor.
7. Grip the tool **Mandrel** top OD surface and break out the tool joint connection.
8. Slowly pull up and remove top-drive from tool.
9. Install **Tool Lift Nubbin** into tool joint and remove tool from stump. See Section 3.3, Hoisting and Handling.

NOTE Use appropriate tag line to control tool during overhead lifting.



4.9 Stowing TMS Tool and Accessories

After the TMS tool is rigged out, stow it and its accessories safely in a non-hazardous area. See Section 9.1.1, Transportation Measures.

1. Wipe down the TMS tool exterior surfaces.
2. Remove both the **Battery Covers** and **Battery Packs** and reinstall the Battery Covers. See Section 3.4.2.
3. Install thread protectors on both tool joints.
4. Gently lay down and then strap down the tool on a sturdy base.
5. Unplug the **Base Station** and remove its antenna.
6. Unplug the **Dual Battery Charger**'s power cube and remove the cube from the Charger.
7. Place each of the following sets in its carrying case:
 - a. the Battery Packs
 - b. the Base Station, its antenna, and its cable
 - c. the Dual Battery Charger and its power cube
8. Stow and secure all these carrying cases with the TMS tool.



4.10 Cold Weather Considerations

When operating a Volant TMS in cold weather take the following precautions:

- As soon as possible and with the TMS tool rigged out in a non-hazardous location, wipe down the **Enclosure** exterior surfaces and **Antenna Guards** following contact with drilling fluids to prevent freeze-up or build-up on the seals.

 **WARNING**

Steaming through the bore of the TMS is permitted where there is no risk of an explosive atmosphere. Hot surfaces pose a risk in explosive atmospheres.

Steam only through the bore of the **Mandrel**. Never steam the Enclosure as this can severely damage its interior components, harming tool function.

Only steam when the TMS is operating so that you can monitor the temperature using the TMS Translator software.

Ensure the TMS stays below 140°F (60°C).

Do not overheat since this may damage seals.

NOTE If circulating through TMS, pump drilling fluids frequently to prevent top-drive/TMS bore from freezing.

 **CAUTION**

For operating temperatures below -4°F (-20°C) ensure all Primary Load-carrying Components' (the Mandrel) markings display "SR2" and a minimum test-temperature lower than their expected operating temperature.

5 TMS Translator Software Operations

This section provides instructions for using the TMS Translator software during rig operations. Consult the product manual P/N **109908** for the TMS Translator software for refined details on how the software works.

5.1 Starting Up Software

When the TMS Translator is installed, it is added to the Windows “Startup” list and will thus start automatically when Windows starts.

1. Power up the computer that has the TMS Translator software installed. This software’s icon (the Volant® logo) will appear in the Windows system tray.
2. Open the TMS Translator: Either left-click on the Volant icon or right-click and select “Open Hardware Translator.”



NOTE Selecting “Shutdown Watchdog Service” deactivates a software monitoring service that keeps the TMS Translator in operation. If there is a serious issue with the software and it ends execution, this Watchdog Service will restart it.

For debugging purposes, if the TMS Translator software needs to be shut down, the Watchdog Service will need to be shut down to allow this.

5.2 Software Navigation (Tabs)

The TMS Translator software user interface consists of four main tabs. Each of these tabs provides information and actions (if present) based on its title label:

1. **System Info:** Information about the connected TMS tool
2. **Calibration:** Calibration status of the connected TMS tool and ability to perform a “shunt” calibration on the connected TMS tool
3. **Diagnostics:** Tool status with warnings and errors for inspection and the ability to “zero” the TMS tool
4. **Connections:** Status and configuration of TMS tool wireless link and software communication port and data mode



5.2.1 System Info Tab

The System Info tab displays general system summary information and is divided into three sections.

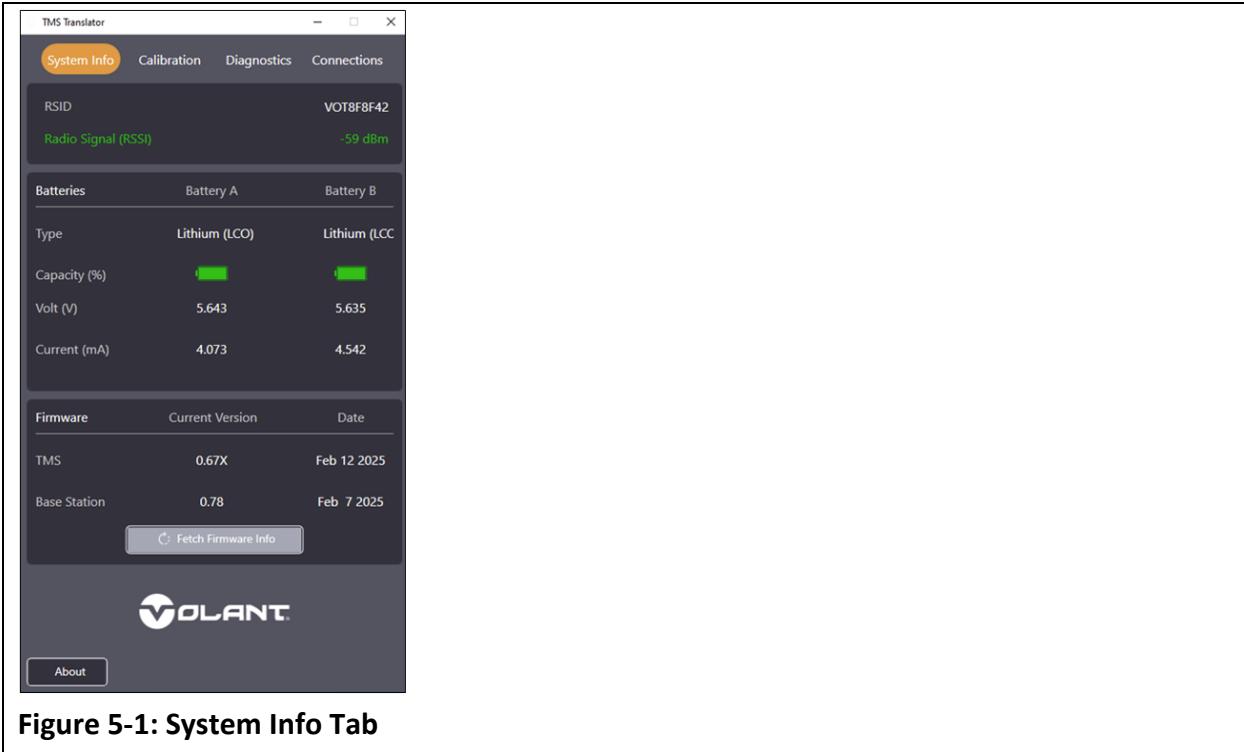


Figure 5-1: System Info Tab

5.2.1.1 The top section displays:

- the RSID (Reed-Solomon Identification) that the **Base Station** is generating for TMS tool communication
- the measured RSSI (Received Signal Strength Indicator) value

5.2.1.2 The middle section displays information about the two **Battery Packs** installed in the connected TMS tool. For both Battery Pack A and Battery Pack B, the software displays:

- battery chemistry
- calculated battery capacity
- measured voltage
- measured current draw

5.2.1.3 The lower section displays the firmware version and date for the detected TMS tool and Base Station.



5.2.2 Calibration Tab

The Calibration tab displays information about system calibration and verification for the connected TMS tool and is divided into three sections.

