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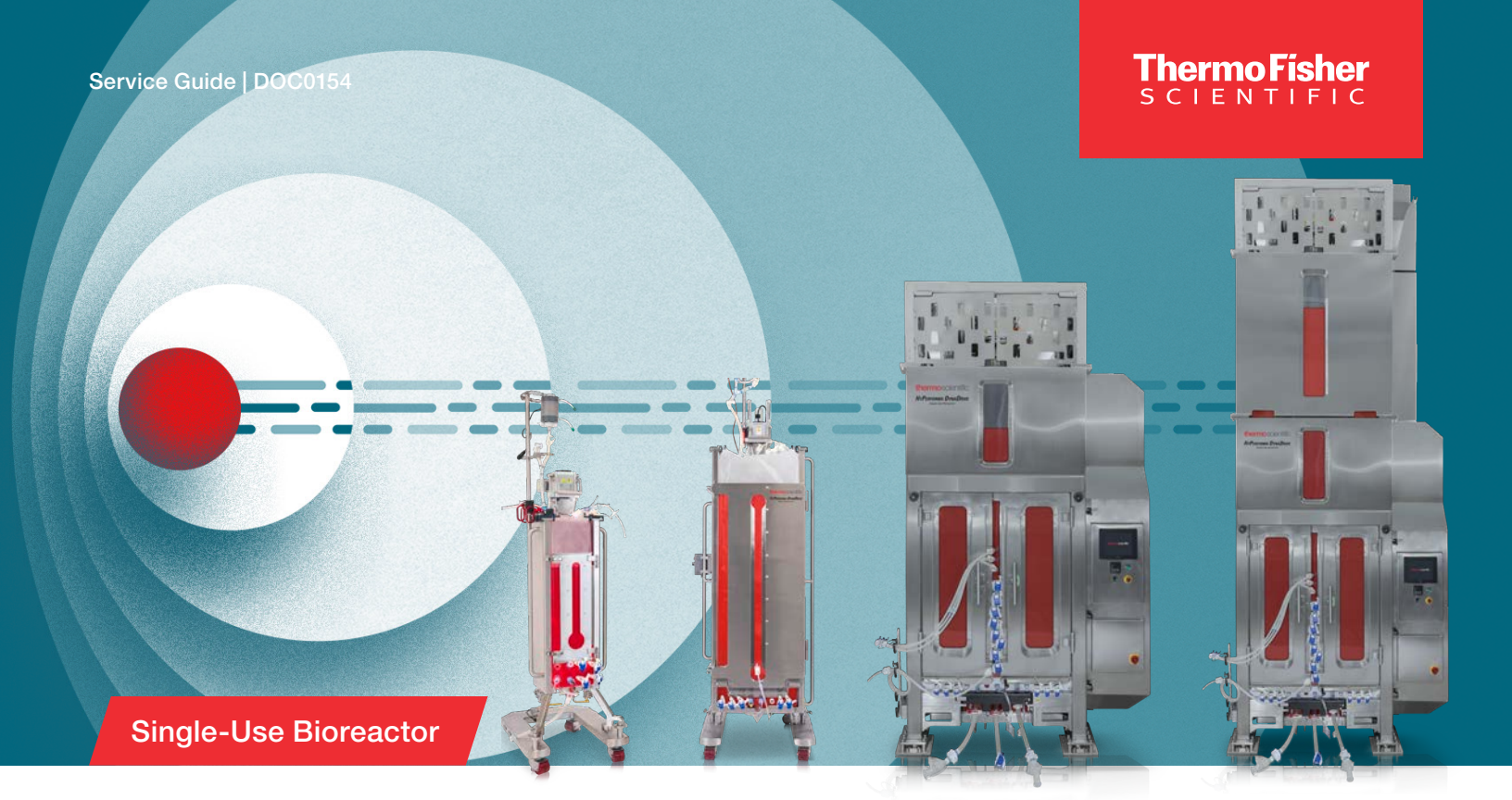

Single-Use Bioreactor

HyPerforma DynaDrive Single-Use Bioreactor Service Guide

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Warnings, safety, and warranty information

WARNING: Read and understand this guide before servicing the equipment.

The Thermo Scientific™ HyPerforma™ DynaDrive Single-Use Bioreactor (S.U.B.) is designed to be operated under traditional eukaryotic cell culture conditions. A general understanding of bioreactor systems and their operation is important prior to using the system for the first time. Read and understand this user's guide before operating; failure to do so could result in injury and potential loss of product. Only trained operators should be allowed to operate the equipment.

WARNING: Hazardous voltage inside.

The agitation motor, motor controller, and electrical control panel (E-Box) all have electrical components. There is a risk of electrical shock and injury. Disconnect power before opening electrical components. Service should be performed by certified personnel only.

Please note any electrical hazard labels on the equipment. Thermo Fisher Scientific recommends using standard lockout procedures when working on electrical components. The main switch on the E-Box may be locked out.

WARNING: Rotating parts—entanglement hazard.

Rotating and moving parts can cause injury. Keep hands away from moving parts during operation.

- Do not operate this equipment unless the supplied guarding is in place and properly functioning.
- It is the responsibility of the end user to assess this equipment and ensure that equipment and safeguards are in good working condition, and that all operators are trained and aware of entanglement hazards and associated protective devices, such as hazard signs and guarding.

WARNING: Follow lockout/tagout procedures.

To prevent injury, when servicing equipment, use your company's lockout/tagout procedures to isolate electrical, mechanical, pneumatic, hydraulic, chemical, thermal, gravitational, or any other potential energy and protect workers from the release of hazardous energy.

WARNING: Hot surface. Do not touch.

The heating jacket is designed to heat the inner vessel wall. Normal operating conditions generate heat, and could create hot surfaces.

- Hot surface inside
- Contact with surfaces may cause burns
- Do not touch while in operation

WARNING: Pinch hazard.

To avoid pinching and injuring an operator or causing damage to the equipment or the BioProcess Container (BPC), use caution when opening and closing the door, securing the BPC to the bottom port in the tank, or during operation of the DynaDrive S.U.B.

WARNING: Tipping hazard. The vessel should only be moved by pushing using the provided handles or at the mid-point of the vessel.

If pulled or moved too quickly, the vessel can tip, potentially leading to damage to equipment or injury to personnel. To reduce the risk of tipping, the vessel should only be moved slowly over smooth, flat surfaces by at least two qualified personnel. During movement, any locking feet should be retracted, and casters should be in the unlocked position. The vessel should not be moved by pulling of any kind.

WARNING: The Thermo Scientific HyPerforma DynaDrive S.U.B. may not be installed in a potentially explosive atmosphere as set forth in the applicable EU ATEX Directive.

It is the responsibility of the end user to review and understand the potential dangers listed in the ATEX 2014/34/EU guidelines.

Electrical connections

Power should be supplied by a non-GFCI 20 amp circuit. Ground faults occur when current is leaking somewhere; in effect, electricity is escaping to the ground. **Electrocution can occur when the human body serves as the path for the leakage to the ground.** A ground fault circuit interrupter (GFCI) senses the current flowing to the ground and switches off the power (trips the GFCI) in a fraction of a second at currents well below those that are considered dangerous. Due to the sensitivity of GFCIs to electrical leakage (a few mA), it is recommended that DynaDrive S.U.B.s are NOT plugged into a GFCI outlet.

Power outlet accessibility

For safety, the power outlet used to power the unit must be accessible at all times. In case of emergency, you must be able to immediately disconnect the main power supply to all of the equipment. Allow adequate space between the wall and the equipment so that power cords can be disconnected in case of emergency.

Warranty information

Any warranties, if applicable, covering this equipment exclude: (a) normal wear and tear; (b) accident, disaster or event of force majeure; (c) your misuse, fault or negligence; (d) use of the equipment in a manner for which it was not designed; (e) causes external to the equipment such as, but not limited to, external puncturing, power failure or electrical power surges; (f) improper storage and handling of the equipment; (g) use of the equipment in combination with equipment or software that we did not supply; (h) equipment sold to you as 'used' products; (i) contact with improperly used or unapproved chemicals or samples; (j) installation, removal, use, maintenance, storage, or handling in an improper, inadequate, or unapproved manner, such as, but not limited to, failure to follow the documentation or instructions in the deliverables or related to the equipment, operation outside of stated environmental or other operational specifications, or operation with unapproved software, materials or other products; (k) manufacture in accordance with requirements you gave us; (l) installation of software or interfacing or use of the equipment in combination with software or products we have not approved; (m) use of the deliverables or any documentation to support regulatory approvals; (n) the performance, efficacy or compatibility of specified components; and (o) the performance of custom equipment or products or specified components or achievement of any results from the equipment, specified components or services within ranges desired by you even if those ranges are communicated to us and are described in specifications, a quote, or a statement of work. **ADDITIONALLY, ANY INSTALLATION, MAINTENANCE, REPAIR, SERVICE, RELOCATION OR ALTERATION TO OR OF, OR OTHER TAMPERING WITH, THE EQUIPMENT PERFORMED BY ANY PERSON OR ENTITY OTHER THAN US WITHOUT OUR PRIOR WRITTEN APPROVAL, OR ANY USE OF REPLACEMENT PARTS WE HAVE NOT SUPPLIED, WILL IMMEDIATELY VOID AND CANCEL ALL WARRANTIES WITH RESPECT TO THE AFFECTED EQUIPMENT. IF THE EQUIPMENT IS TO BE USED IN THE UNITED STATES, WE MAY VOID YOUR WARRANTY IF YOU SHIP THE EQUIPMENT OUTSIDE OF THE UNITED STATES.**

Use restrictions

You must use this equipment in accordance with our documentation and if applicable, with our other associated instructions, including without limitation, a "research use only" product label or "limited use" label license. This equipment is intended for research use or further manufacturing in bioprocessing applications and not for diagnostic use or direct administration into humans or animals, we do not submit the equipment for regulatory review by any governmental body or other organization, and we do not validate the equipment for clinical or diagnostic use, for safety and effectiveness, or for any other specific use or application.

How to use this guide

Scope of this publication

The purpose of this service guide is to provide detailed information about how to service and maintain Thermo Scientific™ HyPerforma™ DynaDrive S.U.B. systems. It is intended for use by Thermo Fisher Scientific certified service personnel who may or may not have experience with the DynaDrive S.U.B.

Document change information

A summary of the changes that have been made to this document are listed below.

Revision	Date	Description	Author
A	12/2021	Initial release	T. Golightly

Questions about this publication

If you have any questions or concerns about the content of this publication, please contact technicaldocumentation@thermofisher.com and your Thermo Fisher Scientific sales team.

Related publications

Please contact your local sales representative for information about the related publications listed below.

Publication	Document number
HyPerforma DynaDrive Single-Use Bioreactor User's Guide	DOC0090
HyPerforma DynaDrive S.U.B. Unpacking Guide	DOC0149
50 L HyPerforma DynaDrive S.U.B. Quick Start Guide	DOC0148
500 L HyPerforma DynaDrive S.U.B. Quick Start Guide	DOC0171
3,000 and 5,000 L HyPerforma DynaDrive S.U.B. Unpacking and Setup Guide	DOC0176
HyPerforma DynaDrive S.U.B. Validation Guide	DOC0172

1

DynaDrive S.U.B. overview

The Thermo Scientific HyPerforma DynaDrive Single-Use Bioreactor (S.U.B.) offers a flexible new alternative to traditional stirred-tank mixing. The system uses a redesigned impeller system: a drive train is connected to both an overhead mixing motor via a sealed bearing assembly and the bottom of the tank, allowing improved mixing while maintaining the integrity of the system. In addition, the DynaDrive S.U.B. facilitates greater scalability by allowing users to begin mixing at only 10% volume in 50 L units, ~8% in 3,000 L units, and 5% in 500 and 5,000 L units.

Each DynaDrive S.U.B. system consists of the following main components:

- **Stainless steel outer support container** with a water jacket heating system. The outer support container is made of 304 or 316 stainless steel, and holds and supports the BioProcess Container (BPC). The square shape of the DynaDrive S.U.B. allows an optimized footprint in contrast to traditional round reactors.
- **BPC**, which is supplied gamma irradiated for ready-to-use, single-use mixing. The flex drive train is located entirely inside of the BPC, and connects to the reactor at the bottom of the tank in addition to the standard top hub, removing the need for traditional drive shafts.
- **Control system**, provided by Thermo Scientific or a third party.

Figures 1.1 and 1.2 illustrate the front and back views of the 50 L DynaDrive S.U.B. unit.

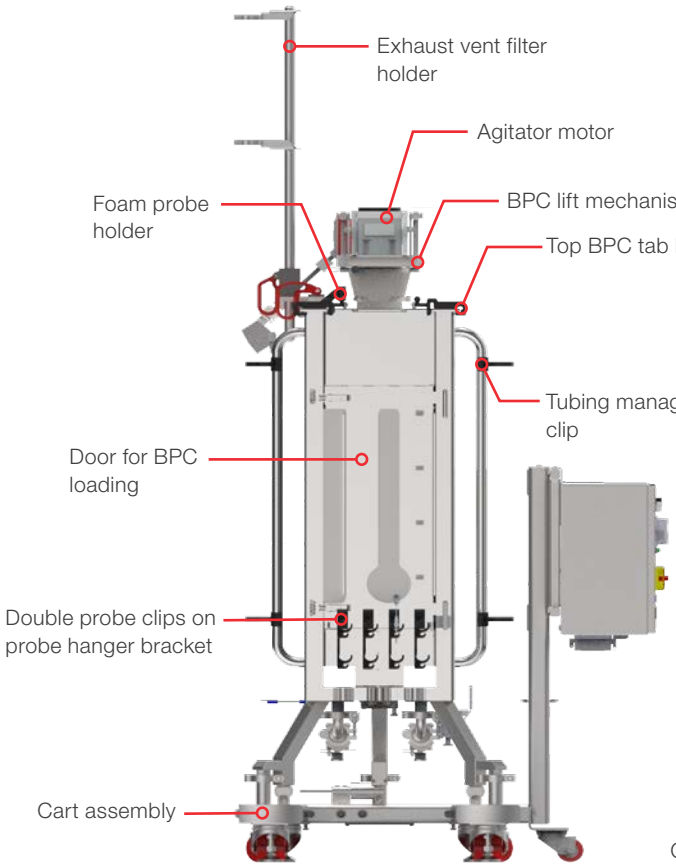

Figure 1.1. Front view of 50 L DynaDrive S.U.B. (with optional E-Box).

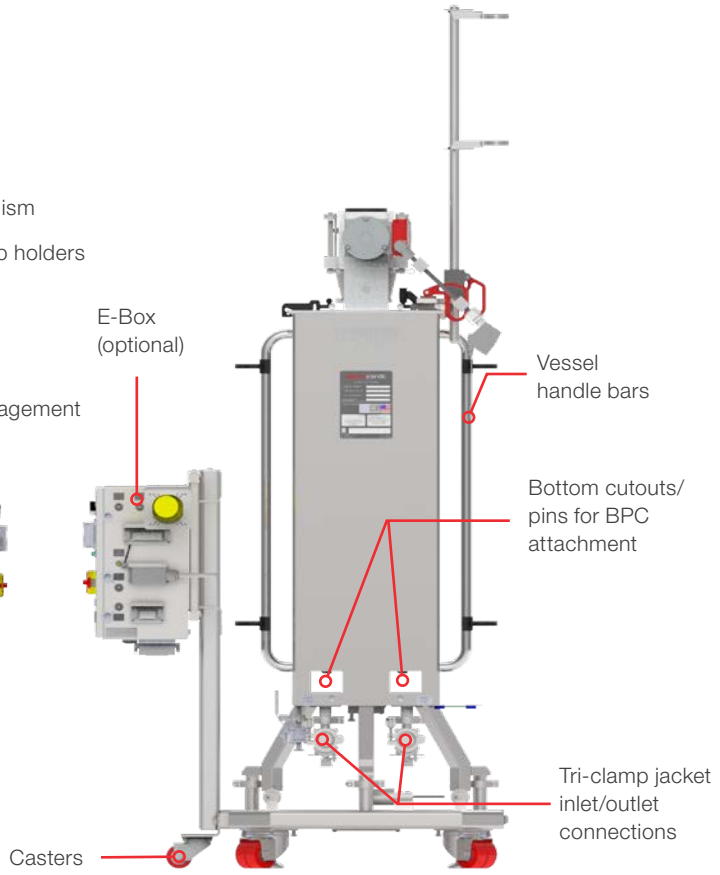

Figure 1.2. Back view of 50 L DynaDrive S.U.B. (with optional E-Box).

