Operation Manual

Power Tong Test Rig

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Change Description

Rev	Change
A	Original Release
B	Page 9: Added Power Unit instructions & graphic (Figure 4)

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SAFETY

READ THIS MANUAL BEFORE USING EQUIPMENT

Equipment supplied by Texas International Oilfield Tools is intended for installation and use in controlled environments involving hazardous operations and situations.

Only authorized and trained personnel shall install, maintain, operate and/or repair equipment supplied by Texas International Oilfield Tools, LTD. Equipment shall be used only for the purpose for which it is intended.

The User is responsible for ensuring the equipment is in safe working order prior to use. Texas International Oilfield Tools, LTD is not responsible for injuries or equipment damage that arises from equipment neglect or misuse.

The User is responsible for ensuring the safety of all personnel within the vicinity of the equipment. Texas International Oilfield Tools recommends a hazard assessment be performed by qualified safety representatives prior to using equipment. All personnel shall possess and use Personal Protective Equipment (PPE) and must be trained at minimum on rig safety, rig procedures, and equipment operation.

Hazard Labels Used in this Manual

DANGER is represented by this hazard symbol and signifies the highest level of risk. Failure to observe and heed this information may result in serious bodily injury or death.

WARNING is represented by this hazard symbol and signifies potential hazards of medium risk. Failure to observe and heed this information may result in significant bodily injury, catastrophic equipment failure, and/or environmental contamination.

CAUTION is represented by this hazard symbol and signifies potential hazards of low risk. Failure to observe and heed this information may result in bodily injury and/or equipment damage.

NOTICE symbol denotes items of importance unrelated to personal injury which highlight additional information provided to aid the user during installation, commissioning, operating, and/or maintaining equipment.

Notes, cautions, warnings, explanations, and information are provided herein to advise readers to take deliberate action to protect personnel from potential injury or lethal conditions. Please pay close attention to these advisories.

INTRODUCTION

Texas International Oilfield Tools, LTD (TIOT) offers a free standing Power Tong Test Rig used for testing of Hydraulic Power Tongs. The Test Rig is designed to resist torque output from Power Tongs for testing purposes. The Power Tong being tested clamps onto a mandrel (not shown) and is tethered from the back of the Power Tong, thru a Load Cell and pinned to the back post.

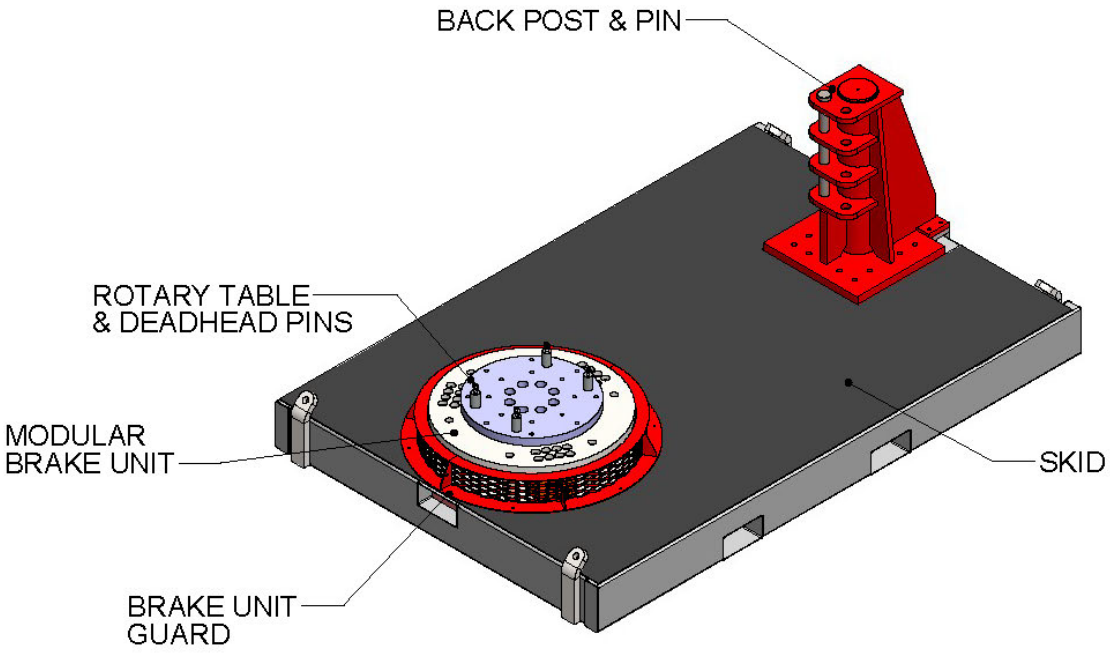


FIGURE 1

DANGER Substantial forces are involved in the Test Rig operation. Extreme caution is always recommended when working on or around this equipment.

WARNING ***DO NOT*** move or transport while any part of the equipment is under pressure.

WARNING Hydrostatic or hydrodynamic pressure must be bled off to 0 PSI (0 BAR) when the equipment is not in use or unattended.

WARNING The User is responsible for ensuring that all pins and components are secured prior to lifting, moving, or transporting the equipment.

CAUTION Use the forklift pockets under the skid to properly lift the test stand when moving or transporting.

SPECIFICATIONS

Capacity		
Part Number	No. of Calipers	Max Braking Torque (ft/lbs)
T87000-3	3	60,000
T87000-4	4	80,000

DANGER Do not exceed torque ratings. Doing so will cause operator injury and test stand damage/failure.

DIMENSIONS

Dimension shown are for reference only and may vary. Shown without power unit and mandrel.