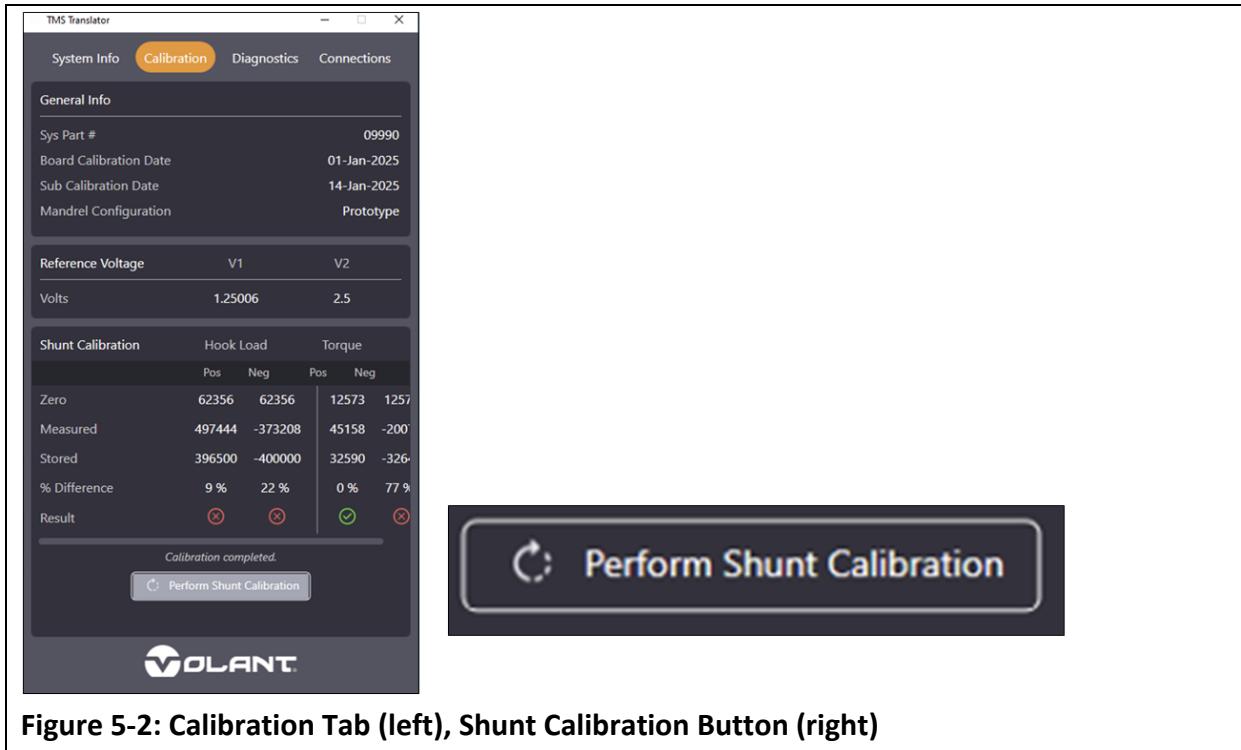


Figure 5-2: Calibration Tab (left), Shunt Calibration Button (right)

5.2.2.1 The top section, “**General Info**,” displays system part numbers and calibration:

Sys Part #: Serial number of the internal electronics

Board Calibration Date: Date the internal electronics were calibrated

Sub Calibration Date: Date the TMS tool was calibrated

Mandrel Configuration: Type (size) of TMS tool

5.2.2.2 The middle section displays the measured Reference Voltages that the TMS system uses during data collection.

5.2.2.3 The lower section has a button for performing a “**Shunt Calibration**” and displays all the results of a Shunt Calibration performed on the TMS tool’s measurement system as well as if the shunt calibration results are within acceptable limits.

NOTE A Shunt Calibration zeroes out any small shifts in the gauges that occur over time and temperature. Perform one before every job and regularly during jobs.

WARNING

Pause operation of the TMS Tool while performing a Shunt Calibration.

Any reading collected while a Shunt Calibration is in progress will have no meaning.



5.2.3 Diagnostics Tab

The Diagnostics tab displays information about the “**Error/Status**” register of the connected TMS tool. This is used for troubleshooting the TMS tool. The Diagnostic Tab is divided into three sections.

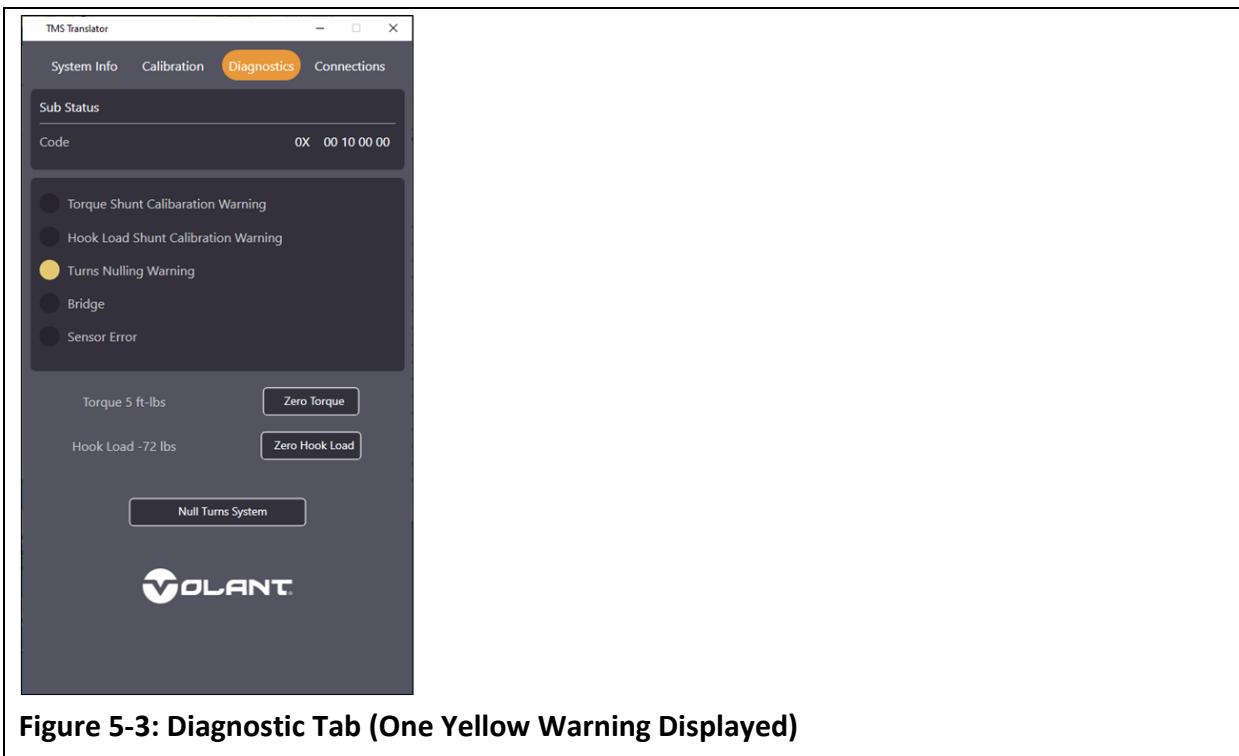


Figure 5-3: Diagnostic Tab (One Yellow Warning Displayed)

5.2.3.1 The top section, “**Sub Status**,” displays the “**Error/Warning**” register from the connected TMS tool and a brief message based on what is returned.

NOTE Refer to the TMS Translator software’s product manual, P/N **109908**, for a detailed description of the error register definition.

5.2.3.2 The middle section displays the operational status of three possible warnings and two possible errors.

DANGER

If any of these displays a warning by turning yellow, Volant recommends stopping operation of the TMS tool and addressing this warning.

If any displays an error by turning red, TMS tool operation **must** stop so the warning can be addressed.



5.2.3.3 The lower section consists of three buttons used to perform operational support functions:

- Zero Torque
- Zero Hook Load
- Null Turns System

The resting values of torque and hook load can shift over time. This can be due to:

- Temperature variation
- Small changes in the measurement circuit over time
- “Bucked” TMS tool connections, which can induce a repeatable shift in hook load of up to 50,000 lb.

To compensate for these shifts, press the “Zero Torque” and “Zero Hook Load” buttons to remove these offset shifts from the torque and hook load.

CAUTION

Set the TMS tool in a neutral load position **before** pressing these buttons. They send commands to the TMS tool that generate new offset values for these measurements.

These changes in offset values should change the values to the left of the buttons accordingly.