Figures 1.3 and 1.4 illustrate the front and back views of the 500 L DynaDrive S.U.B. unit.

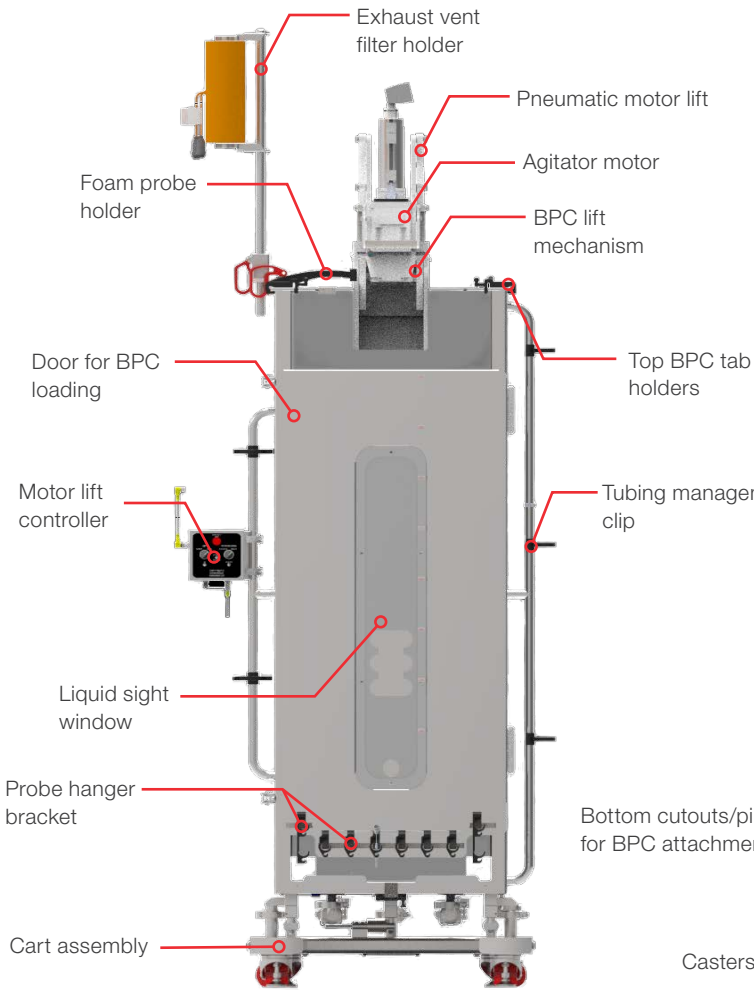

Figure 1.3. Front view of 500 L DynaDrive S.U.B. (without optional E-Box).

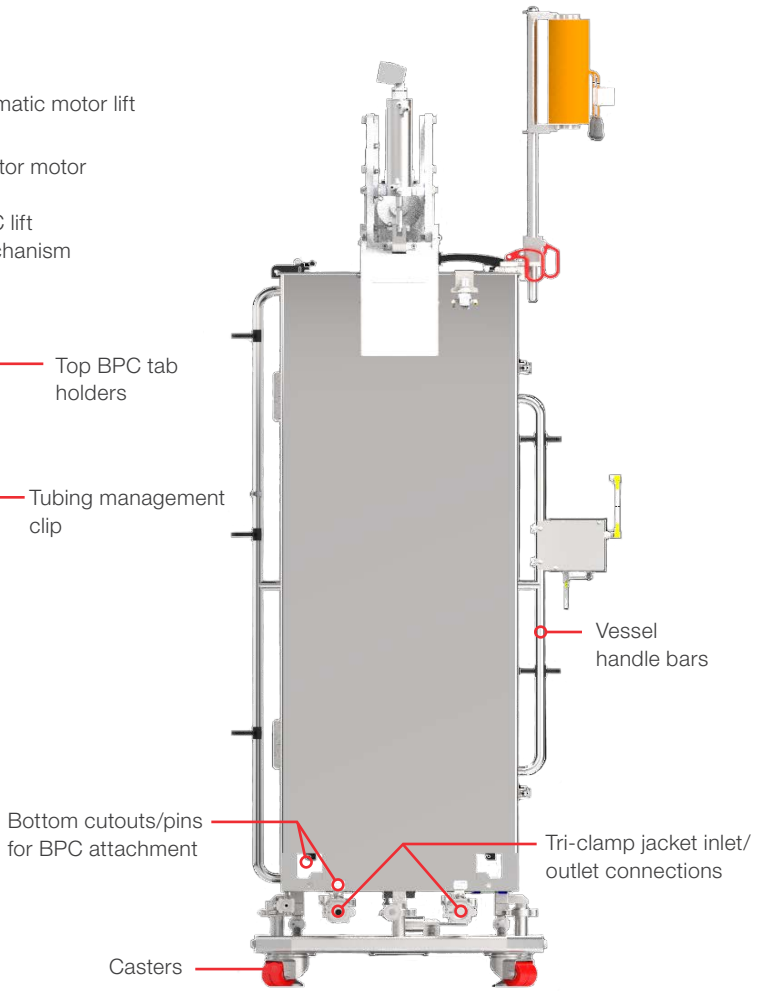

Figure 1.4. Back view of 500 L DynaDrive S.U.B. (without optional E-Box).

Figures 1.5 and 1.6 illustrate the front and back views of the 3,000 and 5,000 L DynaDrive S.U.B. unit.

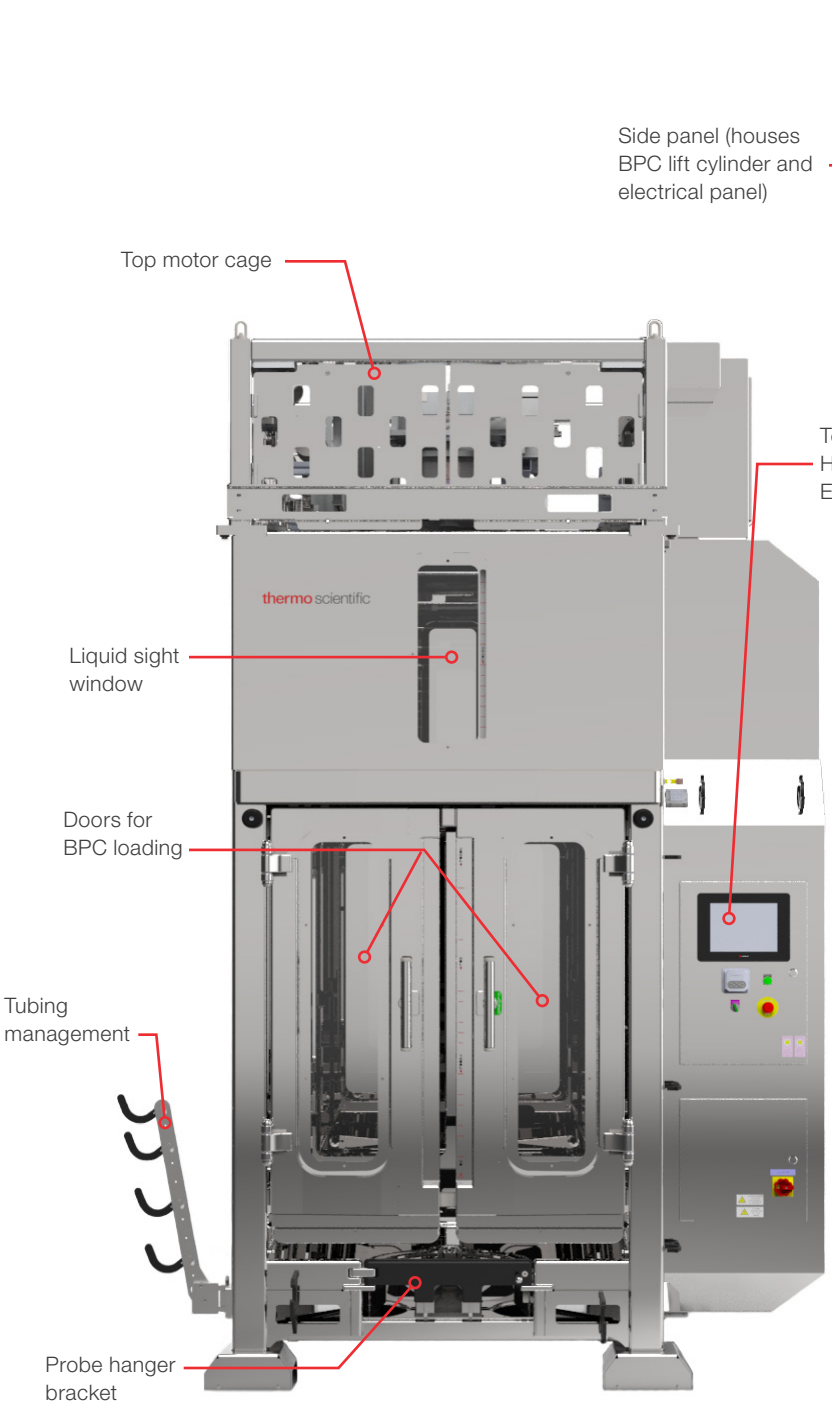

Figure 1.5. Front view of 3,000 L DynaDrive S.U.B.

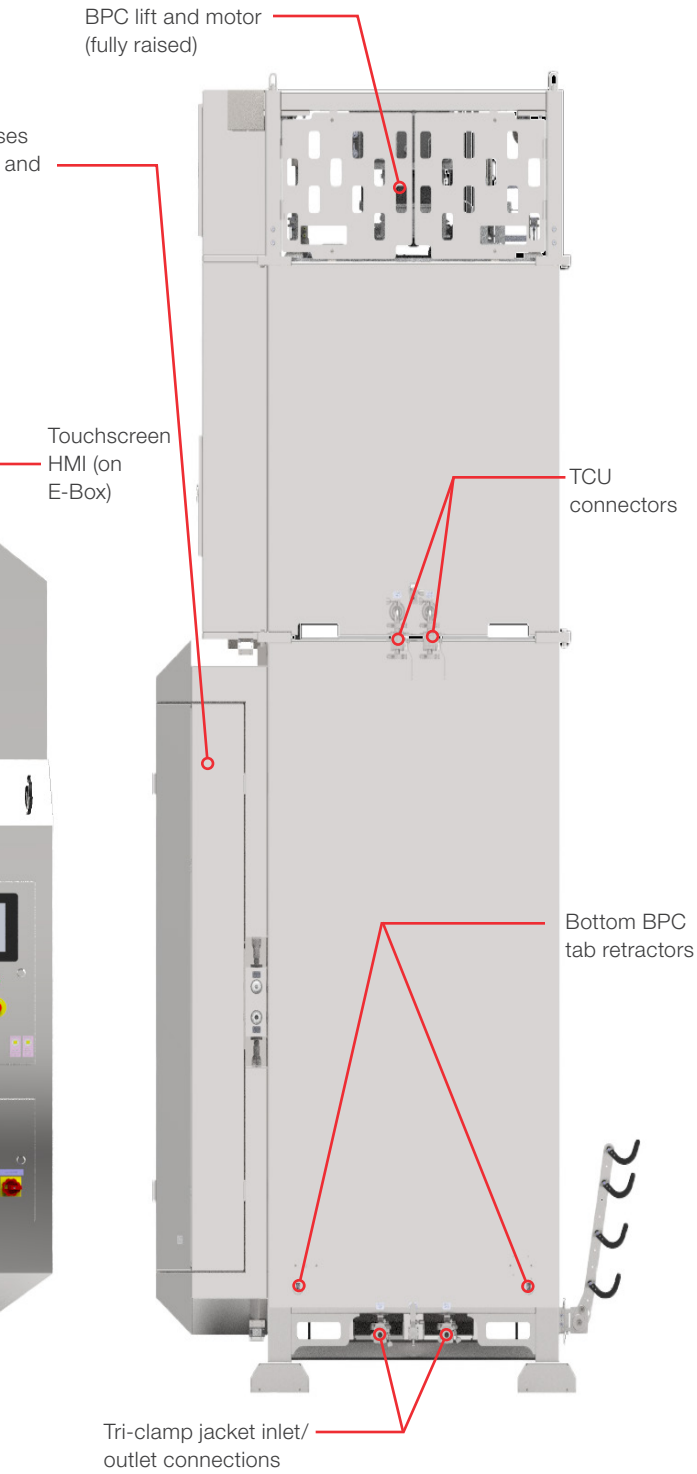

Figure 1.6. Back view of 5,000 L DynaDrive S.U.B.

2

Servicing and preventive maintenance

Chapter contents

2.1 Servicing checklists
2.2 Maintenance

2.1. Servicing checklists

Ensure that the following servicing prerequisites are fulfilled before servicing a DynaDrive S.U.B. system:

- ☑ Transportation allowing for the total weight of the DynaDrive S.U.B. is available.
- ☑ Servicing site includes a flat surface capable of supporting the total dimensions and weight of the DynaDrive S.U.B.
- ☑ Proper tools are available (see Chapter 3).

2.2. Maintenance

The following routine maintenance guidelines are based on standard operating conditions, as defined in the HyPerforma DynaDrive S.U.B. User's Guide (DOC0090).

2.2.1. Routine maintenance

Environmental conditions, operating parameters, and adhering to standard operating procedures as outlined in the user's guide have significant impact upon the useful life of your DynaDrive S.U.B. unit. The following guidelines are based upon the standard operating conditions outlined in the user's guide.

High-wear items such as bearings, seals, O-rings, and sterilization valves common to conventional bioreactor systems have been purposefully considered in the design of the construction of the DynaDrive S.U.B. The S.U.B. system is inherently robust and requires low levels of routine maintenance. Take time between bioreactor runs to clean the exterior of the hardware, which will improve the appearance and overall longevity of the system.

2.2.2. Preventive maintenance

Replacement of the mixing motor is recommended every five years, or as needed. Cables on 3,000 and 5,000 L units should be checked for wear annually.

3

Replacing parts

Chapter contents

3.1 Replacement parts and part numbers
3.2 Replacing the S.U.B. common-jacket drain valve and wing nut tri-clamp
3.3 Replacing the 50 and 500 L quick-release pin
3.4 Replacing the 50 and 500 L assembly bottom hub clamp
3.5 Replacing the IMP motor, BPC lift mechanism, and hub locking mechanism
3.6 Replacing the 50 and 500 L load cells
3.7 Replacing the 3,000 and 5,000 load cells
3.8 Replacing the 3,000 and 5,000 cables ad coolant hoses
3.9 Replacing the 3,000 and 5,000 L pulleys and pulley cables
3.10 Replacing the 3,000 and 5,000 L BPC lift cylinder
3.11 Replacing the 3,000 and 5,000 platform locking mechanism
3.12 Replacing the 3,000 and 5,000 L assembly bottom hub clamp
3.13 Replacing the 3,000 and 5,000 L condenser heater
3.14 Additional replacement parts and part numbers

Before proceeding to perform any work on the DynaDrive S.U.B., it is mandatory to complete the following:

- ☑ Follow lockout/tagout procedures and local site electrical rules and laws.
- ☑ Verify that the assembly was completed using current Good Manufacturing Practices (cGMP).
- ☑ Check with the supplier to determine manufacturer of this assembly.