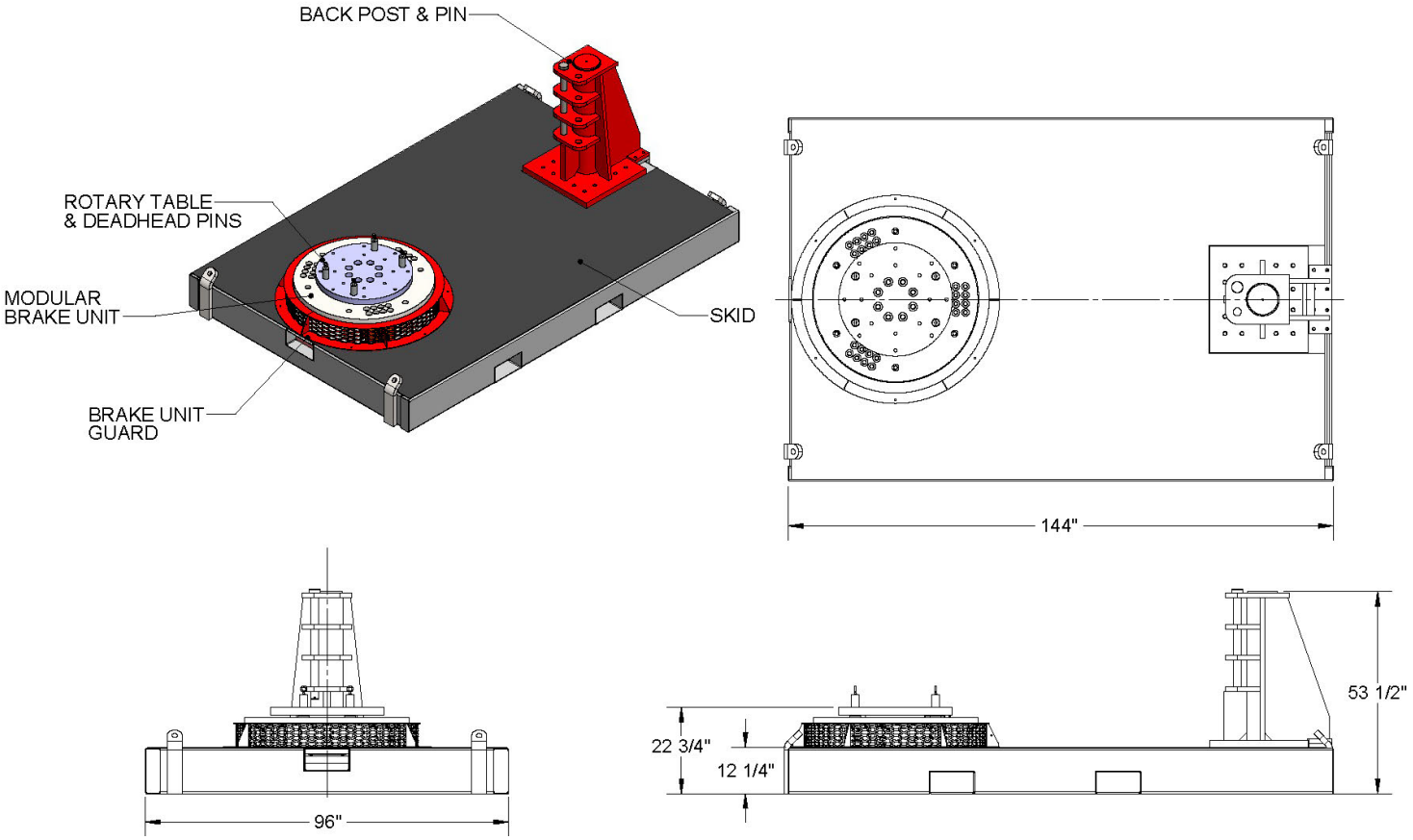


Figure 2

OPERATION: PRE-TEST SETUP

The following steps are to be followed to prepare the Test Rig for operation:

A. The test stand should be positioned on firm ground and leveled both horizontally and vertically. Check all bolted connections, pressure installations, hydraulic components, etc. Ensure that the test stand is defect free and ready for testing.

B. Install an appropriate size mandrel on the rotary table.

DANGER Never operate equipment without pressure gauges and load cells. Gauges and load cells must be functional and in good operating condition.

WARNING Never operate the equipment without all fasteners, pins, tethers, etc. installed and secured.

C. Using a crane or other appropriate lifting device, open the power tong door and position the power tong around the mandrel. Close the power tong door.

D. Attach a load cell in an appropriate location on the back of the power tong where torque readings can be monitored by the operator.

E. Attach a tether to the load cell and the other end to the back post; pin in place using the back post pin.

NOTICE Once attached, the tether should be 90 degrees from the power unit centerline. Use a suitable length tether. See Figure 3.

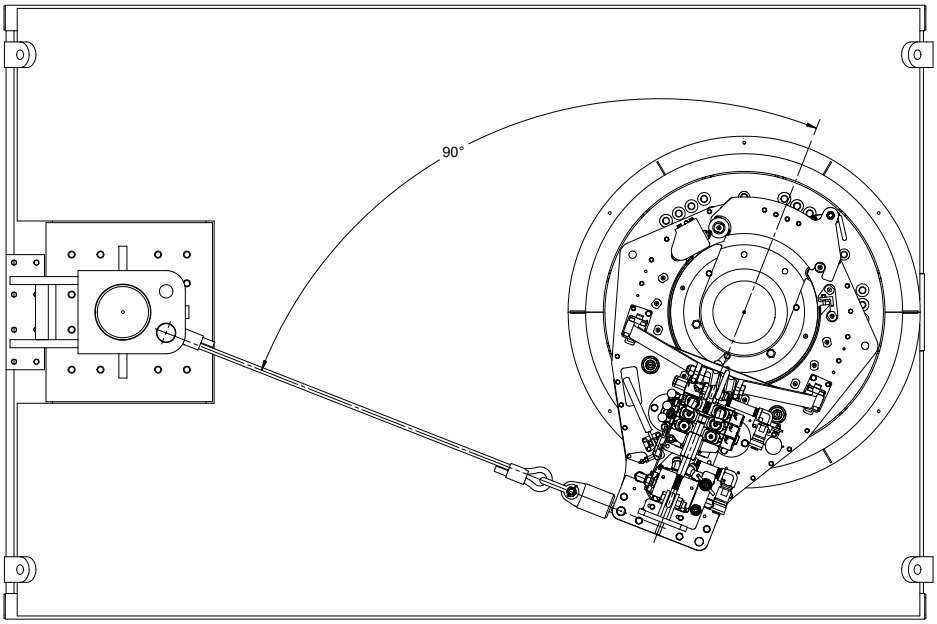


Figure 3

OPERATION: PRE-TEST SETUP – CONT.

NOTICE Testing can be performed from either direction depending upon make-up or break-out testing.

DANGER Ensure that the operator is out of the way of tethers and machinery when shifting direction from make-up to break-out or vice versa.

A. Attach the Power Unit hose to the Power Unit and the connection at the end of the skid (Figure 5).

B. Position the Power Unit on the side of the test stand within the operator's view and reach.

C. Attach the power cord to a protected electrical outlet.

D. Ensure that the stop (Red) button is off (down position).

E. Turn on the Power Unit and pull up on the stop button.

F. When the operator is ready to test the Power Tong, run the tong and slowly adjust the needle valve on the top of the console (Black Knob). As the needle valve increases the pressure to the brake calipers, the Power Tong torque will increase.

G. Turning the needle valve knob in the opposite direction will release the pressure to the brake calipers and decreases the Power Tong torque.