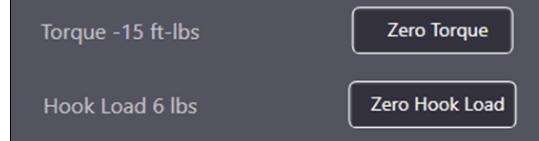


Figure 5-4: Zero Torque and Zero Hook Load Buttons, and Torque and Hook Load Values

Clicking the “Null Turns System” button resets the offset used with the gyroscope data to prevent drifting in the turns calculation. If phantom turns are occurring, press this button to correct this.

CAUTION

After clicking the “Null Turns System” button, ensure you keep the TMS tool stationary for 30 seconds. The “Null Turns System Clicked” dialogue box will activate to remind you of this.

This 30 second delay ensures that the tool zeroes its turns calculations properly. Moving the tool during this period can invalidate the turns data and the entire operation.

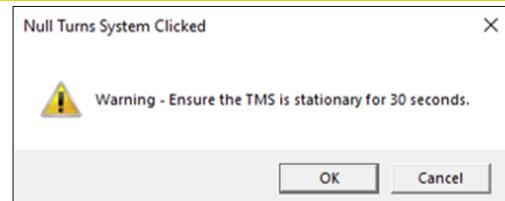


Figure 5-5: Null Turns System Clicked Dialogue Box



5.2.4 Connections Tab

The Connections tab displays information about the wireless data link between the Base Station and the connected TMS tool. It provides the ability to define the RSID for TMS tool communication and displays the protocol mode the TMS Translator software has been configured for along with the port the connection is using.

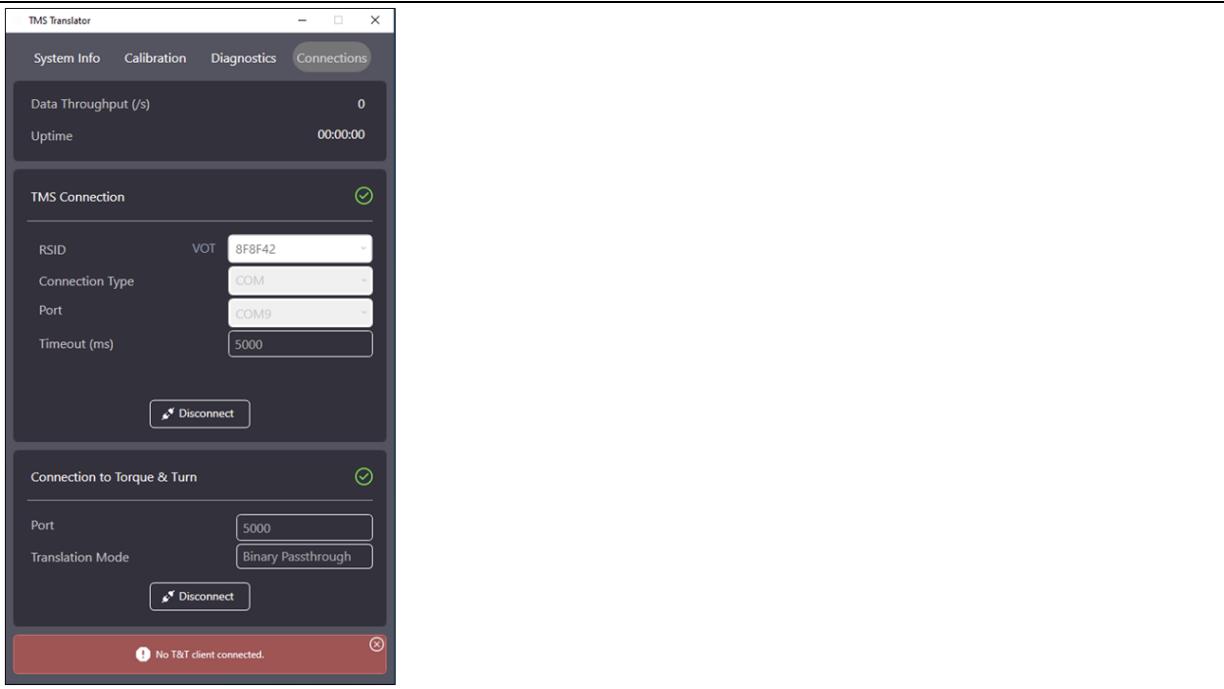


Figure 5-6: Connections Tab

5.2.4.1 The “**Disconnect**” button is for the connection to the 3rd party torque monitoring software. It is mainly for testing purposes.

 **CAUTION**

Pressing the “**Disconnect**” button will stop sending data to the 3rd party torque monitoring software. Proceed with caution if operating in this state.



6 Emergency Operations

Volant® TMS tools are operated with drilling rigs equipped with top-drives. It is the drilling company's responsibility to establish appropriate well controls, top-drive controls, emergency stop devices, and emergency response procedures.

It is the drilling company's responsibility to monitor calibrated loads during operations. If the TMS malfunctions, is overloaded, or is suspected of damage:

1. Support loads by another means and remove all loads from the TMS, including loads due to pressure within the casing.
2. Remove the TMS from service.
3. Contact Volant Customer Support at support@volantproducts.ca for assistance.

NOTE Refer to Section 10, Troubleshooting, if the tool sends dubious data signals or fails to send data signals at all.

DANGER

When removing the TMS tool from the drill string there is a risk of fluid spraying from the string. Before releasing TMS, ensure that no components below it in the drill string contain fluid pressure.

7 Start-up After Emergency

Before resuming operation after an emergency, verify all tool joints in the load train connecting the TMS to the top-drive are properly made up. See Section 4.5, Rigging In.

WARNING

In the event of a well control incident, damage to the TMS may result. If damage to any component is suspected, remove the TMS from service and contact Volant® Customer Support at support@volantproducts.ca for assistance.

8 TMS Maintenance

DANGER

Owners of the TMS tool are **only** intended to perform the maintenance detailed in this section. The **only** disassembly this involves is that of the **Battery Covers** and **Battery Packs**; there are **no** other user repairable or serviceable parts on the TMS tool or its accessories.

All other repairs and services **must** be performed by a trained Volant® technician.

- NOTE** Review the disassembly and assembly sections of this manual (Section 3.4.2) prior to performing maintenance on the TMS.
- NOTE** Consult Volant Customer Support at support@volantproducts.ca before using non-OEM (original equipment manufacturer) replacement parts.
- NOTE** Orient and secure the TMS in the **Assembly Stump** as shown in Figure 8-1 to perform maintenance on the TMS. Note the instructions and capacities marked on the Assembly Stump.

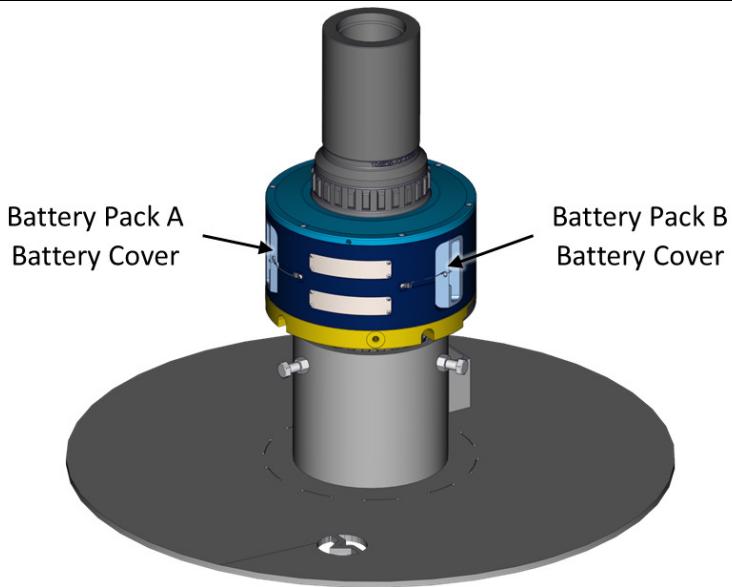


Figure 8-1: TMS Tool in Assembly Stump; Battery Designations

DANGER

Do **NOT** perform maintenance with the TMS tool connected to the top-drive, except for minor maintenance such as changing the Battery Packs and cleaning the **Antenna Guards**. In this case, isolate top-drive before performing maintenance.