3.1. Replacement parts and part numbers

The following tables list part numbers of replacement parts for the DynaDrive S.U.B. system.

Table 3.1. Replacement parts and part numbers for 50 L DynaDrive S.U.B.s.

Components	Cat. no
S.U.B. Common-jacket drain valve	SV50177C.17
Wing nut tri-clamp	SV50177.384
Assembly hub assist lift DynaDrive 50 L	SV51243.01
Quick-release pin, 3/16 in. diameter, 1-1/4 in.	SV51245.09
1/4 HP 200-230 V IPM motor, 10:1 gear	SV51241.01
Assembly bottom hub clamp DynaDrive common	SV51247.01
50 L S.U.B. load cell kit with summing block, no display	SV50988.01

Table 3.2. Replacement parts and part numbers for 500 L DynaDrive S.U.B.s.

Components	Cat. no
S.U.B. Common-jacket drain valve	SV0177C.17
Quick connect	SV50239.93
Ball valve assembly	SV50239.38
Wing nut tri-clamp	SV50177.384
Assembly hub assist lift DynaDrive 500 L	SV51243.02
Quick-release pin, 3/16 in. diameter, 1-1/4 in.	SV51245.09
1/4 HP 200-230 V IPM motor, 10:1 gear	SV50241.02
Assembly bottom hub clamp DynaDrive common	SV51247.01
500 L S.U.B. load cell kit with summing block, no display	SV50988.03

Table 3.3. Replacement parts and part numbers for 3,000 and 5,000 L DynaDrive S.U.B.s.

Components	Cat. no
S.U.B. Common-jacket drain valve	SV51134.03
Modified tri-clamp	SV51245.10
Dual 6-pin connector, 5 1/8 in. length	SV50999.12
3 HP 200-230 V IPM motor, 10:1 gear	SV51241.03
3,000 and 5,000 L S.U.B. single load cell	SV51010.20
3,000 and 5,000 L S.U.B. summing block, no display	SV50177.339
Power cord 240 VAC, 15 A, C19-5M	SV51142.711
Platform cables pulleys	SV51245.04
Lift cable pulleys	SV51245.01
Platform lift cables (left)	SV51246.05
Platform lift cables (right)	SV51246.06
Main lift cables	SV51246.04
Condenser heater	SV51248.02
Common jacket drain valve	SV50177.316
2 in. bore cylinder	SV51245.08
Sensor for 2 in. bore cylinder	SV51245.07
Rod lock for 160 mm bore cylinder	SV51245.03

3.2. Replacing the S.U.B. common-jacket drain valve and wing nut tri-clamp

The following instructions detail how to replace the inlet and outlet drain valves and the wing nut tri-clamps located on the backside of the DynaDrive unit. **Note:** The 5,000 L DynaDrive S.U.B. has an additional pair of inlet and outlet ports at the base of the 2,000 L tank. A ladder or elevated platform is required to reach these ports.

3.2.1. Required parts and tools

See Tables 3.1–3.3 for part numbers based on your system size.

- Spare S.U.B. common-jacket drain valve (part number SV0177C.17)
- Spare 500 L quick connect (part number SV50239.93)
- Spare 500 L ball valve assembly (part number SV50239.38)
- Spare 3,000 and 5,000 L S.U.B. common-jacket drain valve (part number SV51134.03)
- Spare wing nut tri-clamp (part number SV50177.384)

3.2.2. Preparations

Prior to installing the drain valve, ensure that the jacket and the inlet and outlet ports are fully drained.

If you are replacing the entire 500 L ball valve assembly (and quick connect), you will need to remove the hanging brackets before you can remove the valve from the tank (see Figure 3.1).

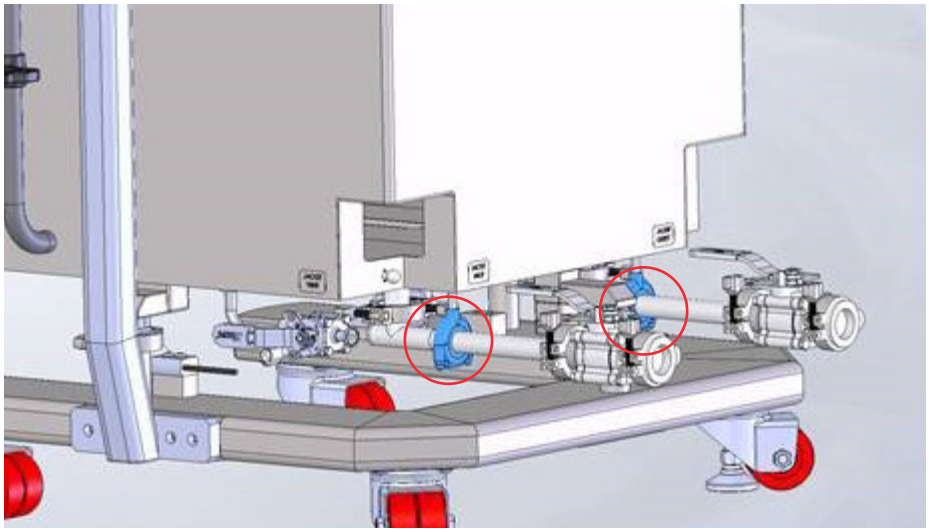

Figure 3.1. Hanging brackets on the 500 L drain valve.

3.2.3. Replacement procedures

1. Remove the valve from the inlet/outlet port by unscrewing the wing nut until it is loose (Figure 3.2). Hold your hand under the valve as you remove the tri-clamp to catch the valve as it detaches (Figure 3.3).

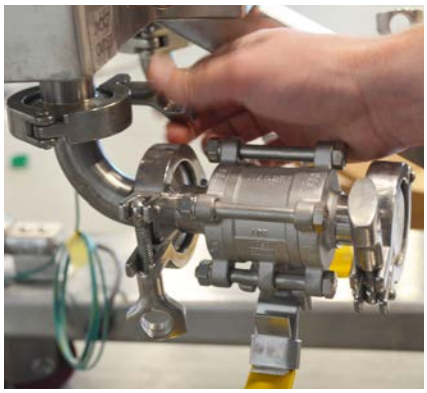

Figure 3.2. Removing wing nut from tri-clamp.

Figure 3.3. Removing drain valve from inlet/outlet port.

Note: There is a rubber seal located between the DynaDrive port and drain valve (Figure 3.4).

Figure 3.4. The rubber seal that is placed between the port and drain valve.

2. Connect the new drain valve to the inlet/outlet port by holding the drain valve against the inlet/outlet port and securing it with the new tri-clamp (Figure 3.5).

Figure 3.5. Attaching tri-clamp around inlet/outlet port and drain valve.

3. Fasten the wing nut until the tri-clamp is secured.

3.3. Replacing the 50 and 500 L quick-release pin

Use the following instructions to replace the quick-release pin located on the BPC lift mechanism on the 50 and 500 L DynaDrive unit.

3.3.1. Required parts and tools

- Spare quick-release pin (part number SV51245.09)

3.3.2. Replacement procedures

1. Push the release button in the center of the quick-release pin (Figure 3.6) and pull away from the vessel to remove the pin (Figure 3.7).

Figure 3.6. Pushing the release button on quick-release pin.

Figure 3.7. Removing the quick-release pin.

2. Unhook the latch pin from the metal ring (Figure 3.8 and 3.9).

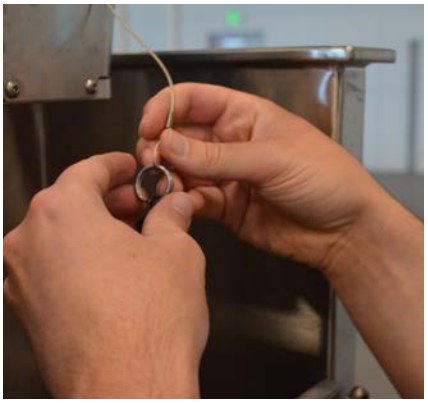

Figure 3.8. Removing quick-release pin from metal ring.

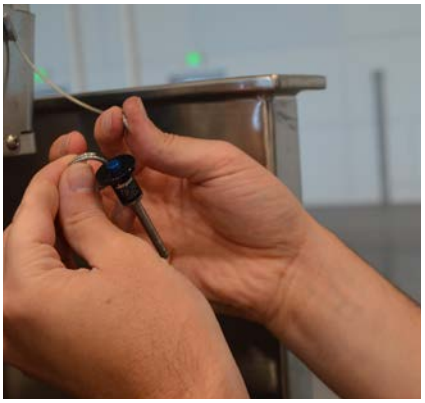

Figure 3.9. Quick-release pin detached from metal ring.

3. Attach a new latch pin to the ring (Figure 3.10).

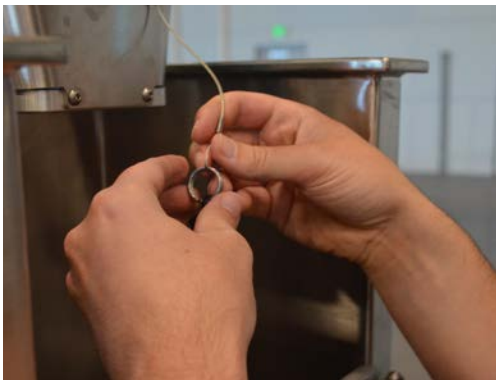

Figure 3.10. Attaching new latch pin to the ring.

4. Push the release button in the center of the quick-release pin (Figure 3.11) and push into the vessel to replace the pin (Figure 3.12).

Figure 3.11. Pushing the release button on quick-release pin.

Figure 3.12. Replacing the quick-release pin.

3.4. Replacing the 50 and 500 L assembly bottom hub clamp

Use the following instructions to replace the assembly bottom hub clamp located on the bottom of the 50 and 500 L DynaDrive unit. See Tables 3.1–3.3 for part numbers based on your system size.

3.4.1. Required parts and tools

- Spare assembly bottom hub clamp (part number SV51247.01)
- 3/16 in. Allen wrench

3.4.2. Preparations

Ensure the BPC is removed from DynaDrive unit before installation.

3.4.3. Replacement procedures

1. Remove the bottom hub clamp assembly by unscrewing the four bolts using the 3/16 in. Allen wrench (Figure 3.13).

Figure 3.13. Removing four bolts from assembly bottom hub clamp.

Figure 3.14. Removing the assembly bottom hub clamp.

2. Replace with the new bottom hub clamp assembly by screwing in the four bolts using the 3/16 in. Allen wrench (Figure 3.15).

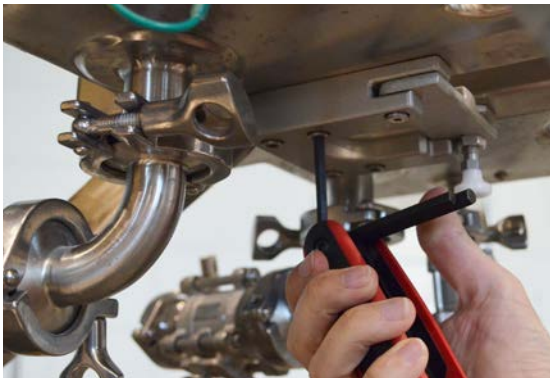

Figure 3.15. Replacing the four bolts to the assembly bottom hub clamp.

3.5. Replacing the IPM motor, BPC lift mechanism, and hub locking mechanism

Use the following instructions to replace the motor and hub locking mechanism located on the top of 50, 500, 3,000, and 5,000 L DynaDrive units, and the BPC lift mechanism on 50 and 500 L units. See Tables 3.1–3.3 for part numbers based on your system size.

3.5.1. Required parts and tools

- Spare motor
- Spare 50 L BPC lift mechanism (part number SV51243.01)
- Spare 500 L BPC lift mechanism (part number SV51243.02)
- Spare hub locking mechanism (part number SV51247.01)
- Allen wrenches: 5/32, 1/4, and 5/16 in.
- Adjustable wrench

3.5.2. Replacement procedures

WARNING: Use ladders and elevated platforms with caution.

A ladder or platform is required to remove the top bolt on 500, 3,000, and 5,000 L units. Before use, ensure the ladder has been inspected and weight-rated for its user. When using a ladder or platform, be sure it is stable, maintain three points of contact, and make sure the steps are clean.

Removing the motor

1. Remove the four long bolts located on the top of the motor assembly using a 1/4 in. Allen wrench (Figure 3.16).

Figure 3.16. Removing one of the four bolts from the top of the motor assembly.

2. Remove the top two bolts on both sides of the motor assembly using a 5/32 in. Allen wrench (Figure 3.17).

Figure 3.17. Removing the top two bolts from the side of the motor assembly.

3. Remove the top plate of the motor assembly (Figure 3.18).

Figure 3.18. Removing the top plate.

4. Remove the top bolt and screw using a 5/16 in. Allen wrench located on the top of the assembly lift (Figure 3.19). Before you fully remove the bolt, you will need to hold onto the hub locking mechanism to ensure it does not fall. **Note:** You will need to use an adjustable wrench to loosen this top bolt. A ladder or elevated platform is required to reach this bolt.

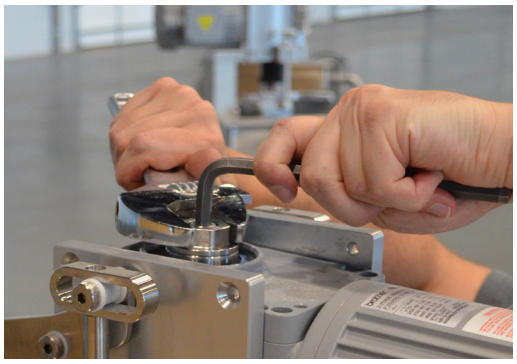

Figure 3.19. Loosening the top bolt.

5. Remove the hub locking mechanism (Figure 3.20).

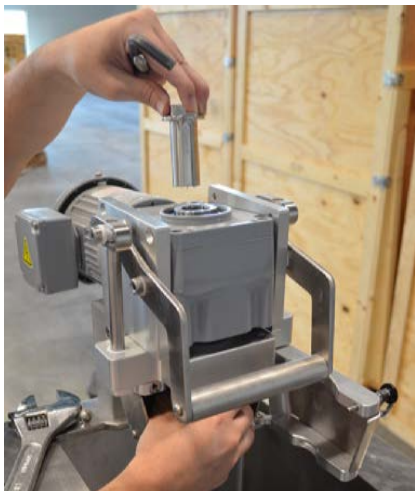

Figure 3.20. Removing the hub locking mechanism from the motor assembly.

6. Carefully remove the motor by lifting it out of the motor assembly (Figure 3.21).

Figure 3.21. Removing the motor from the motor assembly.

Removing and replacing the 50 L BPC lift mechanism

1. Using a 5/16 in. Allen wrench, remove the four bolts located on top of the motor mount (Figure 3.22).

Figure 3.22. Loosening the bolts on top of the motor mount.

2. Remove the BPC lift mechanism from the motor mount spacer. **Note**: To remove the spacer, remove the four bolts using a 5/16 in. Allen wrench (Figure 3.23).

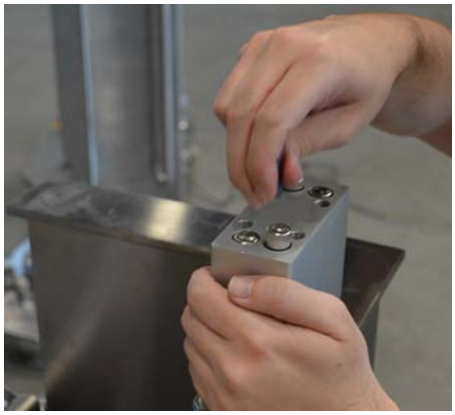

Figure 3.23. Loosening the bolts on top of the motor mount spacer.