Power Unit
Figure 4

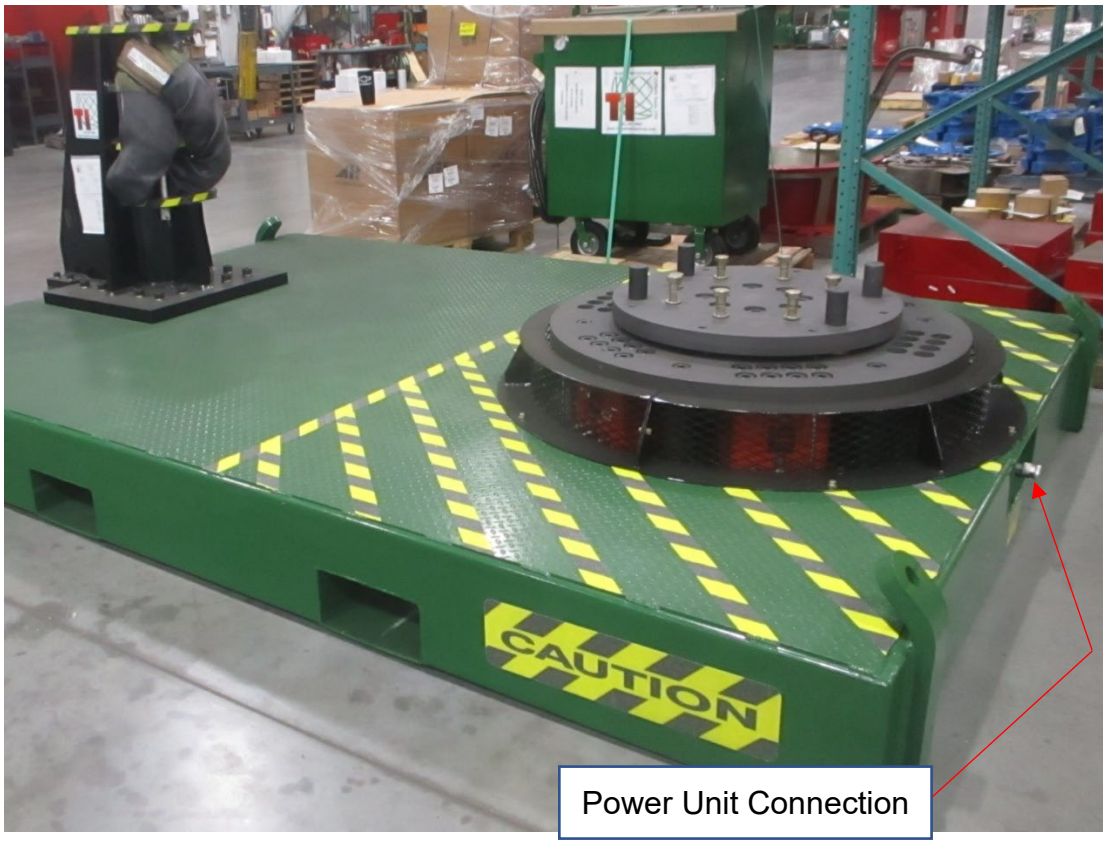


Figure 5

TROUBLESHOOTING

Failure Mode	Possible Cause(s)	Possible Solution(s)
Deformed pin holes	Overload	MPI Welds, Replace Deformed/Damaged Components, Scrap
	Wear	Pull Test Assembly from service and repair or replace.
Bent pins	Overload	Replace pins
Leakage	Worn seals, loose fittings	Tighten fittings as needed. If leakage persists, check the area between the caliper bottom and top halves for seal leakage.
Slow braking time or insufficient braking force.	Speed too high	Check tong settings
	Oil, paint, or grease on the brake pads or rotor.	Clean Rotor
		Clean or replace brake pads
		Check for leaks
Motor will not operate	No pressure from power unit	Ensure that power unit is in proper operating condition.
		Check electrical and connections.

Table 1

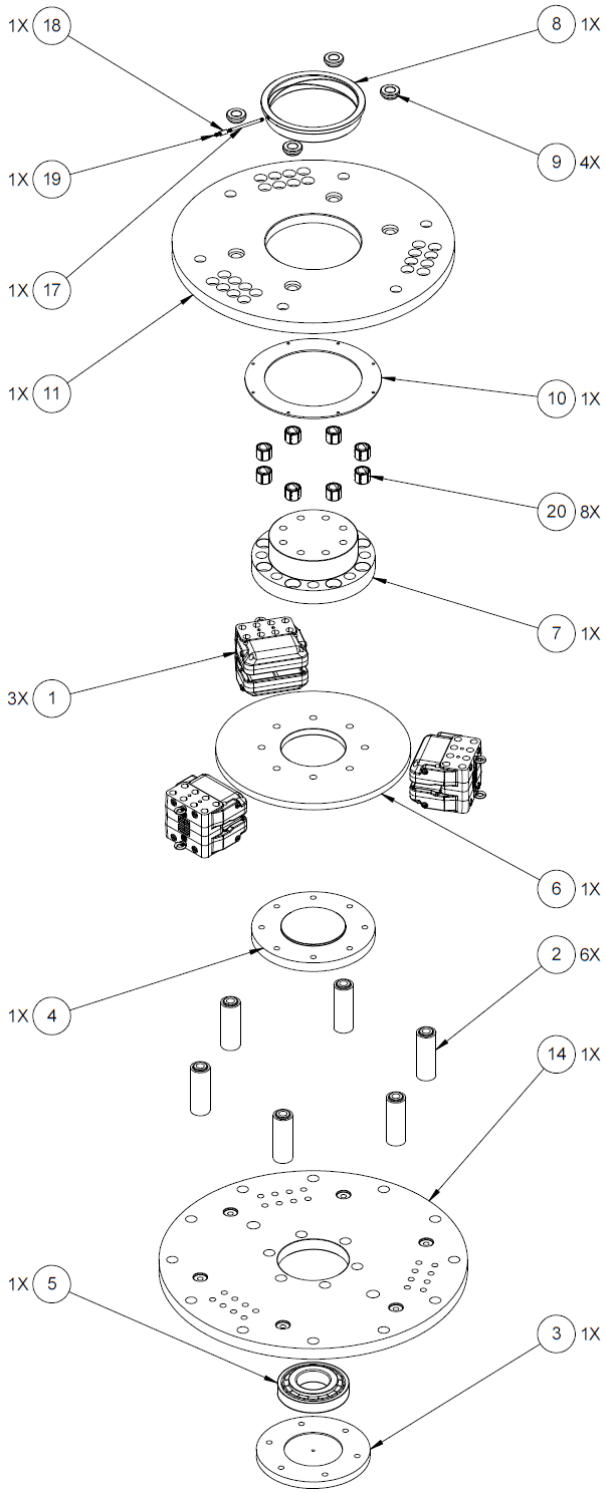
Contact TIOT for troubleshooting assistance, replacement parts, and/or repairs.

PARTS & RECOMMENDED SPARES - BRAKE UNIT

Item No.	Part Number	Description	Qty T87000-B-3	Qty T87000-B-4
1	BSAB90-S-407	Brake Caliper	3	4
2	T87000-B-01	Column	6	6
3	T87000-B-02	Bearing Retainer Cap	1	1
4	T87000-B-03	Bottom Hub	1	1
5	T4B014	Tapered Roller Bearing	1	1
6	T87000-B-04	Brake Rotor	1	1
7	T87000-B-05	Top Hub	1	1
8	T87000-B-06	Top Radial Bushing	1	1
9	T87000-B-07	Thrust Bushing	4	4
10	T87000-B-08	Wear Plate	1	1
11	T87000-B-09-3	Top Plate, 3 Caliper	1	1
12	T87000-B-09-6	Top Plate, 6 Caliper	1	1
13	T87000-B-10-3	Bottom Plate, 3 Caliper	1	1
14	T87000-B-10-6	Bottom Plate, 6 Caliper	1	1
15	030376	Pipe Nipple	1	1
16	030377	Pipe Coupling	1	1
17	080013	Grease Fitting	1	1
18	080121	Transfer Bearing	8	8
19**	*	Brake Pad		
20**		Adapter Plate	1	1
21**		Mandrel	1	1
22**		Back Post Pin	1	1
23**		Back Post Pin Retainer	1	1

*Recommended Spare Part
**Not Shown

Table 2



3 Caliper Brake Unit (T87000-B-3)
Figure 6

PREVENTIVE MAINTENANCE

CAUTION This is a suggested PM schedule. The tool owner has the responsibility to adjust the program according to actual tool usage.