However, due to static electricity concerns, do not clean the tool in this scenario, always discharge human body charge, and do not touch the tool with a statically charged object.



WARNING

Volant recommends that all technicians who will maintain the TMS tool first complete the Volant training program. For more information about the training program, contact Volant Customer Support at support@volantproducts.ca.

DANGER

Always ensure electrical circuits are de-energized prior to performing maintenance. Only perform maintenance in a non-hazardous environment.

Following the maintenance activity, only reconnect electrical circuits while in a non-hazardous location.

8.1 Maintenance Equipment

Maintaining the TMS requires proper tools, drawings, and documentation. The items needed to maintain your TMS are the same items required to operate it. See Section 3.2. Volant can provide complete maintenance kits.

8.2 Maintenance Environment

Effectively maintaining the TMS requires a proper workspace.

8.2.1 Shop Requirements

8.2.1.1 Clean and isolated workspace: The presence of dirt, sand, and airborne particulates must be minimized when working on your TMS. These particles can easily become embedded in the lubricants on TMS parts and can cause wear and damage to internal working parts during operation.

8.2.1.2 Parts storage: All extra and unused parts should be inventoried, organized, and stored in a dry, secure place.

8.2.1.3 Crane or hoist: Refer to Section 2.4.4 for overall tool weight. Volant recommends a floor-to-hoist clearance of 12 ft. (3.7 m) to service any Volant TMS, though some tools may require less clearance. Refer to the weight displayed on one of the TMS's **Name Plates** to determine the lifting capacity of the crane and any slinging used.

8.3 Maintenance Frequency

Volant recommends the minimum inspection frequencies listed in Table 8-1 below. Although the TMS's operating hours, rather than calendar days, are when it actually accrues the need for maintenance, operating hours are sporadic and not universally defined. Contact Volant Customer Support at support@volantproducts.ca if you would like to refine your maintenance plan to your operation schedule.

Volant developed these frequencies using API RP 8B (Recommended Practice for Procedures for Inspections, Maintenance, Repair, and Remanufacture of Hoisting Equipment) as a guideline in combination with its own risk assessment of critical design and functional features that would benefit from supplementary inspection criteria. Volant's recommendations largely follow the API RP 8B guidelines, though some requirements go above and beyond these guidelines.



Table 8-1: Volant's Recommended Inspection Frequencies

Maintenance Type	Minimum Frequency	Action in Case of Fault
Category 1 Inspection	Daily	Category 2 Inspection
Category 2 Inspection	Weekly / Job	Contact Volant Customer Support
Category 3 Inspection	6 months	Category 4 Inspection
Category 4 Inspection	5-year	Contact Volant Customer Support

When an inspection indicates a fault condition, the corresponding action in Table 8-1 is generally required unless otherwise specified. Section 8.4 describes the specific requirements of each Inspection Category.

8.3.1 API RP 8B Inspection and Maintenance Categories

API RP 8B provides suggested periodic inspection and maintenance categories and frequencies for Top Drives as follows:

- Inspection Category I every day
- Inspection Category II every week
- Inspection Category III every 6 months
- Inspection Category IV every 5 years

NOTE The Volant TMS tool is not truly a Top Drive in terms of 8B's definition of one, but Volant considers it similar enough to warrant building its maintenance plan around this framework.

API RP 8B describes a Category I inspection as a daily visual inspection during operations for indications of inadequate performance: cracks, loose fits or connections, elongation of parts, and other signs of wear, corrosion, or overloading—and removing the equipment from service if any of these faults are found. This daily inspection should also involve checking for parts that could potentially fall off or retention devices or features that are damaged, missing, or out of adjustment—and immediately correcting any of these issues.

API RP 8B describes a Category II inspection as a further visual inspection for excessive wear, corrosion, deformation, loose or missing components, deterioration, proper lubrication, visible cracks, and adjustment.

API RP 8B describes a Category III inspection as a Category II inspection plus further inspection, which should include Non-Destructive Testing (NDT) of critical areas and may involve some disassembly to access specific components and identify wear that exceeds the manufacturer's allowable tolerances.

API RP 8B describes a Category IV inspection as a Category III inspection plus further inspection for which the equipment is disassembled to the extent necessary to conduct NDT of all Primary-Load-carrying Components (PLCs) as defined by the manufacturer.



8.3.2 Volant Inspection Categories

NOTE Each Inspection Category involves first performing all of the preceding Inspection Categories.

8.3.2.1 Volant Category 1 Inspection

Volant's Category 1 Inspection largely aligns with the API RP 8B Category I inspection.

8.3.2.2 Volant Category 2 Inspections

Volant's Category 2 Inspection involves verifying proof of calibration and performing a partial tool tear-down primarily to verify that: the **Battery Packs** are charged and the **Mandrel's** condition is acceptable.

The Volant Category 2 Inspection is analogous to the API RP 8B Category II inspection.

8.3.2.3 Volant Category 3 Inspection

Volant's Category 3 Inspection consists of a more extensive tool tear-down and conducting an MPI on the **Mandrel's** tool joint threads.

Volant's Category 3 Inspection is recommended every six months and is analogous to an API RP 8B Category III inspection.

8.3.2.4 Volant Category 4 Inspection

Volant's Category 4 Inspection consists of conducting a thorough visual examination of some manufactured components as well as purchased seals and fasteners. In addition, this inspection conducts an API RP 7G-2 rotary connection inspection of the tool joint threads.

Volant's Category 4 Inspection is recommended every 5 years and is analogous to an API RP 8B Category IV inspection.

For further clarification regarding Volant's tool inspection categories and frequencies when compared to API RP 8B, please contact Volant Customer Support at support@volantproducts.ca.

While Volant recommends documenting all maintenance and inspections, Category 3 and 4 Inspections are critical and **must** be documented.

8.4 Inspection Procedures

8.4.1 Category 1 Inspection

8.4.1.1 Wipe the **Antenna Guards** and **Breather** clean of obstructions.

8.4.1.2 Check that all of the **Enclosure's** SHCS and all of the **Battery Covers' Locking Lugs** are tightly fastened.

8.4.1.3 Check that all 4x **Retaining Rings** are installed on the 2x Battery Covers to retain their Locking Lugs.

8.4.1.4 Check that the **Tether Cables** are free of damage and secured to the Battery Covers and **Enclosure Sleeve**.

8.4.1.5 Observe equipment during operation for indications of inadequate performance.

8.4.1.6 Observe operations for indications of overload of hoisting or torque capacity.



8.4.2 Category 2 Inspection

- 8.4.2.1 Perform a Category 1 inspection.
- 8.4.2.2 Check all exposed fasteners for signs of damage.
- 8.4.2.3 Clean the exterior of the TMS tool, though do **not** pressure wash it. This can severely damage the components in the **Enclosure**, harming tool function.

 **WARNING**

Do not clean the TMS tool when in a hazardous location.

Discharge any human body charge before opening the **Battery Covers** or removing the **Battery Packs**.

Do not touch the TMS tool with a statically charged object such as plastic materials or tools.

- 8.4.2.4 Verify that the TMS has active, valid proof of calibration. Perform a Shunt Calibration. See Section 5.2.2.3.
- 8.4.2.5 If the TMS Translator software indicates that a Battery Pack's charge level is below 50%, remove it and recharge it. Follow the disassembly instructions in Section 3.4.2.1.

 **WARNING**

Do not charge the Battery Packs in a hazardous location.

Charge them in a non-hazardous area, and within a temperature range of 32°F (0°C) and 104°F (40°C), using only **Dual Battery Charger P/N 109242**.