3. Replace the BPC lift mechanism and the motor mount spacer using a 5/16 in. Allen wrench, replacing the four bolts that are located on top of the motor mount (Figure 3.24).

Figure 3.24. Securing the bolts on top of the motor mount.

Removing and replacing the 500 L BPC lift mechanism

1. Using a 1/4 in. Allen wrench, remove the four bolts located on the lift arms (Figure 3.25).

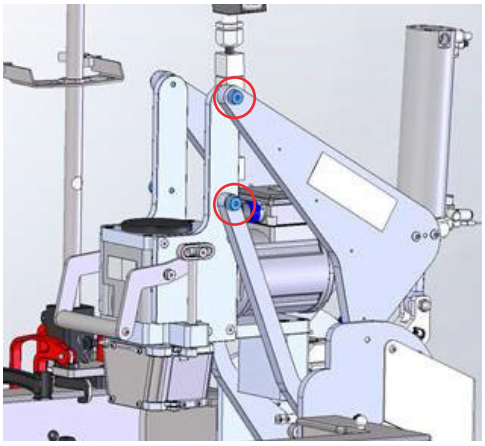

Figure 3.25. Bolts on the lift arm to loosen.

2. Remove the 500 L BPC lift mechanism from the lift arm (Figure 3.26).

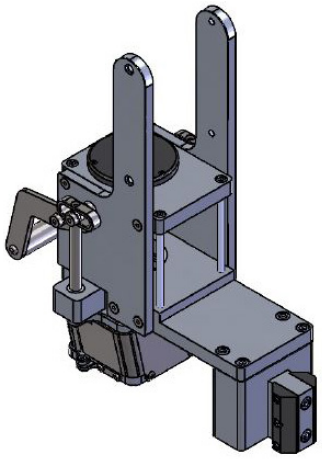

Figure 3.26. Removed 500 L BPC lift mechanism.

3. Replace the BPC lift mechanism in the lift arm using a 1/4 in. Allen wrench, replacing the four bolts that are located on the lift arm (Figure 3.27).

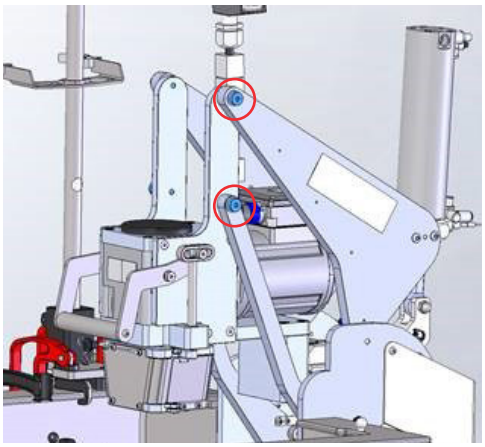

Figure 3.27. Bolts on the lift arm to tighten.

Replacing the motor

1. Carefully replace the motor by placing it back into the motor assembly (Figure 3.28).

Figure 3.28. Replacing the motor from the motor assembly.

2. Replace the hub locking mechanism by sliding the bottom of the hub locking mechanism into the the bottom of the motor assembly (Figure 3.29) and sliding the top of the hub locking mechanism into the top of the motor assembly (Figure 3.30).

Figure 3.29. Replacing the hub locking mechanism at the bottom of the motor assembly.

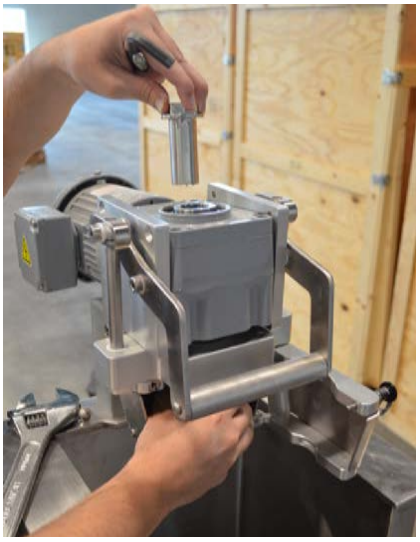

Figure 3.30. Replacing the hub locking mechanism at the top of the motor assembly.

3. Using a 5/16 in. Allen wrench and an adjustable wrench, secure the top bolt located on the top of the assembly lift (Figure 3.31).

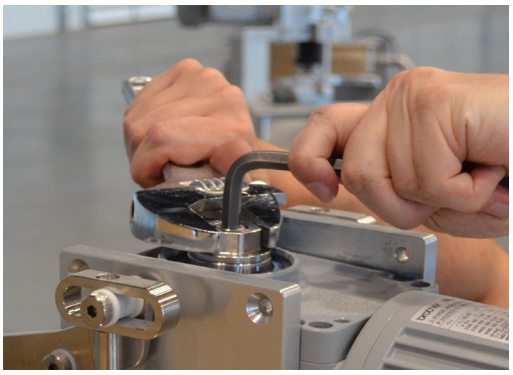

Figure 3.31. Securing the bolt on top of the assembly lift.

4. Replace the top plate of the motor assembly (Figure 3.32).
5. Secure the top two bolts on both sides of the motor assembly using a 5/32 in. Allen wrench (Figure 3.33).

Figure 3.32. Replacing the top plate of the motor assembly.

Figure 3.33. Securing the top two bolts from side of motor assembly.

6. Replace the four long bolts located on the top of the motor assembly using a 7 mm (1/4 in.) Allen wrench (Figure 3.34).

Figure 3.34. Securing one of the four bolts from the top of the motor assembly.

3.6. Replacing the 50 and 500 L load cells

Use the following instructions to replace the load cells and rerouting the wires back into the cart and into the summing block. It is recommended to replace one load cell at a time. See Tables 3.1–3.3 for part numbers based on your system size.

WARNING: Do not attempt to remove or replace any 50 or 500 L DynaDrive S.U.B. load cell cables without the use of a professional electrician. Damage to the equipment and personal injury may occur.

3.6.1. Required parts and tools

- Spare 50 L load cell kit with summing block (part number SV50988.01)
- Spare 500 L load cell kit with summing block (part number SV50988.03)
- Allen wrenches: 1/8, 3/16, and 5/32 in.
- Flathead screwdriver
- Professional electrician

3.6.2. Preparation

1. Ensure that all tri-clamps (three in total) are removed from the base of the legs of the DynaDrive unit (Figure 3.35).

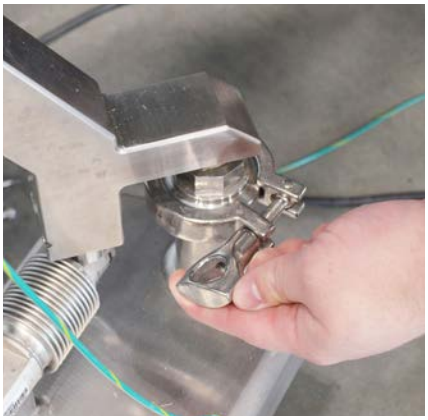

Figure 3.35. Removing the wing nut tri-clamp.

2. Using a 1/8 in. Allen wrench, remove the two bolts that connect the load cell to each of the base of the legs (3) (Figure 3.36).

Figure 3.36. Loosening a bolt securing a load cell to a leg.

3. Twist the load cell lock-out nut clockwise (approximately 6 mm (0.24 in.)) to relieve the pressure from the weight of the DynaDrive unit (Figure 3.37).

Figure 3.37. Twisting load cell lock-out nut clockwise.

4. Use a 3/16 in. Allen wrench, to unscrew the two bolts located on top of each load cell (3) (Figure 3.38).

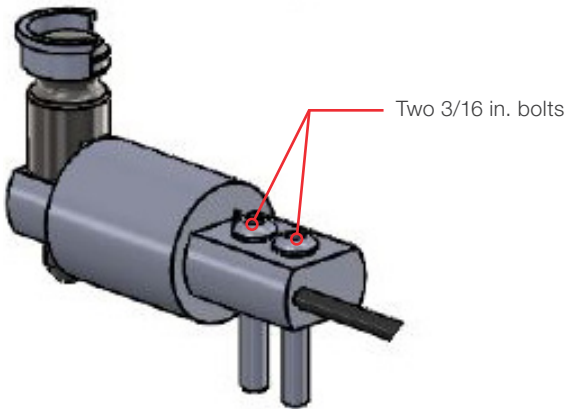

Figure 3.38. Bolts on top of the load cell.

5. Remove the cable wires from the summing block. **Note:** Make sure to make note of where the wires are connected before removing (Figure 3.39).

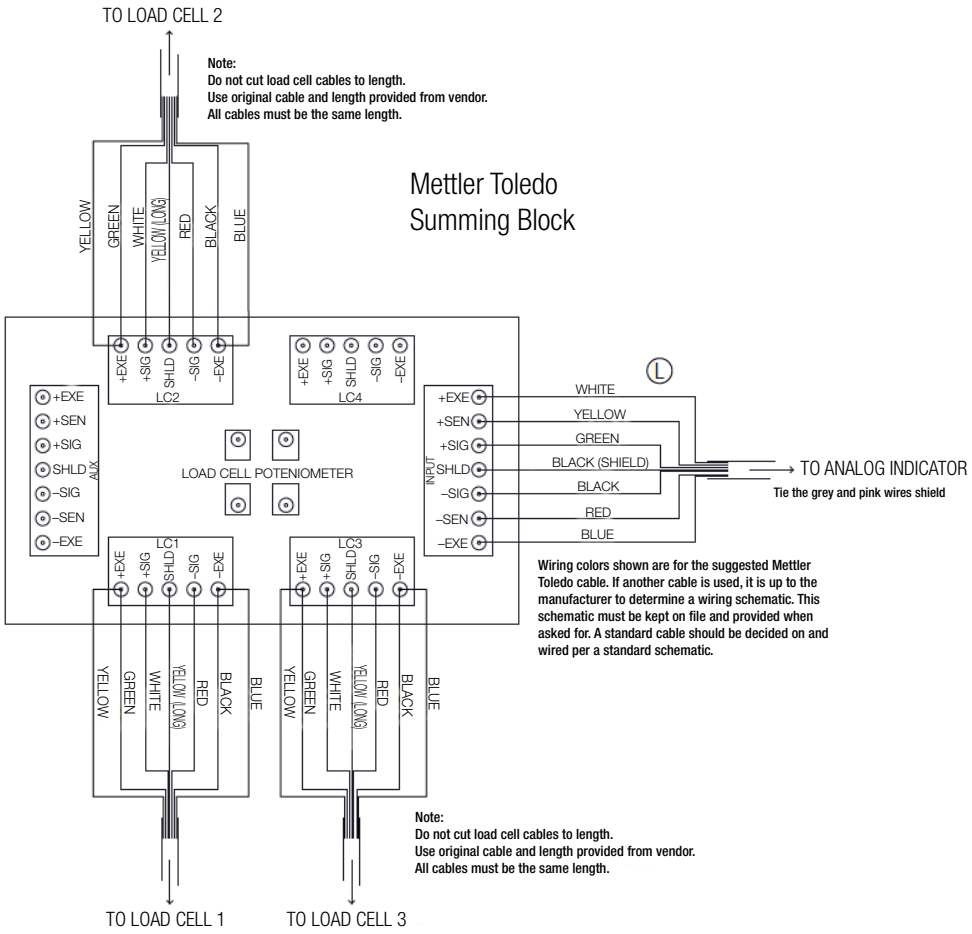

Figure 3.39. Wiring diagram showing connections from the load cell cables to the Mettler Toledo Summing Block.

6. Loosen and remove cables from the liquid tight fitting (Figure 3.40). There are three in total.

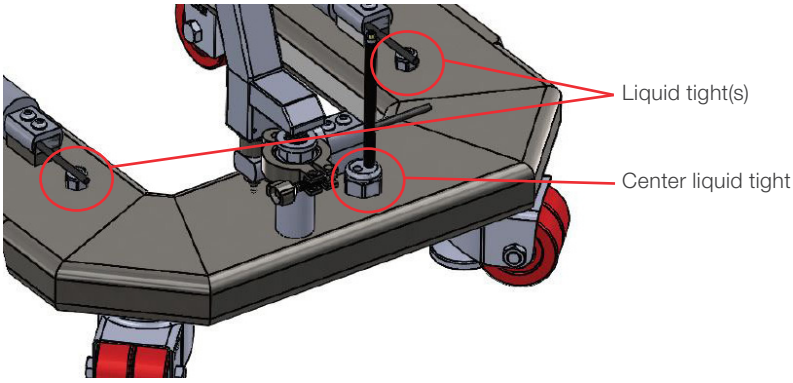

Figure 3.40. Location of load cell cables and liquid tight fittings.

7. Attach a cable router to the end of each of the cables before removing to allow you to more easily replace the new cables.
8. Remove the load cell cables from the summing block if it is a standalone unit. Alternatively, remove the load cell cables from the connector if it is a controller system.
9. Remove the load cell (Figure 3.41).

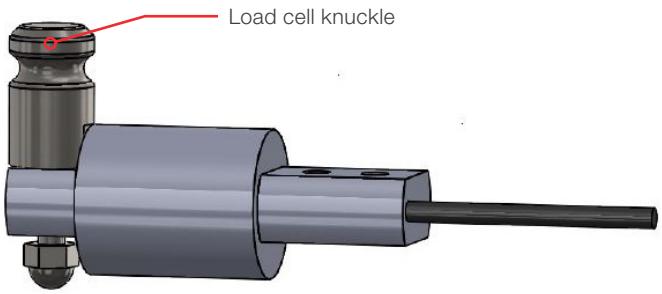

Figure 3.41. Removed load cell.

3.6.3. Replacement procedures

Rewiring the load cells for 50 and 500 L vessels with a controller

To connect the new load cell to a controller you will need to rewire the load cell cable to a 5-pin connector.

1. Use the schematic and Table 3.4 to wire each wire from the load cell cable to the 5-pin connector (Figure 3.42).

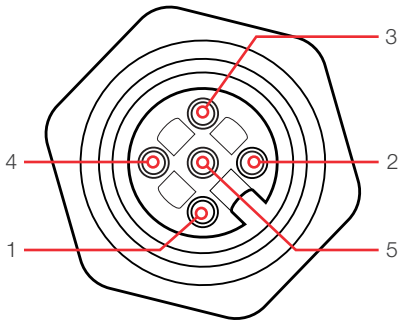

Figure 3.42. Wiring diagram showing connections from the load cell cables to the 5-pin connector.

Table 3.4. 5-pin connector description.

Connector pin	Wire colors	
Connector pin 1	White (SIG –)	Red (SIG –)
Connector pin 2	Green (EXC +)	Green (EXC +)
Connector pin 2	Blue (SENSE +)	Yellow (SENSE+)
Connector pin 3	Red (SIG +)	White (SIG +)
Connector pin 4	Black (EXC –)	Black (EXC –)
Connector pin 4	Brown (SENSE –)	Blue (SENSE –)
Connector pin 5	Yellow (SHIELD)	Yellow-long (SHIELD)

Note: If using a 6-wire load cell, connect "Sense +" to "Excitation +" and "Sense –" to "Excitation –."

2. Use a flathead screwdriver to tighten each screw to secure each wire (Figure 3.43).

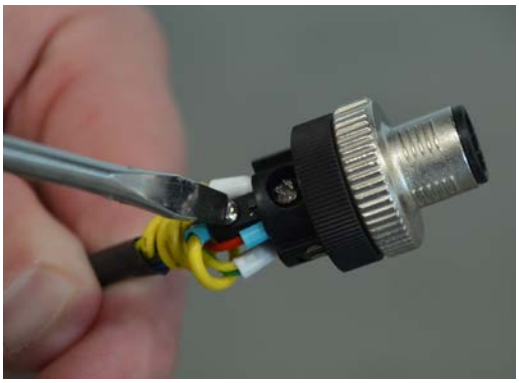

Figure 3.43. Tightening the screw to secure the wire into place.