WARNING When there is suspicion that the test assembly has been ***overloaded***, it should be pulled from operation for overall damage and wear inspection.

NOTICE Normal wear during use will eventually reduce the test assembly's capability. Check all mechanical components including bolts, nuts, pins, and clips for damage and/or wear. Inspect all welds regularly. Cracks or the appearance of damage can indicate disrepair and potential failure and requires prompt attention. The test assembly must be either pulled from operation immediately or repaired.

Daily – While in use and after each test run:

- Check for leakage, cracks, deformation, wear, or other signs of operation issues.
- Inspect pins, bolts, and other mechanical components after each test. If components are worn, damaged, loose, or missing replace or secure as needed.
- Inspect visible welds for cracks or separation. If found, remove test assembly from service and repair damage or replace components.

STORAGE AND TRANSPORTATION

- Unpainted surfaces should be coated with rust preventing agent.
- Prevent excessive exposure to water and moisture.
- Use the forklift pockets under the skid to lift or move the test stand.

Never move or transport the equipment without all secondary retention clips installed and/or without adequate tie-downs, etc. securely in place.

APPENDIX A

SVENDBORG BRAKES

GLOBAL
LEADING
EXPERTS

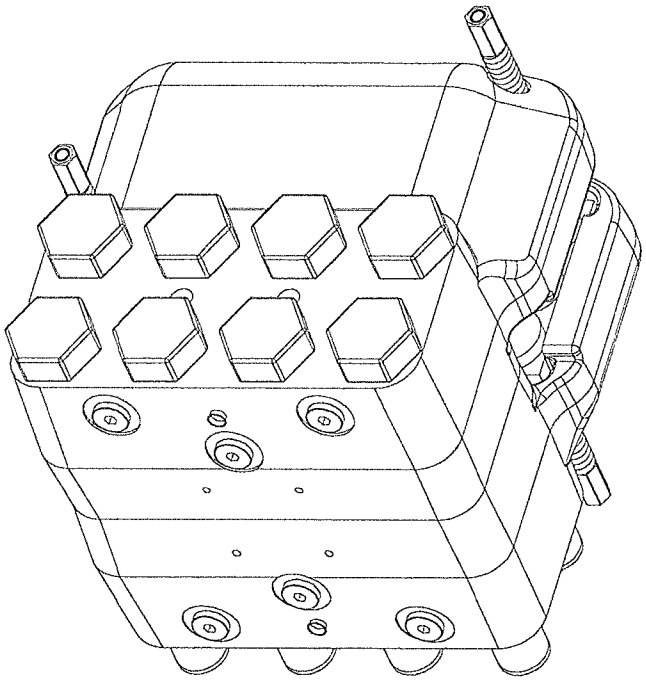
INSTALLATION & MAINTENANCE MANUAL

APPENDIX A

Name:	MEB-0090-020
Date:	18.08.2014
Revision:	B

Installation and Maintenance Manual

HYDRAULIC ACTIVE DUAL SPRING DISC BRAKE BSAB 90-S/R-407



SVENDBORG BRAKES

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APPENDIX A

APPENDIX A

1. General

Thank you for buying a Svendborg Brakes product.
Before using the product please read this manual carefully.

1.1 Who to contact

If you have any questions regarding this manual please contact your local representative or nearest Svendborg Brakes Office:

Head office

Svendborg Brakes - Denmark
Phone: +45 63 255 255
Fax: +45 62 281 058
E-mail: sb@svendborg-brakes.com

For local offices / current contact information, please refer to www.svendborg-brakes.com.

1.2 Safety

The Svendborg Brakes brake line of products are designed to be mounted on a rotating brake disc for use in conjunction with parking brake applications, service brake applications or emergency brake applications only.

Note:

- Always make sure that you consult Svendborg Brakes before using tools or any other equipment not recommended/specified in this manual.
- In order to maintain the guarantee always use original spare parts from Svendborg Brakes.
- It is the customer's responsibility that the brake and hydraulic aggregate are always clean, and free from dirt, grease or oil.
- It is the customer's responsibility that the air gap between brake pads and brake disc never exceeds the air gap recommended.
- Always use a torque wrench when refitting mounting bolts or valves in order to ensure the torque obtained is the torque described in this manual.
- There should be one manual available for the service/maintenance crew as a minimum.

Hydraulic power unit:

- Do not operate the hydraulic power unit before correctly filling the reservoir/oil tank with oil.
- Do not adjust valves or pressure switches to higher operating pressure than specified in the manual.
- Do not change the size or type of components.
- Do not use hydraulic fluids not recommended in this manual.

Brakes:

- Do not operate the brake before removing the air from the hydraulic system by bleeding and then re-filling with oil.
- Do not use higher operating pressures than specified on the nameplate of the brake/or in the manual.
- Do not use the brake pads when they are worn to the minimum thickness as shown in the manual.
- Do not operate the brake if there is dirt or corrosion protection on disc or brake pads.

Personal safety:

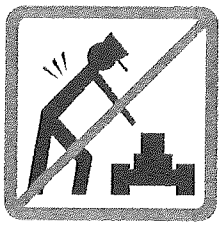
*Do **not** work on the brake/system before attending **all** the following matters:*

- Make sure the brake disc is locked and not able to rotate before adjusting the brake and/or air gap.
- Be sure to lock/secure the brake piston by using the air gap bolt/air gap nut if working on a spring applied brake.
- Make sure there is no pressure on the hydraulic power unit or circuit.
- Make sure that the oil pressure in the accumulator(s) has been relieved/removed.
- Make sure the control signals has been shut off and blocked before working on the system.
- Make sure the electrical power has been shut off.
- Be sure the manual has been read and understood.
- Avoid prolonged skin contact with hydraulic fluids - read the manufacturer's instructions before using hydraulic fluids.
- If using solvent cleaners you must read the manufacturer's instructions before using a solvent cleaner, and then carefully follow these instructions

Heavy equipment

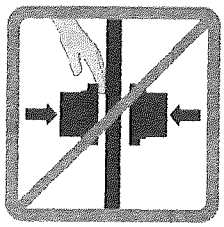
Be careful when lifting the brake or brake components - it is heavy equipment and is not made for manual lifting.

APPENDIX A



Use proper lifting equipment in order to prevent personal injuries.

Fingers warning
Never place your fingers between the brake pad and the brake disc when the brake is connected to the hydraulic system.



1.3 Safety terms/symbols used in this manual

To ensure that you perform certain tasks properly, please take note on the following symbols used throughout this manual.

WARNING: Information to prevent personal injury when trying to complete a task.

CAUTION: Information to prevent damage to the components when trying to complete a task.