- 8.4.2.6 Clean and visually inspect the **Mandrel** tool joint threads to ensure that their conditions are acceptable. Damaged threads must be recut.
NOTE The tool joint connections have recut allowances. Contact Volant Customer Support at support@volantproducts.ca for guidance on recutting these threads.
- 8.4.2.7 Visually inspect the Mandrel's bore. If it has excessive wear, pitting, or erosion, conduct a full Mandrel bore erosion check as in Section 8.4.4.2.2.
- 8.4.2.8 Visually inspect the Mandrel's calibration splines. See Figure 8-2. If the splines have any general wear or damage, contact Volant Customer Support at support@volantproducts.ca for guidance on addressing this.
- 8.4.2.9 Reassemble the TMS tool: Reapply appropriate lubricants, re-torque fasteners, and replace seals and fasteners as needed. (See Section 3.4.2.2.)

8.4.3 Category 3 Inspection

8.4.3.1 Perform Category 1 and 2 Inspections (though do not reassemble the tool).

Although Volant recommends documenting all maintenance and inspections, Categories 3 and 4 are critical and **must** be documented. Documentation must record all significant defects found, repairs made, rework conducted, NDT performed (and its results), and personnel involved in the maintenance and inspection.

8.4.3.2 **Battery Cover** Hardware Removal and Reinstallation

Fully disassemble the Battery Covers and inspect their **Locking Lugs**.

8.4.3.2.1 Remove the 2x **0.512" Internal Spiral Retaining Rings** from **Battery Pack A's** Battery Cover.

8.4.3.2.2 Remove the 2x **Locking Lugs** (using a $\frac{1}{4}$ " SAE Allen key) from this Battery Cover and then remove it.

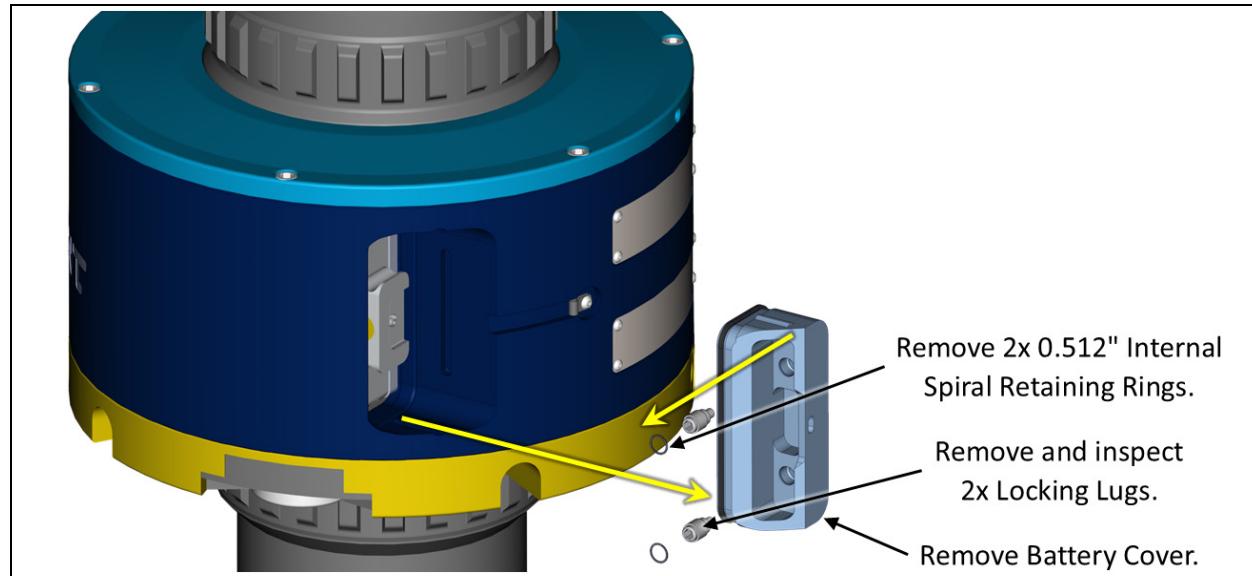
NOTE Each Battery Cover is pre-fastened to the TMS tool using a **Tether Cable**, which ensures the Cover stays paired with the tool. Several of these assembly images hide the Tether Cables for simplicity.

 **WARNING**

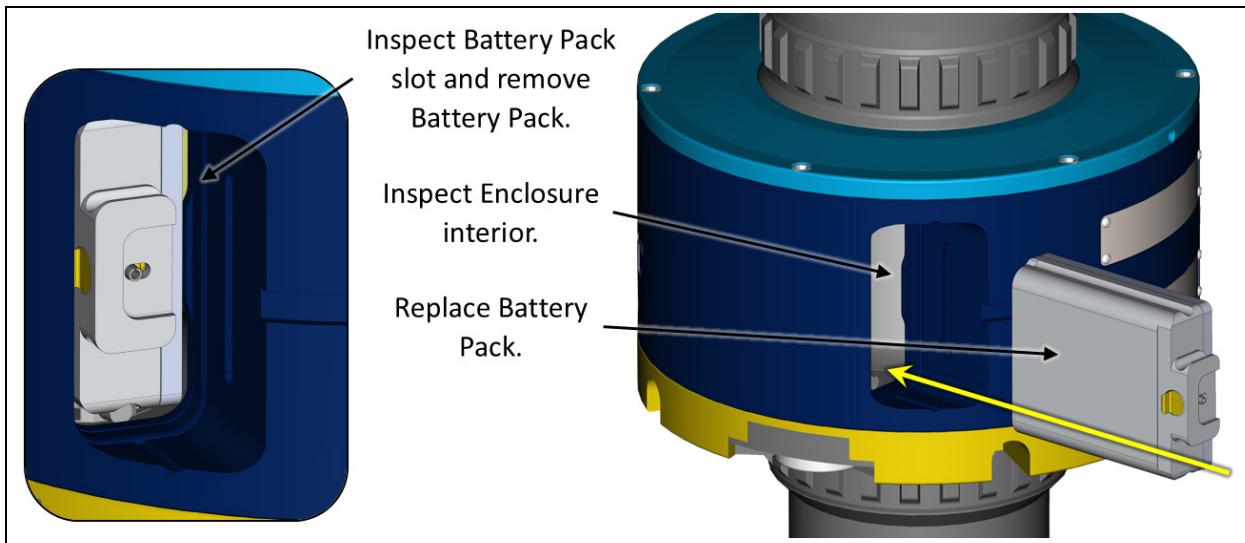
Wear appropriate gloves when removing the Battery Cover to protect against sharp edges.

Some force may be required to overcome the Battery Cover's O-Ring.

8.4.3.2.3 Inspect the threads on the Locking Lugs for signs of thread damage or corrosion. Replace the Locking Lugs as needed.



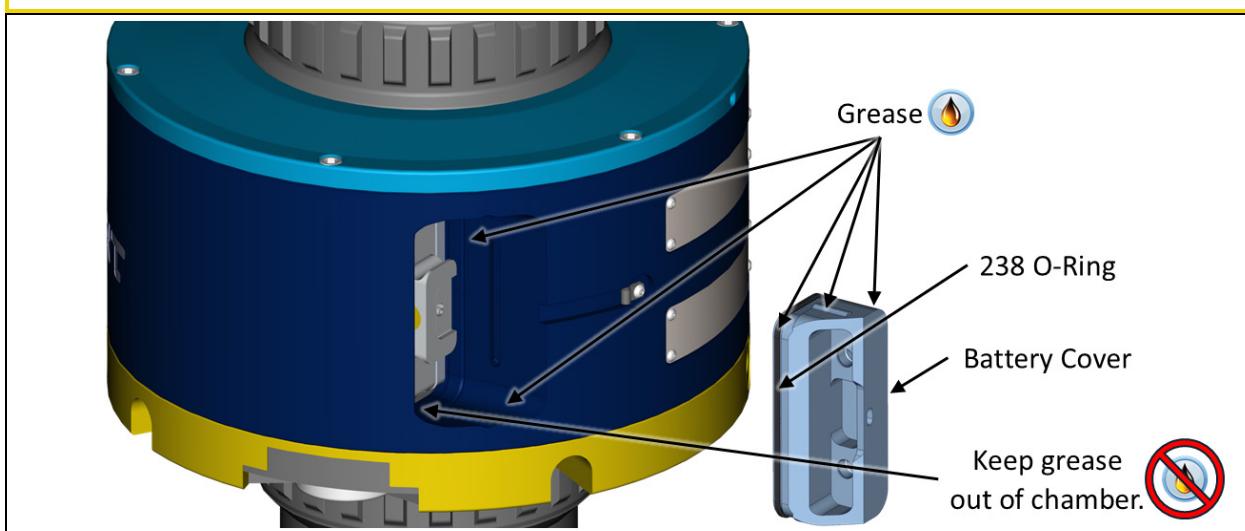
- 8.4.3.2.1 Visually inspect the **Battery Pack** slot on the **Enclosure Sleeve** for debris. Clean if necessary.
- 8.4.3.2.2 Remove the Battery Pack. See Section 3.4.2.1.
- 8.4.3.2.3 Inspect the interior of the **Enclosure** for fluid and moisture ingress. Contact Volant Customer Support at support@volantproducts.ca if Enclosure internals are damaged.
- 8.4.3.2.4 Install a fully charged Battery Pack in this slot.