3. Cover the wiring with the plastic tubing and screw the end to secure the plastic piece to pin-out connector (Figures 3.44 and 3.45).

Figure 3.44. Sliding plastic tubing over wiring.

Figure 3.45. Screwing the end of the plastic tube to the end of the pin-out connector.

4. Slide the remaining plastic piece up to the plastic tube and secure by screwing the piece into tubing (Figures 3.46 and 3.47).

Figure 3.46. Sliding plastic piece up to tubing.

Figure 3.47. Screwing the last plastic piece to the tubing.

Rewiring the load cells for vessels with an E-Box

Important: Wires are calibrated by Mettler Toledo, and cannot be tampered with. Do NOT cut or adjust the length of the wires for any reason.

WARNING: Do not attempt to remove or replace any 50 or 500 L DynaDrive S.U.B. load cell cables without the use of a professional electrician. Damage to the equipment and personal injury may occur.

1. Use a 5/32 in. Allen wrench to remove the two bolts of the summing block plate from the bottom of the cart, and the four bolts in the summing block from the summing block plate (Figure 3.48).

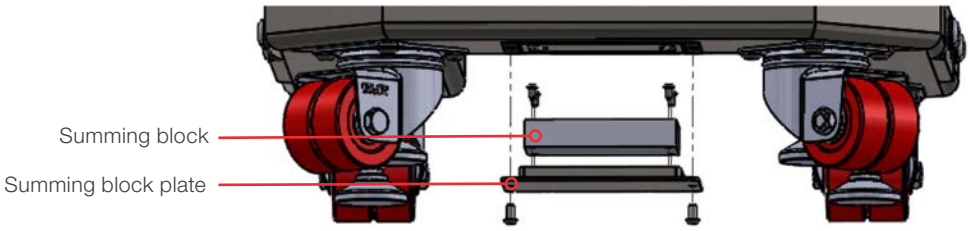

Figure 3.48. Summing block plate and summing block to remove from cart.

2. Connect the load cell wires to the summing block according to the wire schematic in Figure 3.49.

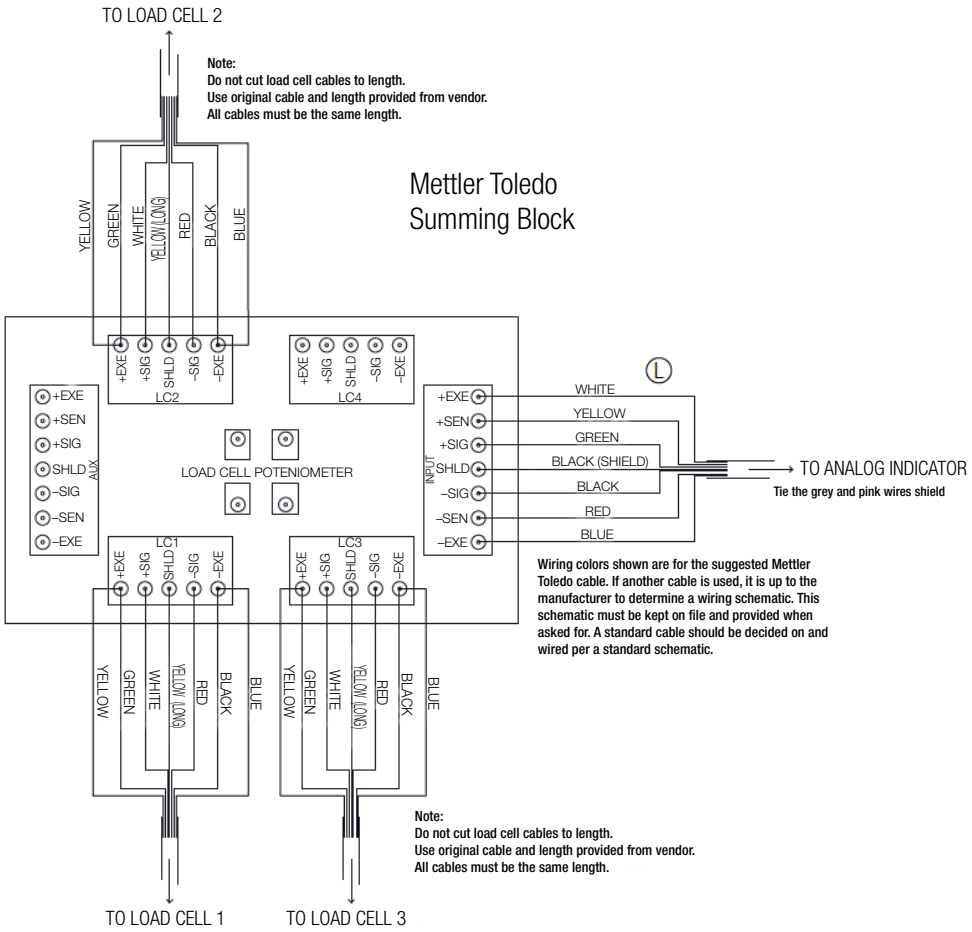

Figure 3.49. Wiring diagram showing connections from the load cell cables to the Mettler Toledo Summing Block.

3. Feed the load cell wires into the liquid tight fitting and through to the summing block (Figure 3.50). **DO NOT CUT ANY LENGTH OFF OF THE LOAD CELL WIRES.**

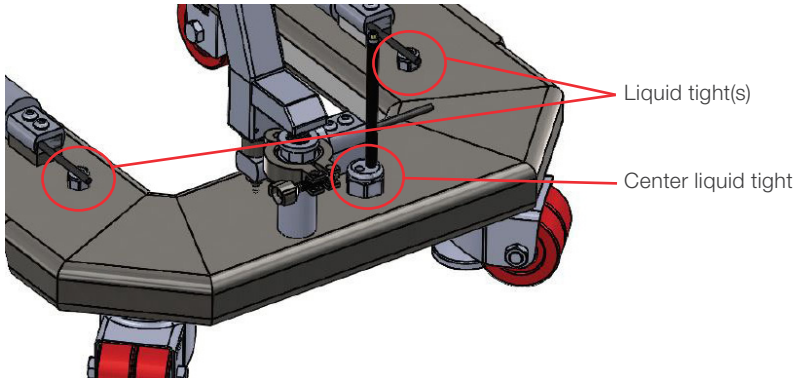

Figure 3.50. Feeding wire through the liquid tight.

Note: The center liquid tight fitting has two holes: one is for the center load cell, the other is for the summing block cable.

4. Feed the summing block cable through the center liquid tight fitting to the summing block (see Figure 3.50) and attach wires according to the wire schematic in Figure 3.49.
5. Coil up excess load cell wire length into the cart body and reattach the summing block and summing block plate to the cart.

Replacing the load cell

1. Insert the delrin slip ring into the hole at the bottom of the tank leg (Figure 3.51). **Note:** These are used to properly center the load cells and must be used to ensure proper security and function.

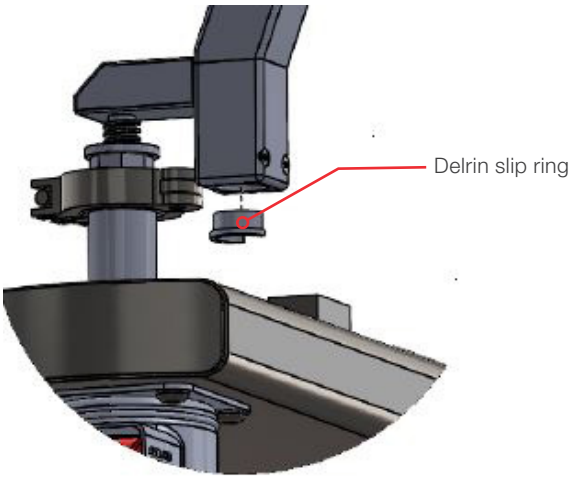

Figure 3.51. Inserting the delrin slip ring into one of the tank legs.

2. Carefully insert the load cell knuckle into one of the tank legs (Figure 3.52). **Note:** Align the load cell stand mount of the load cell with the two threaded holes.

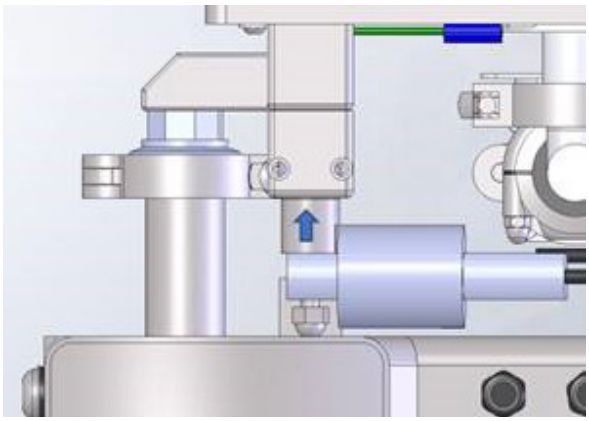

Figure 3.52. Placing load cell on tank base.

3. Fasten the load cell using a 3/16 in. Allen wrench with the two bolts (Figure 3.53). **Note:** Make sure the arrow on the load cell is pointing down.

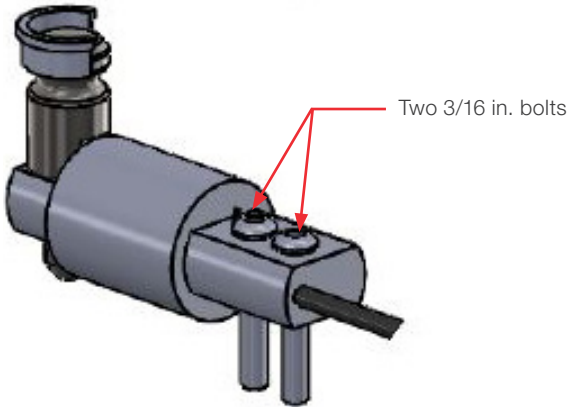

Figure 3.53. Bolts on top of the load cell.

4. Using a 1/8 in. Allen wrench, replace the two bolts that connect the load cell to the base of the leg (Figure 3.54).

Figure 3.54. Replacing the bolts securing the load cell to a leg.

5. Using a crescent wrench, lower the leg by twisting the lock-out nut counter-clockwise until weight is on the load cell (Figure 3.55). **Note:** Lower the nut back down to remove weight off load cell to repeat with the other legs, if necessary.

Figure 3.55. Twisting load cell lock-out nut counter-clockwise.

3.7. Replacing the 3,000 and 5,000 L load cells

Use the following instructions to replace the load cells and rerouting the wires back into the cart and into the summing block. See Tables 3.1–3.3 for part numbers based on your system size.

3.7.1. Required parts and tools

- Spare summing block (part number SV50177.339)
- Spare load cell (part number SV51010.20)
- 5/32 in. Allen wrench
- Crescent wrench
- Hydraulic lift
- Professional electrician

3.7.2. Preparation

Before removing the load cells, you will need to remove the wire cables from the summing block.

WARNING: Do not attempt to remov or replace any 3,000 or 5,000 L DynaDrive S.U.B. load cell cables without the use of a professional electrician. Damage to the equipment and personal injury may occur.

1. Using a 5/32 in. Allen wrench, remove the four outer bolts on the summing block (Figure 3.56).

Figure 3.56. Four bolts on the summing block to remove.

2. Remove the cable wires from the summing block. **Note:** Make sure to make a note of where the wires are connected before removing (Figure 3.57).

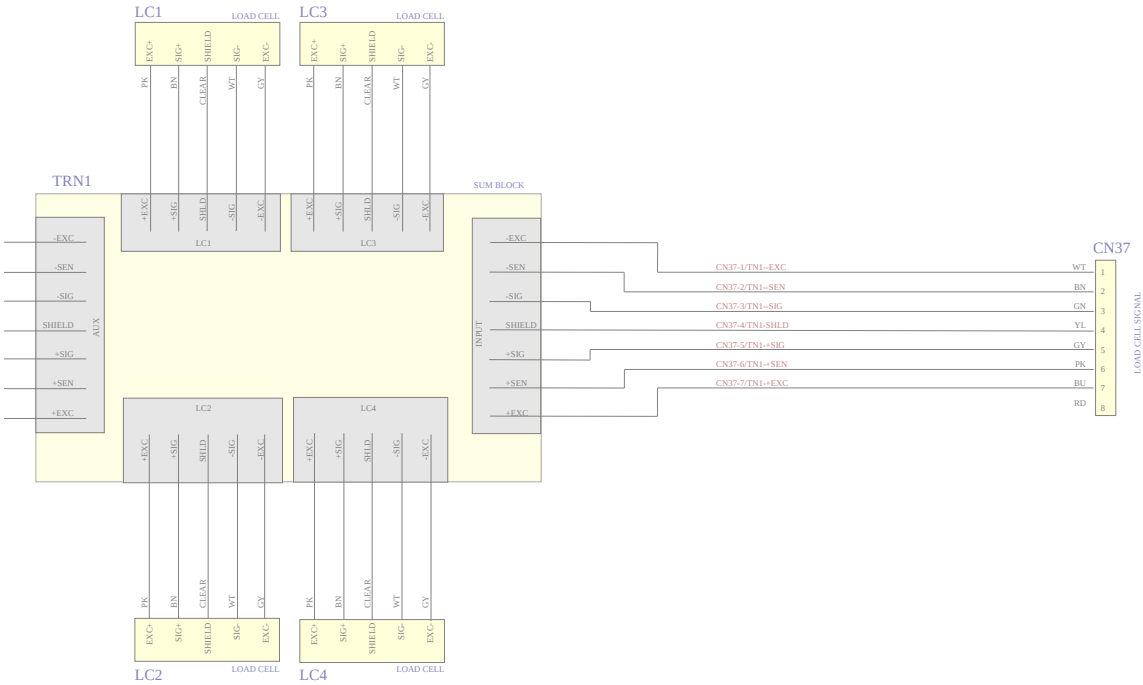

Figure 3.57. Wiring diagram showing connections from the load cell cables to the summing block.

3. Loosen all cable grips from the cables. There are 14 in total.
4. Remove the cables from the unit (Figure 3.58). **Note:** Attach a cable router to the end of each of the cables before removing to allow you to easily replace the new cables.