IMPORTANT: Information that you MUST follow to complete a task.

NOTE: Tips and additional information to aid in completing a task.

Figures within brackets ( ) relate to position number and appendix number i.e. (15-C) refers to position number 15 in appendix C on both drawing and bill of material (parts list).

1.4 Disclaimer

Svendborg Brakes reserves the right to revise this document without prior notification. These documents have been proofread for errors in translation and accuracy. Despite this, technical and typographical deviations may occur.
This document is updated on a regular basis; changes will be published in future printings. Improvements or changes to the described products or manual can be implemented at any time without preceding notice.

In no event shall Svendborg Brakes be liable for any special, incidental, consequential or punitive damages. This includes, but is not limited to: damage to other property or person, inconvenience, loss of goodwill, lost profits or revenue, loss of use of this product or any associated equipment, cost of substitutive equipment, downtime costs or claims of any party such damages, resulting from any misspellings or inaccurate information in this users guide.

This document or parts hereof may in no event be copied, reproduced, changed or translated to other languages without explicit written permission from Svendborg Brakes.

1.5 Original language

The original language of this manual/instruction is English.
All other languages are translations of the original.

1.6 Conversion factors

All units in this manual are in metric units.

If you have needs for conversion between metric and imperial units the following figures can be used.

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Table 1.1			
Conversion factors			
Length:			
1	inch	= 25.4	mm (millimetre)
1	mm (millimetre)	= 0.0394	inch
Mass:			
1	kg (kilogram)	= 2.2046	lb (pound)
1	lb (pound)	= 0.4536	kg (kilogram)
Force:			
1	N (Newton)	= 0.2248	lbf. (pound force)
1	kN (kiloNewton)	= 224.8089	lbf. (pound force)
Pressure:			
1	Bar	= 0.1	MPa (Mega Pascal)
1	Bar	= 14.5038	PSI (pound per square inch)
1	MPa (Mega Pascal)	1	N/mm²
1	N/mm²	145.038	PSI (pound per square inch)
Torque:			
1	Nm (Newton meter)	= 0.7376	lbf.ft. (pound foot)
1	lbf.ft. (pound foot)	= 1.3557	Nm (Newton meter)

Examples:

115 bar	= 11.5 MPa =	1667.94	PSI
320 N/mm²	=	46412.00	PSI
305 Nm	=	224.96	lbf.ft

1.7 Nameplate / Serial-numbers

Before contacting Svendborg Brakes or your local reseller please **record the serial** number of the product found on the nameplate.
This will ease the process of identifying the actual product supplied and will help in locating eventual problems.

The nameplate looks like shown in figure 1.1 and is positioned on the brake as per figure 1.2.

FIGURE 1.1

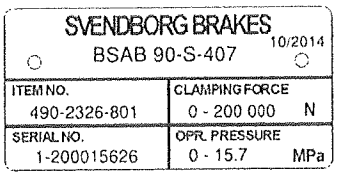
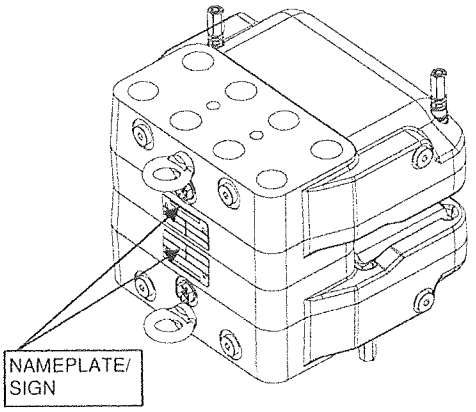


FIGURE 1.2



Example:
Naming of the brake:
"TYPE"
The type is the description (name) of the brake.
Serial number:
The serial number is located on the nameplate/sign at the label named "SERIAL NO.".

The serial number is a unique number, which identifies the brake.

Other information on the nameplate/sign
"ITEM NO"
This is the item number of the brake.

"CLAMPING FORCE" and "OPERATING PRESSURE"

The performance of the brake is shown by the clamping force provided and the corresponding operating pressure.

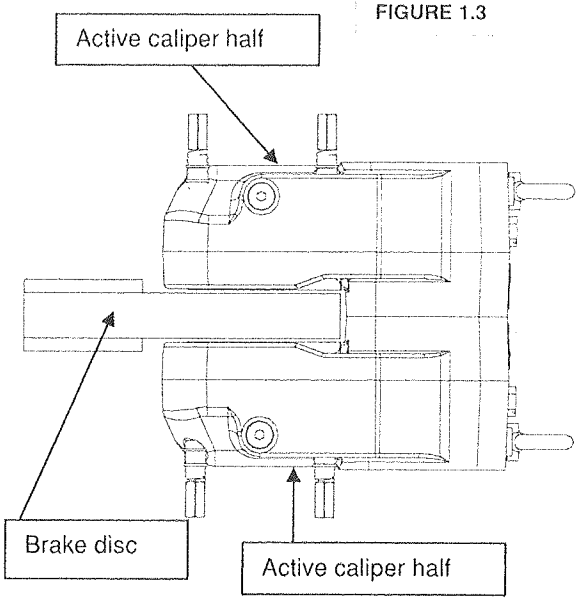
Production year
The year and week number of manufacturing is stated in the upper area of the nameplate. A brake manufactured in week 10 in 2014 is marked "10/2014".

1.8 How the brake works

The brake is designed to transfer a clamping force into a braking torque from the brake caliper to a brake disc - either in order to stop the rotation of the brake disc or to prevent rotation when stopped (parking brake).

APPENDIX A

FIGURE 1.3



1.9 Function

The BSAB 90 is designed as a hydraulically applied disc brake.
The clamping force increases when the hydraulic pressure increases.
The Dual Spring brake consists of two active calipers each containing two pistons.

The active calipers are mounted/joined together onto the bracket using bolts and spacers (spacers only where applicable).
The assembled/bolted unit is fixed to the bracket and does not move.

When braking, the pistons inside both active calipers and both the brake pads will move towards the brake disc and generate a braking force on both sides of the brake disc.
Only limited movement of the brake disc is allowed. The movement of the brake disc must be within the total air gap of the brake as specified. The alignment of the brake and the bracket must be adjusted to match this.
Brake disc movements exceeding the air gap as specified for the brake will in worst case result in damage to the brake/brake disc/hub/coupling or mounting structure.

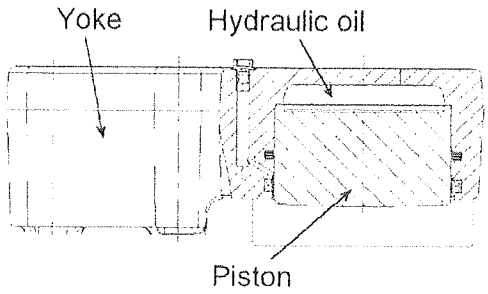
Check the mounting and dimension drawings for exact dimensions, tolerances and allowed movement.

This Manual is valid for the brake option BSAB 90-S/R-407.

The BSAB 90 brake is designed as a hydraulically applied disc brake.

The clamping force is obtained from the hydraulic pressure applying force to the pistons and to the brake pad against the brake disc.
The reaction force is transferred via the yoke.