- 8.4.3.2.5 Inspect the **Battery Cover's 238 Nitrile O-Ring** for wear and cracks, and replace it if any are found. Regrease the installed O-Ring and wipe away excess grease.
- 8.4.3.2.6 Grease the mating surfaces between 1x Battery Cover and its Battery Pack slot opening.

 **CAUTION**

Keep grease out of the Battery Pack chamber; do not allow grease to pass the O-Ring groove. Grease can damage the Enclosure's interior components, harming tool function.



NOTE Images will now show the **Battery Cover**'s fastening **Tether Cable**, which the Battery Cover should always remain fastened to.

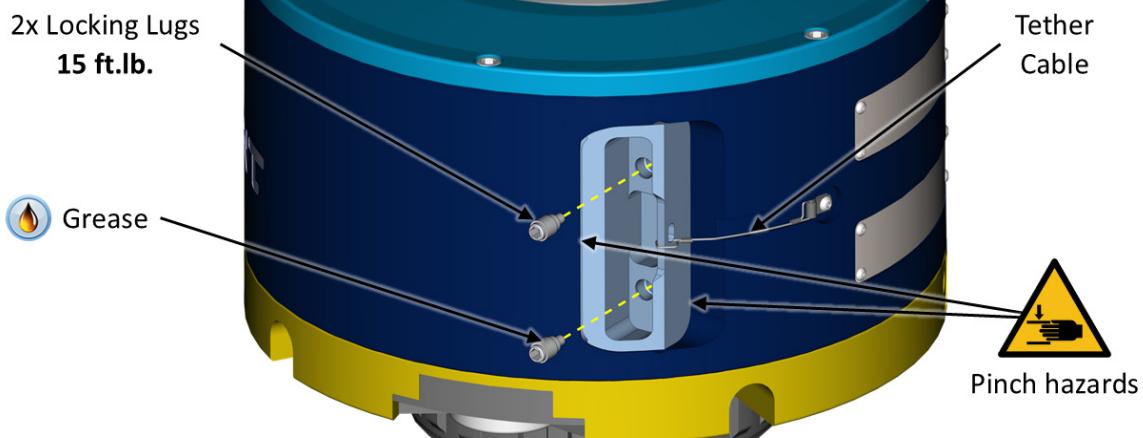
8.4.3.2.7 Fit the Battery Cover onto the **Battery Pack** slot opening. Grease the threads of 2x **Locking Lugs** (P/N 107816). Install them in the Battery Cover and torque them to **15 ft.lb.**

 **WARNING**

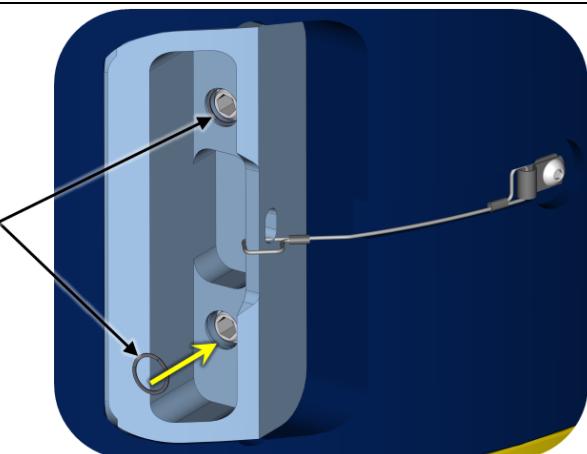
Be aware of pinch points between the Battery Cover and the **Enclosure Sleeve**.

 **WARNING**

If the Locking Lugs are under-torqued, fluids could leak into and severely damage the **Enclosure**.

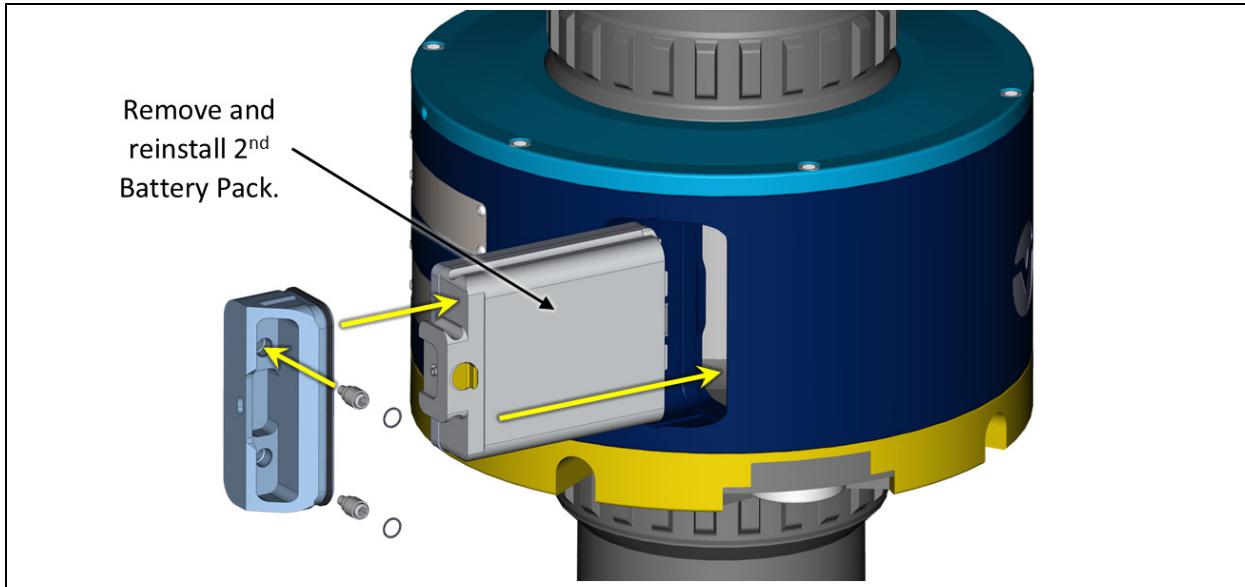


8.4.3.2.8 Further secure the Battery Cover using 2x **0.512" Internal Spiral Retaining Rings** inserted in the slots above the Locking Lugs.



The diagram shows a close-up of the Battery Cover's internal structure. Two small, coiled metal rings are being inserted into circular slots located above the two locking lugs. One ring is shown being inserted into the top slot, and another is shown in the bottom slot. The retaining rings are used to further secure the cover.

8.4.3.2.9 Remove and reinstall 2nd **Battery Pack**: Repeat Sections 8.4.3.2.1–8.4.3.2.8 for **Battery Pack B**.



8.4.3.3 Non-Destructive Testing (NDT) Inspection

Use NDT on the **Mandrel** to identify any damage or wear that exceeds Volant's allowable tolerances. NDT methods include Magnetic Particle Inspection (MPI) and Liquid Penetrant Inspection (LPI).