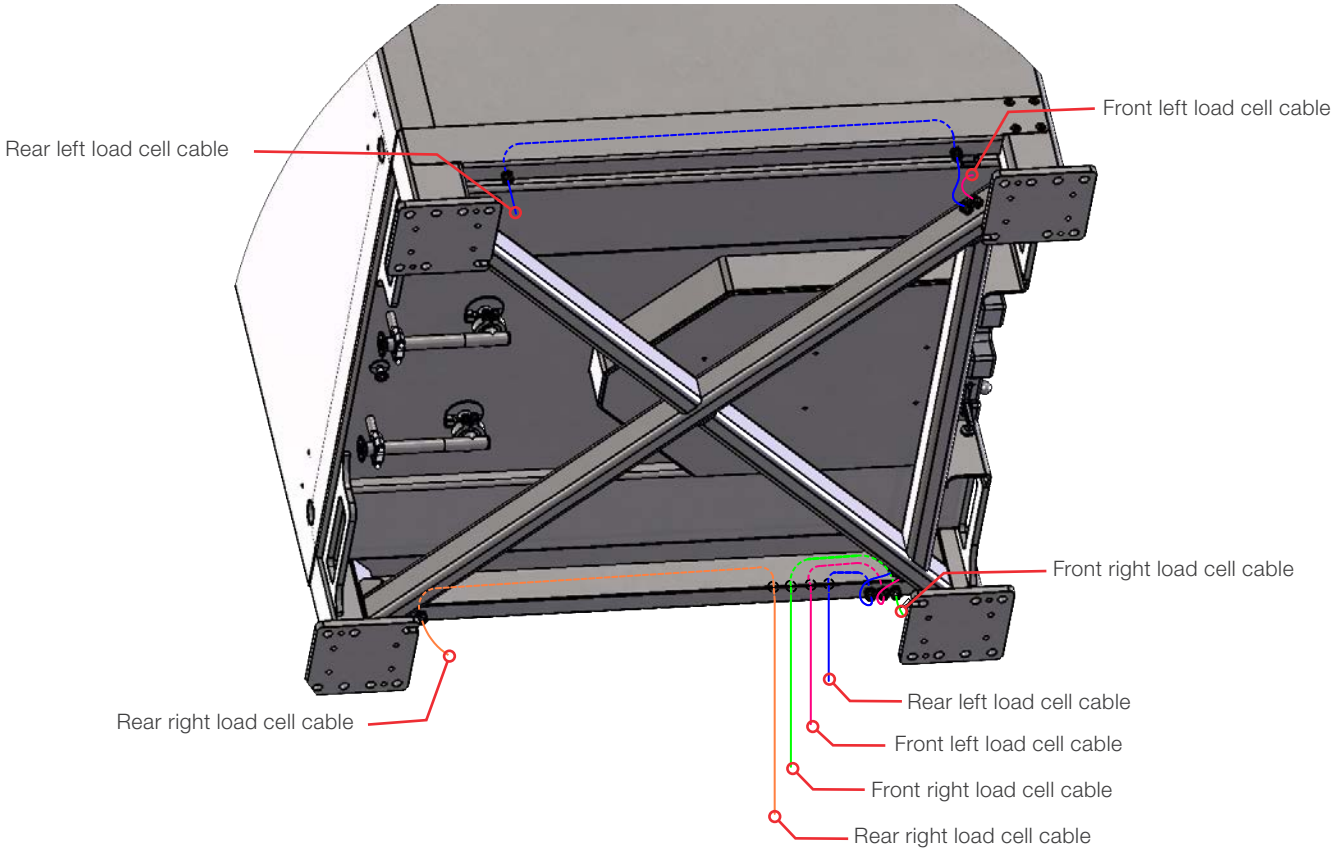

Figure 3.58. Removing the load cell cables from the DynaDrive unit.

3.7.3. Replacement procedures

1. Using a 5/32 in. Allen wrench, remove each foot cover by removing the four bolts (two on each side) (Figure 3.59).

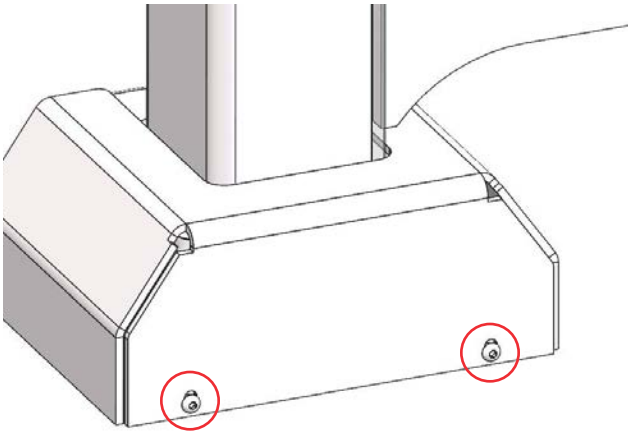

Figure 3.59. Two bolts on the foot cover.

2. Use a hydraulic lift to raise the 3,000 or 5,000 L DynaDrive unit by 1 mm.
3. Once raised, remove the four bolts in the center of each load cell with a crescent wrench (Figure 3.60).

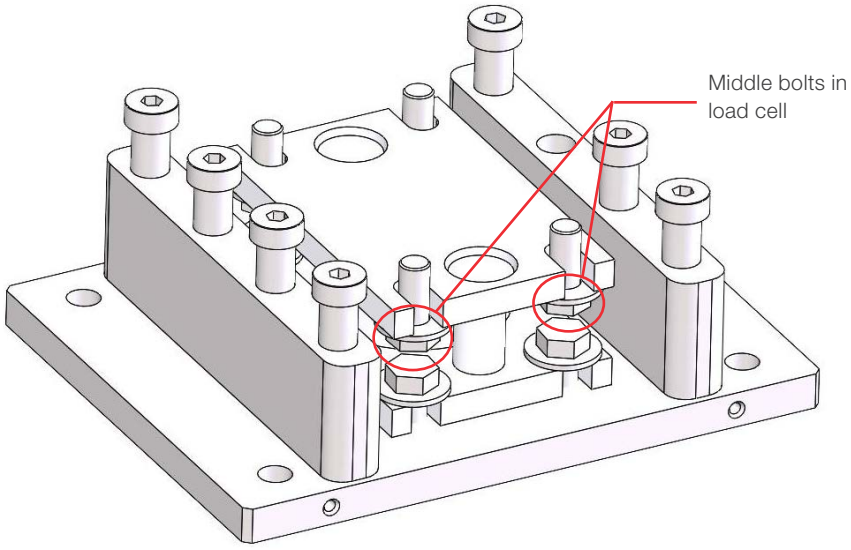

Figure 3.60. Four bolts in the center of the load cell.

4. Slide out the load cell towards you and replace with a new load cell.
5. Replace the four bolts holding the load cell in place (refer to Figure 3.60).
6. Use a hydraulic lift to lower the 3,000 or 5,000 L DynaDrive unit.
7. Using a 5/32 in. Allen wrench, replace each foot cover by replacing the four bolts (refer to Figure 3.59).

Refer to the steps in section 3.7.2 to re-wire the load cell cables back into the DynaDrive unit.

3.8. Replacing the 3,000 and 5,000 L cables and coolant hoses

Use the following instructions to replace the cables and coolant hoses for 3,000 and 5,000 L DynaDrive systems.

3.8.1. Required parts and tools

- Spare cables (part numbers SV51246.04, SV51246.05, and SV51246.06)
- Spare communication/power cable (part number SV51142.711)
- Spare 3,000 L coolant hoses (part numbers SUT30057.01 (6.5 in.) and SUT30057.02 (310 in.))
- Spare 5,000 L coolant hoses (part number SUT30057.01 (6.5 in.) and SUT30057.03 (400 in.))
- Spare tubing clamps (part number SV51246.03)
- Mobile stairs with locking casters

3.8.2. Preparation

Drain any liquid prior to disconnecting coolant hoses.

Note: Make note of how the cables and coolant hoses are placed and wired before you begin to replace these items.

3.8.3. Replacement procedures

For more detailed instructions of replacing cables and coolant hoses, see section 3.3 of the 3,000 and 5,000 L DynaDrive S.U.B. Unpacking and Setup Guide (DOC0176).

3.9. Replacing the 3,000 and 5,000 L pulleys and pulley cables

Use the following instructions to replace the pulleys for 3,000 and 5,000 L DynaDrive systems.

3.9.1. Required parts and tools

- Spare pulleys (part number SV51245.01)
- Spare 1/4 in. cable (part number SV51246.04)
- Flathead screwdriver
- 1/8 in. Allen wrench
- Mobile stairs with locking casters
- Pliers

3.9.2. Preparation

1. Lower the platform completely.
2. Open the HMI control box and remove the plate that covers the pneumatic valves with an 1/8 in. Allen wrench (Figure 3.61).

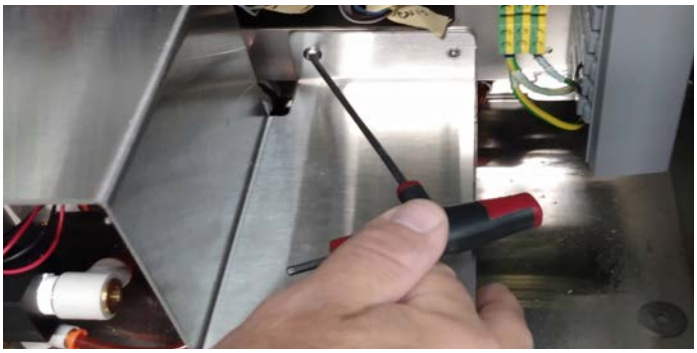

Figure 3.61. Removing the plate that covers the large valve.

3. Use a flathead screwdriver to press and hold the blue button on the B-side large valve to manually lower the cables until you have enough slack to begin replacing the pulleys (Figure 3.62).

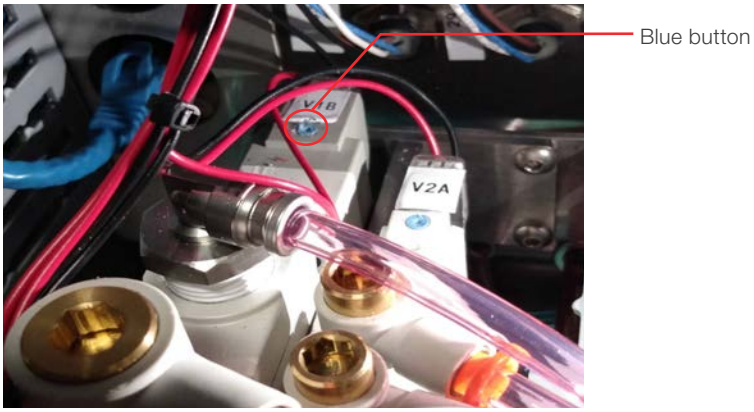

Figure 3.62. Blue button on the B-side large valve.

3.9.3. Replacement procedures for pulleys

1. Using a flathead screwdriver, remove the far right c-clip on the pulley assembly (Figure 3.63).

Figure 3.63. Removing the far right c-clip on the pulley assembly.

2. Pull pin out to remove the end of the cables (Figures 3.64 and 3.65).

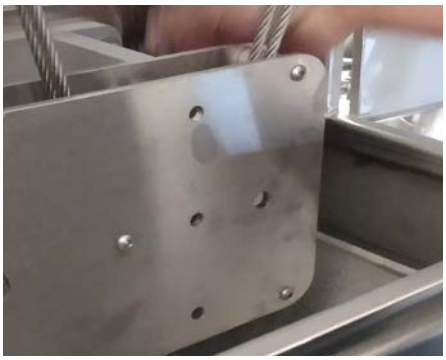

Figure 3.64. Removing the pin from the pulley assembly.

Figure 3.65. Removing the end of the cables from the pulley assembly.

Note: It is recommended to replace each pulley one at a time to make it easier to replace the cables correctly. Begin with the pin on the far right and work your way to the left.

3. Remove the c-clip and pin (Figure 3.66) to remove the individual pulleys and two spacers (Figures 3.67 and 3.68).

Figure 3.66. Removing the c-clip and pin.

Figure 3.67. Removing the front spacer from the pulley.

Figure 3.68. Removing the back spacer and pulley from the pulley assembly.

4. After you have removed the pulley, replace the new pulley and spacers into the pulley assembly (Figure 3.69).

Figure 3.69. Replacing the back spacer and pulley.

5. Align the pulley and spacers in the pulley assembly space (Figure 3.70). **Note:** Make sure the cables are in the correct cable grooves and are aligned correctly.

Figure 3.70. Replacing the front spacer to the pulley in the pulley assembly.

6. Push the pin through the center hole of the pulley assembly and pulley to re-attach the c-clip to the pin (Figure 3.71).

Figure 3.71. Replacing the c-clip and pin.

Notes:

- It is recommended to remove and replace one pulley at a time.
- To re-tighten the cables, it is recommended to manually lift the platform using the large valve button (located in the HMI fuse box) to ensure the cables are aligned properly.

3.9.4. Replacement procedures for pulley cables

1. Follow steps 1 and 2 in section 3.9.3.
2. Use the mobile stairs to locate the other end of the 1/4 in. cables (Figure 3.72).

Figure 3.72. Top end of the 1/4 in. cables.

3. Using a pair of pliers, remove the locking pin and pull out the pin keeping the cables in place.
4. Replace the 1/4 in. cables, starting at the top and wire the cables through the pulleys.

Note: It is recommended to remove and replace one cable at a time to help keep the pulley cables in order.

3.10. Replacing the 3,000 and 5,000 L BPC lift cylinder

Use the following instructions to replace the BPC lift cylinder for 3,000 and 5,000 L DynaDrive systems.

3.10.1. Required parts and tools

- Spare BPC lift cylinder (part number SV51245.08)

3.10.2. Preparation

Lower the platform until it rests on the stops inside the tank. Loosen the cables using the valve. See section 3.9.2.

3.10.3. Replacement procedures

For more detailed instructions of replacing the BPC lift cylinder, see section 3.2 of the 3,000 and 5,000 L DynaDrive S.U.B. Unpacking and Setup Guide (DOC0176).

3.11. Replacing the 3,000 and 5,000 L platform locking mechanism

Use the following instructions to replace the platform locking mechanism for 3,000 and 5,000 L DynaDrive systems.

3.11.1. Required parts and tools

- Spare platform locking mechanism (part number SV51245.20)
- Allen wrenches: 5/32 and 3/8 in.
- Mobile stairs with locking casters
- Pliers

3.11.2. Preparation

1. Using the mobile stairs, locate the locking mechanism platform and the locking cylinder at the top of the unit (Figure 3.73).

Figure 3.73. Location of the locking mechanism platform and locking cylinder.

2. Using a pair of pliers, locate and remove the locking pin attached to the locking cylinder arm and platform locking mechanism (Figure 3.74).

Figure 3.74. Removing locking pin from locking cylinder arm.

3. Remove pin holding the locking cylinder and locking mechanism platform together. Push the locking cylinder to the side (Figure 3.75).

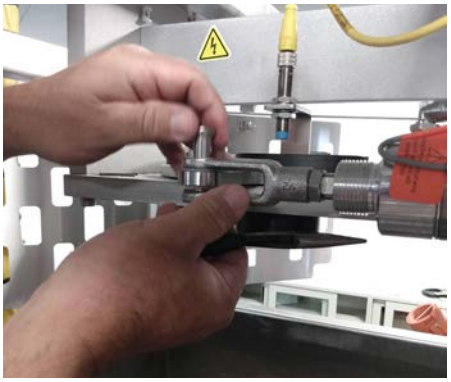

Figure 3.75. Removing pin from locking cylinder arm and locking mechanism platform.

4. Using a 5/32 in. Allen wrench, remove two bolts to detach the sensor bracket from the top of the locking mechanism platform (Figures 3.76 and 3.77).

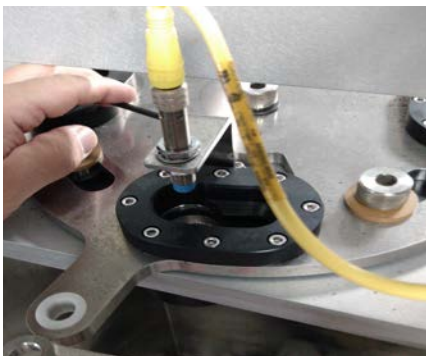

Figure 3.76. Removing the two bolts from the sensor bracket.

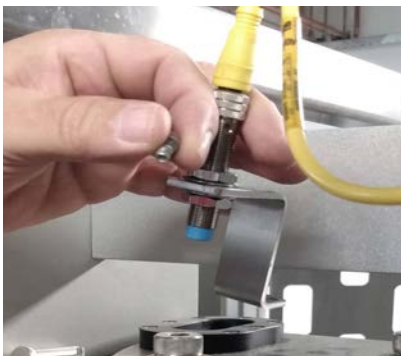

Figure 3.77. Detaching the sensor bracket.

3.11.3. Replacement procedures

1. Using a 3/8 in. Allen wrench, remove the three bolts holding the locking mechanism platform in place (Figure 3.78).

Figure 3.78. Removing bolts from the locking mechanism platform.

2. Remove the platform locking mechanism. Replace with new platform locking mechanism.
3. Using a 3/8 in. Allen wrench, replace the three bolts holding the platform locking mechanism in place (refer to Figure 3.78).
4. Using a 5/32 in. Allen wrench, replace two bolts to attach the sensor bracket on the top of the platform locking mechanism (Figure 3.79).