FIGURE 1.4



Applying and relieving hydraulic pressure to the pressure ports operates the brake.
The brake generates the clamping force by the pistons executing movement towards the brake disc. This happens when the hydraulic oil pressure is applied to the hydraulic unit and the chamber behind the piston.

The braking force decreases when hydraulic oil pressure is removed from the hydraulic chamber/unit causing the piston to execute a short stroke towards the yoke - away from the brake disc.

The pad retraction springs (mounted in the brake pads) will then pull the pads away and allow the brake disc to rotate freely.

1.10 Operating conditions

The BSAB 90 brake is designed for operating at a maximum operating pressure at 15.7MPa (157bar).

For applications in wind turbines the operating temperature range is from -40°C to +60°C.

Please ensure that the hydraulic oil is suitable for operation at the actual temperature.

Please be aware that the reaction time / operating time may vary dramatically depending on oil type and temperature.

1.11 Ports/Connections

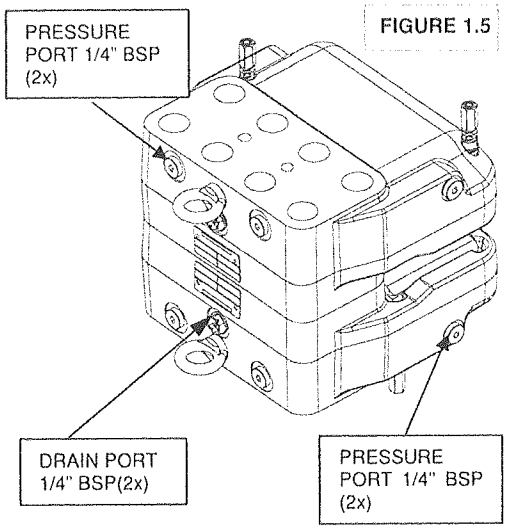
Each caliper half is as standard provided with four pressure connections 1/4" BSP (6-C) and one drain connection 1/4" BSP (7-C) - see figure 1.5.

APPENDIX A

IMPORTANT

Both calipers must be connected in order to make the brake operate correctly.

FIGURE 1.5



Pressure ports

The pressure ports are used to operate the brake. The connection at the lowest position must always be used as a pressure connection when connecting the brake to the hydraulic system. The pressure ports not in use must be plugged with a steel plug with an o-ring. The pipe work for the pressure connection should be designed so that the hydraulic system for the brakes can be bled as close to the brake unit as possible.

The brake should always be bled from the highest port when mounted.
The highest pressure connection can be used if flushing is required.
Flushing is depending on the design of the hydraulic system and may not be an option.

Drain ports

The drain connection (7-C) provides access to the chamber between the outer seal (4-C) (and (5-C)) and the wiper (3-C) through a hole in the yoke.
This can be used to detect leakage and prevent leaking oil from reaching the brake disc.

1.12 Connecting the brake(s)

The brake(s) can be connected in several different ways depending on the actual application/needs.

The brake is as standard supplied with a plastic plug in the drain port (7-C). The pressure ports are plugged with steel plugs (6-C).

It is not necessary to use flexible hoses when connecting the brake/calipers. They can be connected with pipes, but for installation and maintenance issues, it may provide some advantages using flexible hydraulic hoses as a final part/section of the connection when connecting the pressure ports on the brake to the hydraulic power unit.

Pressure connection

Connect the pressure to the lowest port and bleed from the highest port.
Bleeding can be done by using a test point male (1/4" BSP) (mini-mess) and hose - see recommended spare parts for item numbers.

IMPORTANT

Bleeding must be done for both brake calipers i.e. both sides of the brake.

Drain connection

CAUTION

Never apply any pressure to the drain port (7-C).
If hydraulic pressure is applied to the drain port, the oil/pressure enters the chamber between the seal and the wiper. The pressure then blows off the wiper and most likely destroys the seals.

It is the highly recommended to connect the drain port to a (preferably clear) tube leading to a drain bottle. This prevents damp air from entering the brake and leaking oil from reaching the brake disc. Remember to use the lowest positioned drain port for the drain connection.

IMPORTANT

Beware that oil on the brake disc reduces the braking force remarkably.

FIGURE 1.6

The drain port could also be connected directly to the tank of the hydraulic power unit.

Using drain bottles that are clear and one bottle for each brake caliper makes detection of potential leakages easier.

APPENDIX A

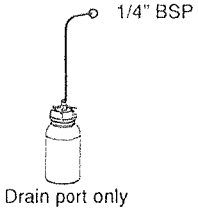


FIGURE 1.7

1.13 Lubrication

Different types of lubrication are used in different situations.
This can either be for lubrication of the seals or when tightening bolts of a diameter above 16mm.

Some symbols are used on the drawings to indicate where lubrication is needed during service.

△	Grease - Molykote P74
□	Grease - Molykote Longterm 2 Plus
O	Hydraulic oil
MoS_2	Molybdenum Disulfide

Molykote is produced by Dow Corning.
The hydraulic oil may be synthetic or mineral oil as per recommended oil types.
Molybdenum Disulfide (MoS_2) is to be found in various forms; either spray, fluid or solid state.

1.14 Transport

When leaving the factory the brake is always packed / wrapped to ensure maximum security for the product during transport.
The weight of one brake caliper is approx. 26kg (excluding brake pads and bracket). The total weight of two caliper halves is about 55kg.

1.15 Storage

General minimum storage requirements are:
- All equipment containing hydraulic parts incl. brakes must be stored indoors and above +5°C to avoid condensation.
- All electrical equipment must be stored indoors, in dry, non-condensing conditions above +5°C
- Equipment/boxes must not be in direct contact with water/rain and must be stored under cover.

Brake(s), steel parts, hydraulic and electrical parts shall be stored indoors within a temperature range of +5°C to +40°C.
Maintenance of the brake is needed for storage longer than 12 months. In order to prevent the seals drying out and sticking to the piston, the brake piston must be operated at full stroke at least 20 times every 12 months.

The hydraulic unit must be stored indoors within a temperature range of +5°C to +40°C.
Oil should be added to the tank and pumps should be started up for storage longer than 12 months.

Bolts, nuts and washers etc. should not be removed from their original product packaging and must be kept dry indoors. Temperature control is not required.

Brake pads must be stored indoors. Temperature control is not required.

Spare seal kits should be kept away from direct sunlight and should be stored in their original bag, ideally in a box or dark area.

Control panels must be stored indoors in an upright position within a temperature range of +5°C to +40°C. Battery maintenance will be required for storage longer than 12 months.

Brake discs, couplings and hubs are treated with corrosion protection. If stored outdoors, the equipment must be stored in a sealed plastic bag in its wooden box. The box must be placed under cover but does not need controlled temperature.

The brake(s)/bracket(s) are treated at the factory with corrosion protection.

IMPORTANT

Anti-corrosion protection should be reapplied if removed during transporting or handling.

1.16 Disposal

General

The operator and/or user is responsible for the proper disposal of the brake and the associated components.
In case of any doubts about the correct disposal please do not hesitate to contact Svendborg Brakes or your local dealer or regional disposal enterprises for further information.