8.4.3.3.1 Mandrel Inspection

Tightly wrap the Enclosure in plastic wrap to protect it from MPI fluid.

 **CAUTION**

Take care to not apply MPI fluid to the **Enclosure**, as this could damage its components.

Conduct MPI according to Section 8.4.7 of API Specification 8C on the Mandrel's tool joint thread roots, as shown in Figure 8-2 below.

Document **all** relevant indications. Volant Customer Support at support@volantproducts.ca can assist with assessing and reviewing them and recommending how to address them.

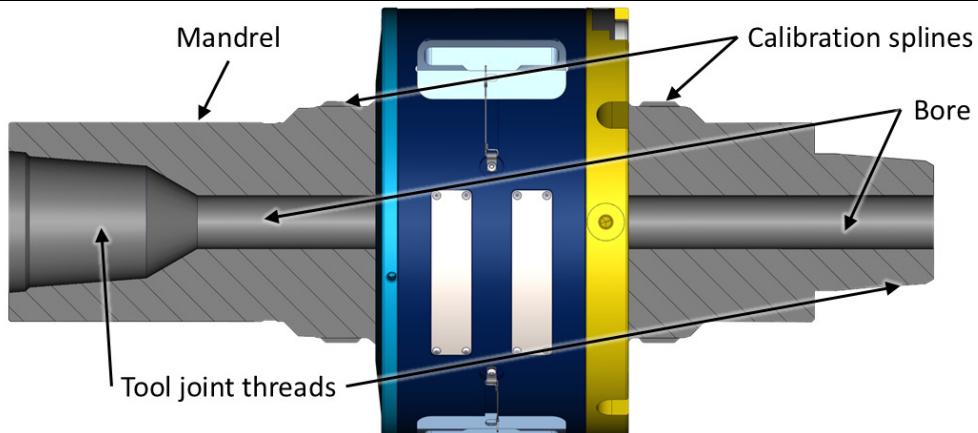


Figure 8-2: Mandrel Inspection Features

8.4.3.4 Reassemble the TMS tool: Reapply appropriate lubricants, re-torque fasteners, and replace seals and fasteners as needed. (Return to Section 8.4.3.2.4.)

8.4.4 Category 4 Inspection

8.4.4.1 Perform Category 1, 2, and 3 Inspections (though do not reassemble the tool).

Although Volant recommends documenting all maintenance and inspections, Categories 3 and 4 are critical and **must** be documented. Documentation must record all significant defects found, repairs made, rework conducted, NDT performed (and its results), and personnel involved in the maintenance and inspection.

Inspect for any component damage and allow for re-lubrication of all disassembled TMS components. Ensure all the parts are free of contaminants and lubrication before inspection. If any TMS components are found to be damaged or non-conforming, contact Volant Customer Support at support@volantproducts.ca for further part evaluation.

8.4.4.2 Non-Destructive Testing (NDT) Inspection

8.4.4.2.1 Tool Joint Inspection

Conduct an API RP 7G-2 rotary connection inspection of both tool joint threads.

Document **all** relevant indications. Volant Customer Support at support@volantproducts.ca can assist with assessing and reviewing them and recommending how to address them.

8.4.4.2.2 Mandrel Bore Erosion Check

Monitoring the erosion of the Mandrel's bore at its choke zone for the **Enclosure** is essential for guaranteeing TMS system calibration. As the Mandrel loses cross-sectional area, this will affect the tool's strain gauges' responses. Similarly, monitoring the bore within the pin tool joint is essential for guaranteeing TMS tool hoist and torque capacities.

Using a bore gauge, measure the Mandrel's bore diameter at 2–3 equally spaced locations within these two critical areas. Ensure that the bore gauge is properly calibrated.

Refer to Table 8-2 for the maximum acceptable internal diameters for these two areas.

NOTE If the Mandrel pin tool joint has been recut at all, this will reduce the length values in Table 8-2. In this case, contact Volant Customer Support at support@volantproducts.ca for assistance in assessing erosion.

Visually inspect the bore in addition to measuring its diameter. If the bore does not appear smooth and uniform, use a borescope or similar device to confirm the severity of any irregular wear or pitting. Significant irregular wear or pitting are not acceptable due to the impact on fatigue life and measurement accuracy.

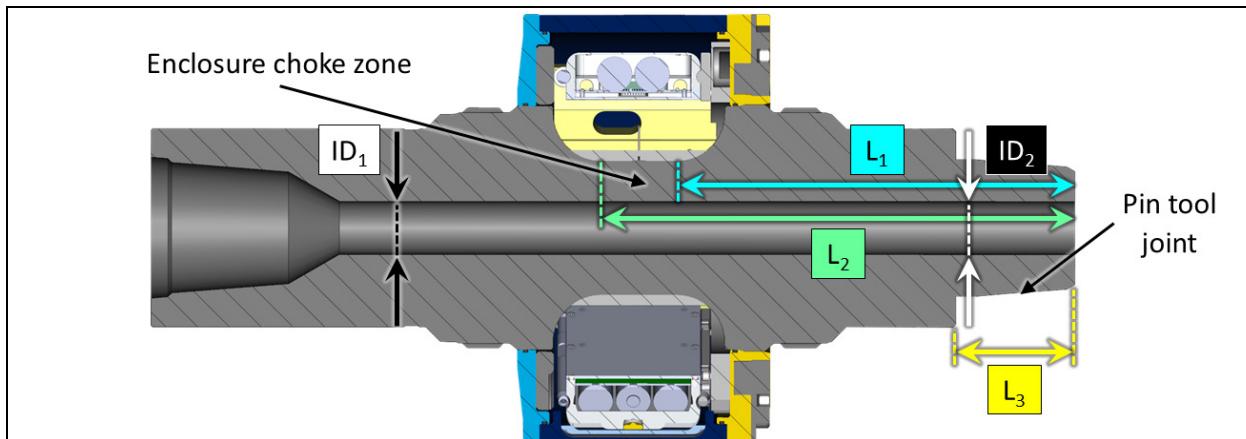


Table 8-2: Critical Erosion Values

Tool	L ₁	L ₂	L ₃
TMS 60 with NC50 tool joint	15.0 in. ± 0.5 in.	18.0 in. ± 0.5 in.	4.5 in. ± 0.5 in.
TMS 60 with 6-5/8" REG tool joint	15.5 in. ± 0.5 in.	18.5 in. ± 0.5 in.	5.0 in. ± 0.5 in.
TMS 100 with 6-5/8" REG tool joint	15.5 in. ± 0.5 in.	19.0 in. ± 0.5 in.	5.0 in. ± 0.5 in.
TMS 100 with 6-5/8" FH tool joint	15.5 in. ± 0.5 in.	19.0 in. ± 0.5 in.	5.0 in. ± 0.5 in.
TMS Tool and Pin Tool Joint	ID _{1Max}	ID _{2Max}	
TMS 60 with NC50 tool joint	2.25 in.	2.23 in.	
TMS 60 with 6-5/8" REG tool joint	2.25 in.	2.31 in.	
TMS 100 with 6-5/8" REG tool joint	2.37 in.	2.31 in.	
TMS 100 with 6-5/8" FH tool joint	2.37 in.	2.41 in.	

8.4.4.3 Reassemble the TMS tool: Reapply appropriate lubricants, re-torque fasteners, and replace seals and fasteners as needed. (Return to Section 8.4.3.2.4.)



8.5 Original Equipment Manufacturer Refurbishment Program

Volant can assist in TMS inspections, including:

8.5.1 Category 4 Inspection

OEM technicians will perform a complete tool tear-down and a Category 4 Inspection based on API RP 8B recommended practices, which include Magnetic Particle Inspections (MPIs) and complete component assessments.

8.5.2 TMS Refurbishment

If at any point during an inspection the tool requires repair or service, Volant will recommend a refurbishment plan that will return the tool to a functional condition.