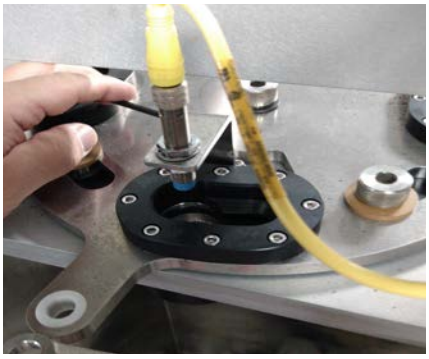

Figure 3.79. Replacing the two bolts to the sensor bracket.

5. Replace pin holding the locking cylinder arm and platform locking mechanism together (Figure 3.80).

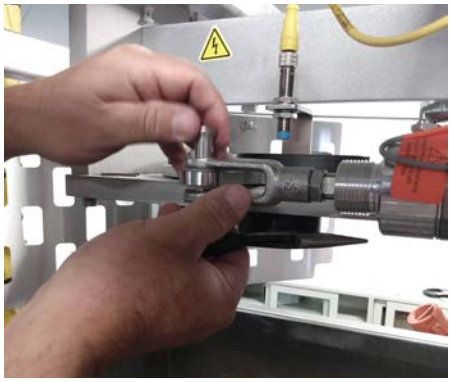

Figure 3.80. Replace pin to locking cylinder arm and locking mechanism platform.

6. Using a pair of pliers, insert the locking pin into the pin locking cylinder arm and platform locking mechanism and re-position the locking pin (Figure 3.81).

Figure 3.81. Replacing locking pin to locking cylinder arm.

3.12. Replacing the 3,000 and 5,000 L assembly bottom hub clamp

Use the following instructions to replace the assembly bottom hub clamp located on the bottom of the 3,000 and 5,000 L DynaDrive unit. See Tables 3.1–3.3 for part numbers based on your system size.

3.12.1. Required parts and tools

- Spare assembly bottom hub clamp (part number SV51245.21)
- 7/32 in. Allen wrench

3.12.2. Preparations

Ensure the BPC is removed from DynaDrive unit before installation.

3.12.3. Replacement procedures

1. Remove the bottom hub clamp assembly by unscrewing the six bolts using the 7/32 in. Allen wrench (Figure 3.82).

Figure 3.82. Removing one of six bolts from bottom hub clamp assembly.

2. Replace with the new bottom hub clamp assembly by screwing in the six bolts using the 7/32 in. Allen wrench (Figure 3.83).

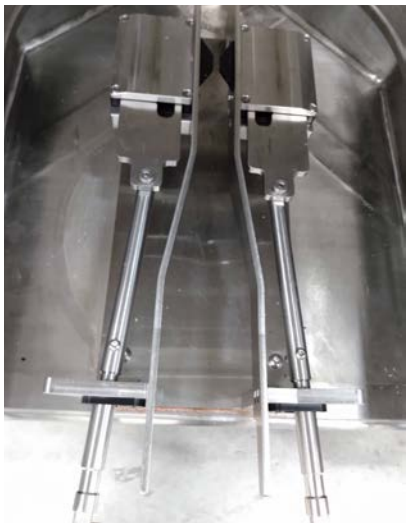

Figure 3.83. Replacing bottom hub clamp assembly.

3.13. Replacing the 3,000 and 5,000 L condenser heater

Use the following instructions to replace the condenser heaters for 3,000 and 5,000 L DynaDrive systems.

3.13.1. Required parts and tools

- Spare condenser heater (part number SV51248.02)
- Tool to cut cable ties

3.13.2. Preparation

Remove cable ties holding the heater cables down.

3.13.3. Replacement procedures

1. Press in the button that releases the lock pin, then pull out the lock pin (Figure 3.84).

Figure 3.84. Removing the lock pin.

2. Unplug the condenser heater from the variable frequency drive (VFD) electrical box from the filter heater ports (Figure 3.85).

Figure 3.85. VFD electrical box and filter heater ports.

3. Pull the condenser heater towards you off of the heater mount (Figure 3.86).

Figure 3.86. Removing the condenser heater from the heater mount.

4. Replace with the new condenser heater by sliding the heater onto the heater mount (Figure 3.87).

Figure 3.87. Replacing the condenser heater from the heater mount.

5. Plug the condenser heater cables into the filter heater ports (labeled Heater 1 and 2) (Figure 3.88).

Figure 3.88. VFD electrical box and filter heater ports.

6. Replace lock pin (Figure 3.89).

Figure 3.89. Replacing the lock pin.

3.14. Additional replacement parts and part numbers

The following table lists part numbers for replacing additional DynaDrive S.U.B. system components.

Table 3.5. Additional replacement parts and part numbers.

Components	Cat. no
50 L S.U.B. cable management system	SV50992.01
500 L S.U.B. cable management clip	SV51255.01
3,000 and 5,000 L S.U.B. cable management clip	SV51245.16
50 L foam probe holder	SV51253.01
500 L foam probe holder	SV51253.02
3,000 and 5,000 L foam probe holder	SV51245.19
Double probe clips	SV51256.01
50 L BPC top tab holder	SV51252.01
500 L BPC top tab holder	SV51254.01
3,000 and 5,000 L large tubing hook assembly	SV51245.05
3,000 and 5,000 L large tubing hook short part	SV51245.15
3,000 and 5,000 L large tubing hook tall part	SV51245.14

3.14.1. Installing tubing management system

1. Clip the tubing management part in the desired location and orientation anywhere along the vertical handle bar.

   Note: The part will snap into place with a medium amount of force (Figure 3.90).

Figure 3.90. Tubing management system clipped to the handle bar.

3.14.2. Installing foam probe holder

1. Snap or slide the foam probe holder into place on the left side of the top rim of the unit.
2. Adjust location as needed to ensure alignment with the foam probe tube (Figures 3.91–3.93).

Note: The foam probe tubing must be clipped into this holder to ensure the probe stays vertical and does not interfere with the drive system.

Figure 3.91. 50 L foam probe holder.

Figure 3.92. 500 L foam probe holder.

Figure 3.93. 3,000 and 5,000 L foam probe holder.

3.14.3. Installing BPC tab holders

1. Slide each holder into place on the left and right side of the top rim (Figures 3.94 and 3.95).

Figure 3.94. Sliding 50 L BPC tab holder into place.

Figure 3.95. Sliding 500 L BPC tab holder into place.

2. Ensure you slide the holders far enough onto the rim that they will not fall off the front (Figure 3.96).

Figure 3.96. BPC tab holder in place.

3. Pull each BPC tab up in front of the tab holder, and then push the tab onto the tab holder sphere to secure the BPC in place (Figures 3.97 and 3.98).

Figure 3.97. Pulling BPC tab over onto the tab holder sphere.

Figure 3.98. BPC tab on tab holder sphere.

4

Recommended spare part inventory

Spare part inventory of each customer should be based on failure risk.

The following tables list part numbers for additional DynaDrive S.U.B. system components, such as load cell kits and accessories.

Table 4.1. Harsh mount load cell display part numbers for 50 and 500 L systems using the Thermo Scientific E-Box.

Components	Cat. no
Mettler Toledo IND331 display, harsh mount style with analog interface (STD), 120 VAC US line cord/plug	SV50177.306
Mettler Toledo IND331 display, harsh mount style with Allen-Bradley RIO interface, 120 VAC US line cord/plug	SV50177.307
Mettler Toledo IND331 display, harsh mount style with Device Net interface, 120 VAC US line cord/plug	SV50177.308
Mettler Toledo IND331 display, harsh mount style with Ethernet/IP and Modbus TCP interface, 120 VAC US line cord/plug	SV50177.309
Mettler Toledo IND331 display, harsh mount style with Profibus interface, 120 VAC US line cord/plug	SV50177.310

Table 4.2. 50 L DynaDrive vent filter heater kit part numbers for use with Pall KA3 vent filters. Includes vent filter heater, controller with water-tight closure, quick-connects, and installation power cord.

Components	Cat. no
120 VAC, 23.8 W, Pall Kleenpak KA3 series 46 vent filter heater, integrated, M12–4 pin connector (used when integrated with controller)	SV50191.45
240 VAC, 30.3 W, Pall Kleenpak KA3 series 46 vent filter heater, integrated, M12–4 pin connector (used when integrated with controller)	SV50191.46

Table 4.3. 500 L DynaDrive vent filter heater kit part numbers for use with Messner 10 in. series 46 vent filters. Includes vent filter heater, controller with water-tight closure, quick-connects, and installation power cord.

Components	Cat. no
120 VAC, 99.6 W, Meissner 10 in. series 46 vent filter heater, integrated, M12–4 pin connector (used when integrated with controller)	SV50191.47
240 VAC, 99.6 W, Meissner 10 in. series 46 vent filter heater, integrated, M12–4 pin connector (used when integrated with controller)	SV50191.48

Table 4.4. Vent filter heater kit part numbers for use with Pall KA3 vent filters. Includes vent filter heater, controller with water-tight closure, quick-connects, and installation power cord.

Components	Cat. no
NEMA rated vent heater with programmable controller (100–120 VAC), power cord. Includes low-temp. alarm, preset temp. 50°C, and power cord with flying leads.	SV50191.11
NEMA rated vent heater with programmable controller (200–240 VAC), power cord. Includes low temp. alarm, preset temp. 50°C, and power cord with flying leads.	SV50191.13

Table 4.5. Vent filter heater kit part numbers for use with Meissner Ultracap 10 in. vent filters. Includes vent filter heater, controller with water-tight closure, quick-connects, and installation power cord.

Components	Cat. no
NEMA rated vent heater with programmable controller (100–120 VAC). Includes low-temp. alarm, preset temp. 50°C, and 20 ft. NEMA 5-15 power cord for US/Japan.	SV50191.16
NEMA rated vent heater with programmable controller (200–240 VAC). Includes low temp. alarm, preset temp. 50°C, and 20 ft. BS1363 power cord for UK.	SV50191.17
NEMA rated vent heater with programmable controller (200–240 VAC). Includes low temp. alarm, preset temp. 50°C, and 20 ft. CEE7/7 power cord for Europe.	SV50191.18
NEMA rated vent heater with programmable controller (200–240 VAC). Includes low temp. alarm, preset temp. 50°C, and 12 ft. IEC320 power cord for 2,000 L S.U.B. control box.	SV50191.19

Table 4.6. AC motor part number.

Components	Cat. no
50 L DynaDrive S.U.B. AC motor	SV51241.01
500 L DynaDrive S.U.B. AC motor	SV51241.02

Table 4.7. Miscellaneous and accessory part numbers.

Components	Cat. no
Probe assembly with CPC AseptiQuik connector (non-sterile, for use in autoclave)	SH30720.02
Probe assembly with Pall Kleenpak connector (non-sterile, for use in autoclave)	SH30720.01
Heavy-duty tubing clamp—single	SV20664.01
Heavy-duty tubing clamp—pack of 10	SV20664.04
Stainless steel autoclave tray, for autoclaving probe assemblies	SV50177.01
Sterile sampling manifold with luer lock—single	SH30845.01
Sterile sampling manifold with luer lock—pack of 10	SH30845.02
Adjustable filter bracket (50 and 500 L units only)	SV50177.313
Assembly retractor (3,000 and 5,000 L units only)	SV51245.11–12
1 in. series N66 ball valve (3,000 and 5,000 L units only)	SV50177C.17
Motor sleeve assembly (3,000 and 5,000 L units only)	SV51242.03
Stroke tie rod cylinder (3,000 and 5,000 L units only)	SV51245.02
6-pin shielded cable (3,000 and 5,000 L units only)	SV51245.18
Flex drive safety circuit (3,000 and 5,000 L units only)	SV30207.01

5

Troubleshooting and frequently asked questions

Chapter contents

5.1 Hardware operation issues
5.2 Cell culture operation issues
5.3 Sparging issues
5.4 Probe and connector issues
5.5 Other issues

5.1. Hardware operation issues

Issue: The DynaDrive S.U.B. will not operate.

Solutions:

Check the power supply.

- Verify the position of the main electrical plug connection at the wall outlet, the main power disconnect, and the emergency stop switch.
- Verify the condition of the main electrical circuit breaker at your facility. If the protection breaker has been tripped, determine the fault condition. The condition may exist where other electrical systems are requiring current loads beyond those allowed by the breaker. The DynaDrive S.U.B. system should be placed on its own electrical circuit.
- Disconnect the main power cord. Inspect the electrical circuit breakers and fuses inside the electrical box of the S.U.B. controller. Determine the fault condition by visual inspection. If the fault condition cannot be determined by visual inspection, contact the manufacturer.

Issue: The DynaDrive S.U.B. temperature is below target or slow to respond.

Solutions:

Check the temperature controller and sensor.

- Verify that the temperature probe (RTD) is not loose, and has been fully inserted into the BPC thermowell.
- Verify that the thermowell has been filled with sufficient glycerol to aid in heat transfer.
- Verify that the temperature control unit (TCU) is operating, and all of the ball valves are open.
- Verify that the system is filled with a sufficient volume of fluid. There must be enough media (minimum volume) in the BPC to provide contact with the container. Add more media if the BPC is not touching the heater area.

Issue: Noise is being emitted from the mixer assembly.

Solution:

No action is required.

The bearing port assembly supplied with the DynaDrive S.U.B. is an important component in maintaining a sterile environment during cell growth. The special seals used in the DynaDrive S.U.B. may generate some noise during operation, particularly after the first day of operation. This noise may vary in intensity and frequency, but generally has no significant effect on performance or overall durability of the BPC during the intended life of the product.

Issue: The mixer controller does not respond to user inputs.

Solutions:

Allow the speed to stabilize before using the keypad interface.

- Adjusting the speed control too rapidly may require several seconds for speed stabilization.
- Wait ten seconds, then attempt to adjust the speed at the keypad interface.
- Verify the position of the input select switch of the variable frequency drive (VFD). If the toggle switch is not in the middle position, the controller will not be able to receive control inputs from the control keypad on the front panel.

Issue: I typically use level sensors to control the volume and feed rate or supplement during a bioreactor run; how would I do this with the DynaDrive S.U.B.?

Solution: **Use load cells or a scale to control volumes based upon weight.**

The DynaDrive S.U.B. is not equipped with level sensors. However, the S.U.B. can be set up to allow supplement feeds and volumes to be managed by weight.

5.2. Cell culture operation issues

Issue: Dissolved oxygen readings are low or slow to respond.

Solutions: **Check the physical condition of the dissolved oxygen (DO) probe, the calibration of the probe, and gas flow rate into the DynaDrive S.U.B.**

- DO probes require routine maintenance; replace the damaged probe or membrane when necessary.
- Verify the DO probe calibration relative to setpoints of zero and span.
- Inspect the line sets connected to direct spargers for restriction (closed tubing clamp, pinched line, low supply pressure).

Issue: Dissolved oxygen readings are erratic or unstable.

Solutions: **Adjust the bioreactor controller to suit the volume of your DynaDrive S.U.B. system.**

- Many different parameters can affect the ability of a bioreactor controller to maintain a target setpoint during process control. Modern controllers utilize computer algorithms to adjust targeted parameters; the most common technique is that of a tunable controller that uses variables of the proportional integral derivative (PID). Tuning these PID values to the specific characteristics of the system dynamics will, in most cases, stabilize process parameters to an acceptable level. We recommend that you consult the user guide of the particular bioreactor controller you are using.
- A grounding reference to the media can be created by using a grounding lead between the tank and the body of the stainless steel DO probe or to the stainless steel connector (if present) on the sample line of the BPC.

Issue: pH levels are questionable or out of range.

Solutions: **Verify the calibration of the probe and utilize either media or gas buffers.**

- pH levels can be managed in a similar manner to conventional bioreactors once calibration of the probe is verified by use of an off-line sample. Carbon dioxide gas sparged through the media or headspace, biocarbonate levels in the media and the addition of liquid titrant solutions all serve to manage the pH balance of the bioreactor environment. See section 3.5.4 for more information on probe calibration in the DynaDrive User's Guide (DOC0090).
- A grounding reference to the media can be created by using a grounding lead between the tank and the body of the stainless steel DO probe or to the stainless steel connector (if present) on the sample line of the BPC.