Brake pads

The brake pads are made from a steel back plate and brake pad material/lining. The brake pad material is either made from an

organic compound or from sintered metal. Each type is asbestos free and free of lead.

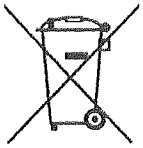
The brake pads can be treated as steel waste/scrap.

Hydraulic oil
Hydraulic oil must be treated professionally when disposed in order to prevent pollution.
The oil must be removed from the brake and from the hydraulic system/unit and stored in proper containers until delivery to local disposal enterprises.

Brake
The brake is in general made of cast iron or machined steel.
Once the hydraulic oil has been removed from the brake, and the seals have been removed the brake can be treated as steel waste/scrap.

Seals
The seals and o-rings used in the brake are made of either Polyurethane (PUR), PTFE (Teflon) or rubber (NBR).
They can all be treated as normal waste.

Electronics
If equipped with any electronic equipment as sensors, indicators or similar - this equipment should be treated as electronic waste.



1.17 How to order spare parts

When ordering spare parts for your brake please refer to the specific item number in the parts list/bill of material - see appendices or the recommended spare parts list.

For full identification of the brake please note the serial number and preferably the item number and type, stated on the name plate/sign - see Section 1.7 - *Nameplate / Serial-numbers*.

2. Installation

2.1 Lifting and handling

The BSAB 90 Dual spring brake is equipped with eyebolts on the calipers and should only be lifted by means of placing a hook through them.
In order not to damage any parts on the brake do not fit any hook or tie any rope, chain or strap around indicators, hoses etc.
When lifting please note that the weight one caliper half is approx. 26kg (excl. brake pads). The total weight of two caliper halves incl. brake pads is about 55kg.

2.2 Cleaning the brake disc

Before installing the brake calipers the brake disc must be cleaned from any dirt or anti corrosive protection.

The anti-corrosive protection can normally easily be removed in two steps:

1) By using kerosene or similar for the initial cleaning.
2) Using solvent cleaners to remove the remaining dirt completely.

Use a cleaning solvent for the final cleaning. Solvent cleaners could be clear methylated or white spirits or isopropyl alcohol.

Any residual oil or anti-corrosion preparation will reduce the coefficient of friction greatly.

⚠ WARNING

Solvent cleaners are flammable and poisonous and can cause burns.

To avoid serious personal injury when you use solvent cleaners, please read the manufacturer's instructions before using a solvent cleaner and then carefully follow those instructions.

Also follow these procedures:
- Wear eye protection
- Wear clothing that protects your skin
- Work in a well-ventilated area

Always follow local rules and regulations for/when working with solvents.

2.3 Cleaning the mounting surfaces

The mounting surface of the bracket must comply with the relevant arrangement drawings and mounting data drawings.
It is critical that the brake is bolted to the mounting surface in compliance with the tolerance specified on the caliper dimension drawing.

IMPORTANT

The joint between the mounting surfaces of the yoke and the customer post/gearbox is classified as a friction joint.

Therefore NO lubricant or other compound shall be applied between the caliper and mounting surfaces.

The mounting of the caliper does NOT rely on the shear capacity of the mounting bolts but of the friction joint. This friction joint is created by the clean, dry, lubricant free surface machined to the correct surface finish and of the tension created by the mounting bolts.

The mounting surfaces for the yoke and bracket (if applicable) should be cleaned in the same way as the brake disc - see section 2.2 - *Cleaning the brake disc.*

⚠ WARNING

Solvent cleaners are flammable and poisonous and can cause burns.

2.4 Handling/mounting the brake pads

Friction material is a very essential part of the brake system and the brake pads should be handled carefully to avoid damages to the brake pads/friction material.
The brake pads should be kept as clean as possible - be careful to protect the pads from grease and oil. Even a small amount of oil can reduce the friction coefficient considerably.

NOTE

All brake pads supplied by Svendborg Brakes are asbestos free and free of lead. Certificate is available on request.

Svendborg Brakes supplies several types of brake pads with different brake pad materials depending on the actual needs in the application.

In general there are two types of brake pads:
- Brake pads with organic/composite linings
- Brake pads with sintered metal pucks/material

2.4.1 Organic brake pad material is very sensitive to grease and oil and cannot be cleaned. If exposed to this the brake pad must in most cases be discarded and replaced.

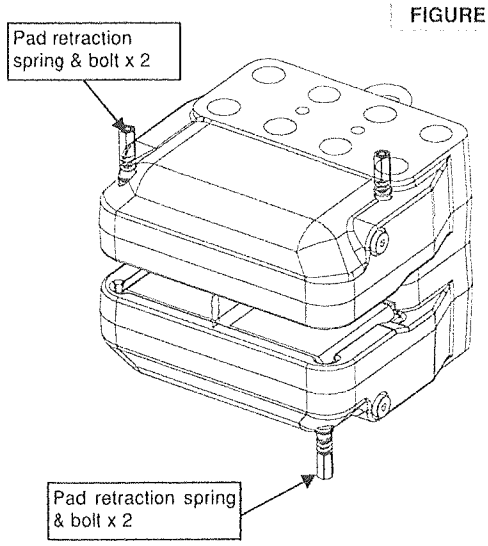
2.4.2 Brake pads with sintered metal brake pad material are less sensitive to dirt, grease and oil and can in some cases - where not fully soaked up with oil - be cleaned with solvent and re-used.

⚠ WARNING

Solvent cleaners are flammable and poisonous and can cause burns.
Please follow the manufacturer's instructions and see section 2.2 - *Cleaning the brake disc.*

2.4.3 After mounting the brake pads the pad retraction springs should be mounted onto the brake pads.

FIGURE 2.1



2.5 Mounting the brake

Mounting can in general be done in several ways:

1) Mount and align the bracket, mount the brake(s) to the bracket and check the alignment (and adjust accordingly).
2) Mount the brakes to the bracket, mount and align the bracket to the brake disc and foundation.
3) If the brake is bought with a bracket it may already be mounted from the factory - the brake and bracket are to be mounted and aligned.

The following instruction is based on that the brake is to be mounted on the bracket on site.

If the brake is already mounted onto the bracket please skip the corresponding sections.
Short summary of what to do:

- Prepare the brake
- Check/clean mounting surfaces
- Mount the bracket (if applicable)
- Mount the brake pads and pad retraction springs on the caliper half.
- Mount the brake
- Check alignment/adjust accordingly
- Tighten the brake/bracket

Prepare the brake

2.5.1 Move eyebolts to the position needed.

Check the mounting surfaces

2.5.2 Check that the mounting surface of the bracket complies with the relevant arrangement drawings and mounting data drawings i.e. is flat and positioned with the right angles to the brake disc, before mounting the brake.

2.5.3 Ensure that the mounting surfaces are clean from dirt and oil - otherwise clean as per section 2.3 - *Cleaning of the mounting surfaces.*

Mount the bracket (if applicable)

2.5.4 Mount the bracket and align it to the brake disc.
Do not tighten the mounting bolts to the full torque as adjustment may be needed.