8.5.3 General Tool and Component Assessment

Volant's Customer Support group is available 24/7 via phone or email to help assess equipment. Parts and tools may also be sent directly to Volant for a complete assessment.

Volant's OEM Refurbishment Program will provide any associated reports and certificates upon the completion of the inspection. For more information contact Volant Customer Support at 1.877.7VOLANT (1.877.786.5268) or support@volantproducts.ca.

If you require a quote or have additional equipment needs, contact Volant Sales at 1.866.8VOLANT (1.866.886.5268) or sales@volantproducts.ca.

9 Transportation and Storage

NOTE Images in this section are for illustrative purposes and may not reflect your TMS configuration or means of transportation. Follow these instructions regardless of TMS configuration or means of transportation.

9.1 Transportation

WARNING

Always remove the **Battery Packs** from the TMS tool for transportation.

9.1.1 Transportation Measures

9.1.1.1 Clean and dry the TMS in a non-hazardous area and perform a Category 2 Inspection prior to transporting it. (See Section 8.4.2.)

9.1.1.2 Remove both the **Battery Covers** and Battery Packs and reinstall the Battery Covers. See Section 3.4.2.

9.1.1.3 Install thread protectors on both tool joints.

9.1.1.4 Gently lay down the tool on a sturdy base as shown in Figure 9-1 below.

9.1.1.5 Strap the TMS down on blocks, which should be placed under both ends of the **Mandrel** (though not under its splines or pin tool joint threads).

9.1.1.6 Seal the TMS tool using a vapour barrier such as the shrink-wrap and place a desiccant within the vapour barrier. Follow the desiccant manufacturer's instructions to determine the amount of desiccant to use.

- 9.1.1.7 Unplug the **Base Station** and remove its antenna.
- 9.1.1.8 Unplug the **Dual Battery Charger**'s power cube and remove the cube from the Charger.
- 9.1.1.9 Place all available **Battery Packs**; the Base Station, its antenna, and its cable; and the Dual Battery Charger and its power cube all in their respective carrying cases.
- 9.1.1.10 Stow and secure all these carrying cases with the TMS tool.

 **WARNING**

When transporting a TMS, take care to not exceed the vehicle payload.

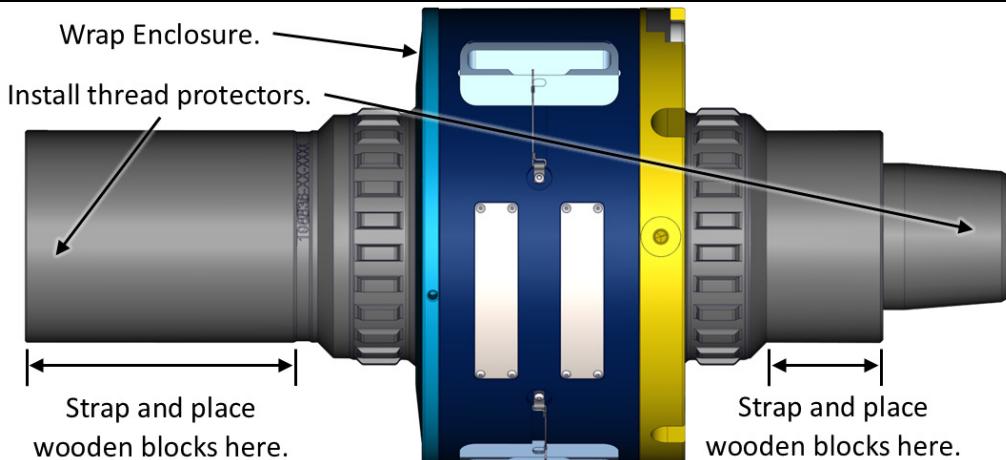


Figure 9-1: TMS Blocked and Strapped

9.2 Storage

9.2.1 Storage Measures

 **WARNING**

Do not leave the Battery Packs installed when the TMS is in storage.

The Battery Packs must be fully charged at least every 60–90 days. Otherwise, their charge life will degrade, and this will affect TMS tool performance.

 **WARNING**

Do not charge the Battery Packs in a hazardous location.

Charge them in a non-hazardous area, and within a temperature range of 32°F (0°C) and 104°F (40°C), using only Dual Battery Charger P/N **109242**.

- 9.2.1.1 Clean and dry the TMS tool (though do **not** pressure wash it) and perform a Category 2 inspection prior to storing it. (See Section 8.4.2.)
- 9.2.1.2 Clean and dry all accessories (though do **not** pressure wash them, and do **not** use cleaning chemicals on them): the Battery Packs, Base Station, and Dual Battery Charger.



- 9.2.1.3 Secure the TMS tool as described in Section 9.1.
- 9.2.1.4 Store the TMS system (including all accessories) in a clean, safe location that will stay within 32°F to 104°F (0°C to 40°C).
- NOTE** Keep spare seals in an airtight UV-protective container. Replace any seals that had been operating in harsh environments (extreme heat, extreme cold, very high humidity, very low humidity), even if they appear to be in good condition.
Volant® recommends replacing seals once a year, even if they appear to be in good condition.
- 9.2.1.5 If the TMS system is assembled and stored for more than three months, perform a Category 2 Inspection before putting it back into service. (See Section 8.4.2.)
- 9.2.1.6 Take special considerations for long-term storage. For each storage location, consider the environmental conditions that could vary over time, such as temperature and humidity.
- 9.2.1.7 If applying any protective compounds or corrosion inhibitors for long-term storage, first verify that the surfaces are free of moisture and contaminants. Remove all of these compounds before putting the tool back into service.



10 Troubleshooting

DANGER

If any of the warnings or errors in the TMS Translator software's Diagnostics tab display a warning by turning yellow, Volant® recommends stopping operation of the TMS tool and addressing this warning.

If any display an error by turning red, TMS tool operation **must** stop so the warning can be addressed.

NOTE For each issue, investigate the **Causes** and attempt their **Corrective Actions** in their listed order.

NOTE Refer to product manual P/N **109908** for detailed troubleshooting of the Translator software.

10.1 Connecting TMS Tool

The TMS Translator software does not form a wireless connection to the TMS tool.

Cause: TMS tool is not powered on.	Verification: Performing this corrective action resolves the issue.	Corrective Action: Remove the Power Switch Cover and press the Power Switch .
Cause: Batteries in the installed Battery Packs are dead.	Verification: Placing these Battery Packs in the Dual Battery Charger indicates depleted charge.	Corrective Action(s): Remove both the Battery Packs. See Section 3.4.2.1. Replace the Battery Packs with fully charged ones. See Section 3.4.2.2.
		 WARNING Do not charge the Battery Packs in a hazardous location. Charge them in a non-hazardous area, and within a temperature range of 32°F (0°C) and 104°F (40°C), using only Dual Battery Charger P/N 109242 .
Cause: The RSID the Base Station is broadcasting isn't the specific one the TMS tool can recognize.	Verification: Compare the RSID printed on the TMS tool's label to the RSID displayed in the System Info tab in the TMS Translator software.	Corrective Action(s): Under the Connections tab in the TMS Translator software, set the RSID using this format: VOTxxxyzz. Reset the Base Station by unplugging its USB cable, waiting 30 seconds, and plugging it back in. This will update the RSID it broadcasts.



10.2 TMS Tool Operation

Torque or hook load values are shifting or otherwise suspected of being false.		
Cause: Temperature variation, measurement circuit changes, or “bucked” tool connections.	Verification: Performing this corrective action resolves the issue.	Corrective Action(s): Press either the “Zero Torque” or “Zero Hook Load” button, as needed, to remove offset shifts on the torque or hook load values.
Phantom turns are occurring in the rotations measurement.		
Cause: Drifting in the equipment.	Verification: Performing this corrective action resolves the issue.	Corrective Action(s): Hold the TMS tool stationary, press the “Null Turns System” button, and wait 30 seconds. This resets the offset used with the gyroscope data.

II Revision History

Rev.	Date	Description	Revision Author
A	June 02, 2025	Initial release	Brett Bernakevitch



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