Issue: **We are not achieving the cell growth we expected in the DynaDrive S.U.B. while running under our normal bioreactor agitation and sparging rates. What should we do?**

Solutions: **Reduce agitation and sparging rates.**

- Often low cell viability and cell growth can be attributed to excessive sparging or agitation. We recommend that you reduce the sparge rate compared to what you might use in a conventional bioreactor. Gas flow rates supplied as overlay should also be reduced as much as possible. Too much gas creates excess foam and higher shear conditions. Provide only the level of agitation needed (low viability and lysed cells), reduce agitation speed (cell aggregation and settling), and increase agitation.
- Media formulation can also have a significant effect on cell culture growth in the DynaDrive S.U.B. Surfactants such as Pluronic™ decrease shear and increase kLa, but at a cost of increased foaming. Thermo Scientific can offer custom media especially for the S.U.B. and your specific cell line(s).

5.3. Sparging issues

Issue: **There is excessive foam in the bioreactor headspace.**

Solutions: **Alter the liquid surface tension related to the culture media and/or sparge gas.**

- A media supplement of antifoam can be used in the DynaDrive S.U.B. These serve to lower the surface tension of the media and will reduce the presence of foam.
- High sparge rates of air can result in the presence of excessive foam. Testing has shown that sparging with oxygen will typically result in a dramatic reduction of foam in the headspace.

Issue: **The sparger does not seem to be working although gas is present.**

Solutions: **Allow the sparger membrane to purge.**

- If the DynaDrive S.U.B. is filled with liquid and allowed to sit idle for extended periods of time without gas being supplied to the sparger, liquid can accumulate between the membrane and check valve. Various media additives may restrict the membrane temporarily. Several minutes of gas pressure being supplied to the sparger should purge the membrane, allowing it to function properly.
- Certain operating conditions can create situations when the sparger membrane may become restricted due to insufficient line pressure from the bioreactor controller gas feed line. Increasing the flow rate to one liter per minute, or momentarily raising the pressure regulator outlet pressure to 0.34 bar (5 psi) may alleviate the problem. Alternatively, several seconds at this higher pressure will allow the membrane to purge pores that may be blocked due to the presence of accumulated liquid.

5.4. Probe and connector issues

Issue: We forgot to introduce the pH and DO probes prior to media fill; can we still make a sterile connection under these conditions?

Solutions: Yes, as long as the clamps were closed on the aseptic connector probe ports before liquid fill.

- The aseptic connectors must be dry to make the connection of the probe assemblies. When media is already present in the DynaDrive S.U.B., follow the probe insertion procedures as outlined in section 3.5.3 in the DynaDrive User's Guide (DOC0090).
- Some fluid may enter the bellows when the probe is inserted into a BPC already filled with media. This is normal and will not affect the sterility of the system.

5.5. Other issues

Issue: The BPC seems overly tight.

Solution: Verify that the container is venting and inspect it for the cause of overpressure.

- Reduce the inlet gas flow rate of overlay and direct sparger.
- Inspect the exhaust filter for restriction or blockage.
- Excessive foaming should be avoided for several reasons. If foam levels are allowed to reach the exhaust filter, the filter will become restricted, resulting in excessive internal pressure within the confines of the DynaDrive S.U.B. This may cause product failure and bursting of the BPC.

Issue: The pneumatic lift is not working.

Solutions: Verify that the air is turned on, the controller has power, and double-check all of your sensors.

6

DynaDrive S.U.B. specifications

Table 6.1. 50 L DynaDrive S.U.B. specifications.

	Specification
Bioreactor geometry	
Rated liquid working volume	50 L
Minimum liquid working volume	5 L
Total reactor volume (liquid & gas)	66 L
BPC chamber diameter	29 cm (12 in.)
BPC chamber shoulder height	102 cm (40 in.)
Liquid height at rated working volume	74 cm (28 in.)
Fluid geometry at working volume (height/diameter) ratio	2.9:1
Overall reactor geometry (height/diameter ratio)	3.8:1
Impeller	
Impeller (quantity x blade count)	3 x 2 modified pitch blade, 1 x 2 sweep impeller
Impeller scaling (impeller diameter/tank diameter)	0.37
Impeller diameter	11 cm (4 in.)
Impeller calculated power number (N)	4
Agitation	
Agitation speed range of VFD	30–200 rpm ± 1.5 rpm or 1% of setpoint, whichever is greater
Recommended minimum during cell culture agitation (at all volumes)	120 rpm
Nominal tip speed	68 cm/s (27 ft./min.)
Motor	
Agitation motor drive (type, voltage, phase)	IPM, 230 VAC, 3
AC motor power rating	186.4 W (0.25 hp)
Motor torque rating	9.5 Nm (82 in.-lb)
Gear reduction	10:1
Programmable VFD, remote panel interface, power fault auto restart	Standard
Motor communication methods (for external controller)	0-10 V, 4-20 mA
Temperature control	
Jacket area: full/10% volume	0.51 m^2/0.06 m^2 (5.5 $ft.^2$/0.65 $ft.^2$)
Jacket volume	3 L
Jacket flow rate at 3.4 bar (50 psi)	136 L/min.
Process connection	1.5 in. Sanitary tri-clamp
Nominal heating/cooling load (W)	500 W
Approximate liquid heat-up time (5°C to 37°C)—10% volume, with ThermoFlex 10,000 TCU	2 hr
Approximate liquid heat-up time (5°C to 37°C)—100% volume, with ThermoFlex 10,000 TCU	2 hr
RTD or thermocouple: 3.18 mm (1/8 in.) OD, 15.24 cm (6 in.) length	RTD: Pt-100 (standard)

Table 6.2. 50 L DynaDrive S.U.B. specifications (continued).

	Specification
Support container	
Overall width	103 cm (41 in.) with optional E-Box 69 cm (27 in.) without E-Box
Overall length	77 cm (30 in.)
Overall height	178 cm (70 in.)
Dry skid weight (mass)	236 kg (519 lb.) with optional E-Box 195 kg (430 lb.) without E-Box
Wet skid weight—rated working volume (mass)	286 kg (631 lb.) with optional E-Box 245 kg (542 lb.) without E-Box
General	
Electrical power supply requirement (voltage, phase, amp)	120/208–240 VAC, single, 20 A (50/60 Hz)
pH & DO probe—autoclavable and single-use options available (single-use are integrated into the BPC)	12 mm diameter x 215–235 mm insertion length x 13.5 PG (pipe) thread
Noise level	< 70 dB at 1.5 m
Recommended operating parameters	
Room operating temperature range	17°C to 40°C ± 0.5°C (104°F ± 0.9°F) (with optional E-Box)
Motor speed	90–200 rpm
Volume range	5–50 L
Maximum bag pressure	34 mbar (0.5 psi)

Table 6.3. 500 L DynaDrive S.U.B. specifications.

	Specification
Bioreactor geometry	
Rated liquid working volume	500 L
Minimum liquid working volume	25 L
Total reactor volume (liquid & gas)	586 L
BPC chamber diameter	63 cm (25 in.)
BPC chamber shoulder height	187 cm (74 in.)
Liquid height inside tank at rated working volume	159 cm (63 in.)
Fluid geometry at working volume (height/diameter) ratio	2.7:1
Overall reactor geometry (height/diameter ratio)	3.2:1
Impeller	
Impeller (quantity x blade count)	3 x 2 modified pitch blade, 1 x 2 sweep impeller
Impeller scaling (impeller diameter/tank diameter)	0.37
Impeller diameter	23 cm (9 in.)
Impeller calculated power number (N)	4
Agitation	
Agitation speed range of VFD	35–120 rpm ± 1.5 rpm or 1% of setpoint, whichever is greater
Recommended minimum during cell culture agitation (at all volumes)	50 rpm
Nominal tip speed	60 cm/s (118 ft./min.)
Motor	
Agitation motor drive (type, voltage, phase), AC motor only	IPM, 230 VAC, 3
AC motor power rating	400 W (0.5 hp)
Motor torque rating	5.6 Nm (76 in.-lb)
Gear reduction	15:1
Programmable VFD, remote panel interface, power fault auto restart	Standard
Motor communication methods (for external controller)	0-10 V, 4-20 mA
Motor lift power supply requirements	24 VDC, 90 psi of air
Temperature control	
Jacket area: full/10% volume	0.51 m^2/0.06 m^2 (5.5 $ft.^2$/0.65 $ft.^2$)
Jacket volume	13.6 L
Jacket flow rate at 3.4 bar (50 psi)	71 L/min.
Process connection	1.5 in. Sanitary tri-clamp
Recommended heating/cooling load (W)	5000 W
Approximate liquid heat-up time (5°C–37°C)—10% volume, with ThermoFlex 10,000 TCU	1 hr
Approximate liquid heat-up time (5°C–37°C)—100% volume, with ThermoFlex 10,000 TCU	3 hr
RTD or thermocouple: 3.18 mm (1/8 in.) OD, 15.24 cm (6 in.) length	RTD: Pt-100 (standard)

Table 6.4. 500 L DynaDrive S.U.B. specifications (continued).

	Specification
Support container	
Overall width	141 cm (56 in.) with optional E-Box 103 cm (41 in.) without E-Box
Overall length	101 cm (40 in.)
Overall height	311 cm (122 in.)
Dry skid weight (mass)	522 kg (1,151 lb.) with optional E-Box 481 kg (1,060 lb.) without E-Box
Wet skid weight—rated working volume (mass)	1,022 kg (2,251 lb.) with optional E-Box 981 kg (2,160 lb.) without E-Box
General	
Electrical power supply requirement (voltage, phase, amp)	120/208–240 VAC, single, 20 A (50/60 Hz)
pH & DO probe—autoclavable and single-use options available (single-use are integrated into the BPC)	12 mm diameter x 215–235 mm insertion length x 13.5 PG (pipe) thread
Noise level	< 70 dB at 1.5 m
Recommended operating parameters	
Operating temperature range	17°C to 40°C ± 0.5°C (104°F ± 0.9°F)
Motor speed	35–120 rpm
Volume range	25–500 L
Maximum bag pressure	34 mbar (0.5 psi)

Table 6.5. 3,000 and 5,000 L DynaDrive S.U.B. specifications.

	3,000 L	5,000 L
Bioreactor geometry		
Rated liquid working volume	3,000 L	5,000 L
Minimum liquid working volume	250 L	250 L
Total reactor volume (liquid & gas)	3,730 L	5,585 L
BPC chamber diameter	137 cm (54 in.)	
BPC chamber shoulder height	255 cm (101 in.)	385 cm (152 in.)
Liquid height inside tank at rated working volume	205 cm (81 in.)	342 cm (135 in.)
Fluid geometry at working volume (height/diameter) ratio	1.7:1	2.9:1
Overall reactor geometry (height/diameter ratio)	2:1	3.2:1
Impeller		
Impeller (quantity x blade count)	2 x 2 modified pitch blade, 1 x 2 sweep impeller	4 x 2 modified pitch blade, 1 x 2 sweep impeller
Impeller scaling (impeller diameter/tank diameter)	0.37	
Impeller diameter	49 cm (19 in.)	
Agitation		
Agitation speed range of VFD	0–85 rpm ± 1.5 rpm or 1% of setpoint, whichever is greater	
Recommended minimum during cell culture agitation (at all volumes)	30 rpm	
Nominal tip speed	77 cm/s (152 ft./min.)	
Motor		
Agitation motor drive (type, voltage, phase), AC motor only	IPM, 208 VAC, 3	
AC motor power rating	2200 W (3 hp)	
Motor torque rating	96 Nm (847 in.-lb)	
Gear reduction	5:1	
Programmable VFD, remote panel interface, power fault auto restart	Standard	
Motor communication methods (for external controller)	Modbus	
Motor lift power supply requirements	208 VAC, 90 psi of air	
Temperature control		
Jacket area: 10%/full volume	1 m^2/6.82 m^2 (10.8 $ft.^2$/73.36 $ft.^2$)	1.43 m^2/10.66 m^2 (15.44 $ft.^2$/114.69 $ft.^2$)
Jacket volume	43.1 L	60.6 L
Jacket flow rate at 3.4 bar (50 psi)	TBD	TBD
Process connection	1.5 in. Sanitary tri-clamp	
Recommended heating/cooling load (W)	≥ 18 kW	
Approximate liquid heat-up time (5°C–37°C)—10% volume, with ThermoFlex 10,000 TCU	TBD	TBD
Approximate liquid heat-up time (5°C–37°C)—100% volume, with ThermoFlex 10,000 TCU	TBD	11.5 hr
RTD or thermocouple: 3.18 mm (1/8 in.) OD, 15.24 cm (6 in.) length	RTD: Pt-100 (standard)	

Table 6.6. 3,000 and 5,000 L DynaDrive S.U.B. specifications (continued).

	3,000 L	5,000 L
Support container		
Overall width	228 cm (90 in.)	
Overall length	164 cm (65 in.)	
Overall height	345 cm (136 in.)	486 cm (192 in.)
Dry skid weight (mass)	2,525 kg (5,566 lb)	3,224 kg (7,109 lb)
Wet skid weight—rated working volume (mass)	5,518 kg (12,166 lb)	8,124 kg (18,109 lb)
General		
Electrical power supply requirement (voltage, phase, amp)	240 VAC, single, 20 A	
pH & DO probe—autoclavable and single-use options available (single-use are integrated into the BPC)	12 mm diameter x 215–235 mm insertion length x 13.5 PG (pipe) thread	
Noise level	< 70 dB at 1.5 m	
Recommended operating parameters		
Room operating temperature range	17°C to 40°C ± 0.5°C (104°F ± 0.9°F)	
Motor speed	0–90 rpm	
Volume range	250–3,000 L	250–5,000 L
Maximum bag pressure	34 mbar (0.5 psi)	
Temperature control		
Cold plate area of both plates/each plate	5,690 cm^2 (882 $in.^2$)/2,845 cm^2 (441 $in.^2$)	
Heater plate area of both plates/each plate	1,523 cm^2 (236 $in.^2$)/716 cm^2 (118 $in.^2$)	
Condenser TCU size	Minimum 2,000 W	
Temperature set point	5°C	
Pressure set point	30–70 psi*	
Flow rate	Minimum 3 GPM	
Recommended heater set point	50°C	

*Assumes 1 in. diameter hose on TCU.

7

Regional contact information

Chapter contents

7.1 Ordering/support contact information
7.2 Technical support

7.1. Ordering/support contact information

In the Americas and Asia

1726 Hyclone Drive
Logan, Utah 84321
United States

Tel: +1 435 792 8500

Email: customerservice.bioprocessing@thermofisher.com

In Europe

Unit 9 Atley Way
Cramlington, NE 23 1WA
Great Britain

Tel: +44 (0) 1670 734093

Fax: +44 (0) 1670 732537

Email: customerservice.bioprocessing@thermofisher.com

7.2. Technical support

Technical support for the DynaDrive S.U.B. is available in a variety of formats. Some or all of the following may be appropriate, depending on individual experience and circumstances.

Technical service hotline and email

Contact your Thermo Scientific sales representative for general product pricing, availability, delivery, order information and product complaints.

Call +1 435 792 8500 (United States) or +44 (0) 1670 734093 (Europe, U.K.) for direct and immediate response to overall product questions, and product technical information (Technical Support). You can also contact Technical Support by emailing:

techsupport.bioprocessing@thermofisher.com

Initial setup and operation

Appropriate technical support is available to assist in the initial setup and operation of each S.U.B. system. If you require assistance in setting up and operating your S.U.B. system, please inquire at the time of purchase.

Training

Training can be provided for startup and operation of the S.U.B. Contact your Thermo Scientific sales representative.

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