Mount the brake

2.5.5 Fit the brake pads in the caliper halves. - Be careful to protect the pads from grease and oil. Even a small amount of oil can reduce the friction coefficient considerably.

2.5.6 Lift one caliper half, including the brake pad, to the bracket and align the holes for the mounting bolts.

2.5.7 Mount the mounting bolts through the caliper and bracket and let the caliper rest on the bolts.

2.5.8 Lift the other caliper half into place and align it to the mounting bolts - Remember to fit the O-ring (2-A), between the calipers.

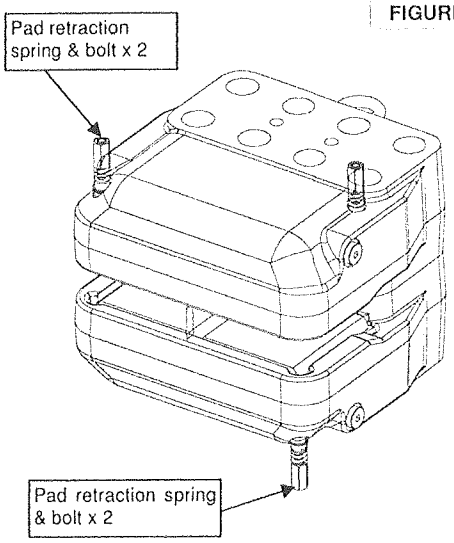
2.5.9 Fit and tighten the washers and nuts slightly. Before fully tightening the nuts and bolts please make a visual check to see if any interference between brake, bracket and brake disc is present. Make sure that the brake disc rotates freely without touching the

brake halves and fit the brake so that the pads are aligned correctly with the disc.
To allow expansion, caused by temperature increase in the brake disc, a clearance of minimum 1mm. per 1000mm. of the brake disc diameter is recommended between the caliper halves and the brake disc.

NOTE

The brake calipers may need to be lifted before final tightening of the bolts/nuts as gravity makes the calipers tend to move down.
In general this should not be a problem - but if the bracket has large mounting holes this could cause problems.

FIGURE 2.2



2.5.10 Fit the pad retraction springs and bolts and mount these - tighten firmly according to table 2.2 - *Bolts for pad retractions springs.*

Table 2.2		
Bolts for pad retraction springs		
Bolt size	Torque	
		Dry
M8 8.8		19 Nm
"Lubricated" is based on Molykote - MoS2		

Check alignment

2.5.11 Check the alignment of the brake/bracket and brake disc.

Adjust the position of the bracket by moving it or adding shims until the brake is perfectly aligned to the brake disc.

2.5.12 Check that the brake disc is able to rotate freely, without touching the brake.

Tighten the bracket/brake

2.5.13 When aligned, tighten the mounting bolts for the brake (8 x M27) grade 10.9 or 12.9 to the correct torque.
Use the tightening torques from the spare-parts drawing or Table 2.3 - *Mounting bolts for caliper half.*

Table 2.3		
Mounting bolts for caliper half		
Bolt size	Torque	
	Lubricated MoS2	Dry
Standard bolts (DIN 912/DIN 931/ISO 4014 style)		
M27 10.9	1080 Nm	
M27 12.9	1290 Nm	
"Lubricated" is based on Molykote - MoS2		

2.6 Inspecting the alignment of the brake

2.6.1 Check the tolerances with app. B. The disc's angularity and run out in relation to the base plate must not exceed the permissible values.
The distance between brake pad holder and the brake disc should be equal on both sides.

IMPORTANT

The axial movement of the brake disc must not exceed 0.3mm - see mounting drawing appendix B.

2.7 Bleeding and flushing the caliper

Each brake caliper and all hydraulic power units supplied from Svendborg Brakes have been individually flushed before leaving the factory.
Despite that fact the hydraulic system must be flushed and bled before taking the system into operation.
The flushing of the system will remove dust particles and potential dirt from the system. Even a tiny amount of dust can cause damages to the system.

After the flushing, the individual brake calipers should be bled in order to remove any air in the system.
If the calipers are not properly bled, damages to the seals may occur.

2.7.1 The calipers hydraulic system must always be bled in conjunction with assembly, repairs or when making changes in the system.

Failure to bleed the brakes will allow air to remain in the brake system. This may prevent the hydraulic system from generating sufficient braking force
Furthermore, air in the system can create "diesel effect" and destroy/blow the seals.

The caliper must be bled at the highest point on the brake through the pressure port (6-C). A special bleeding plug (Mini mess/test point) 1/4" BSP and a hose can be supplied from Svendborg Brakes.

2.8 Bedding in

To obtain the rated coefficient of friction between the brake pad and the brake disc, and to ensure the pad surface is aligned to the disc, it is essential that the pads are bedded to the disc surface.

The coefficient of friction may drop by approx. 20% when not bedded in.

This can be done by making a series of load-tests with increasing load or speed until sufficient coefficient of friction is achieved.
If the brake disc is new, the time of bedding in will be longer because the disc also has to be bedded in. Always use new pads with a new disc. Never use used pads with a new disc.

During the process of "bedding in", the disc temperature should be monitored to ensure that the disc does not overheat.

Organic pads:
Organic pads can normally be bedded in by driving the disc through the pads with a minimum of 25% of the rated clamping force applied or, if that is not possible by making a series of activations with increased load or increased speed.

Maximum temperature of the disk during bedding in, is approx. 200 ° C for organic brake pads

Sinter-metal pads:
The bedding in process for sinter-metal pads is the same as for organic pads, but with a slightly higher clamping force when bedding in - approx. 40% of the rated clamping force applied.

Maximum temperature of the disk during bedding in, is approx. 350°C for sinter metal brake pads.

This instruction for the bedding in process is also to be found delivered with new brake pads.

2.8.1 Connect a hand pump and a pressure gauge into one of the pressure ports (6-C).

2.8.2 Start the application/rotating of the brake disc.

2.8.3 Apply the hydraulic pressure to the correct pressure level. Run until bedded in.

Example:
25% of clamping force needed
25% of the operating pressure of 15.7MPa is approximately 4.0MPa (40 bar)
The hydraulic pressure of 40 bar should be applied during bedding in.

2.9 Removing the brake

2.9.1 Make sure that there is no pressure applied to the caliper and then disconnect the hydraulic system.

2.9.2 Remove the pad retractions springs (and bolts) from the calipers.

2.9.3 Secure the worn brake pads in its positions by means of strips or similar when lifting/handling the brake.

2.9.4 The brake can now be removed safely by unscrewing the mounting bolts (8xM27-12.9) going through the caliper.

3. Maintenance

3.1 Replacing the brake pads

The brake pads must be replaced at the latest when 2mm of the friction material / lining is left on the brake pad.

The brake pad thickness can always be checked with a gauge. Measure the total thickness of the individual pad and measure the thickness of the steel back plate – subtracting these gives the lining thickness.

The brake pads should be kept as clean as possible - be careful to protect the pads from grease and oil. Even a small amount of oil can reduce the friction coefficient considerably.

3.1.1 Ensure there is no pressure on the caliper.

3.1.2 Remove the 4 pad retraction springs (and bolts).

3.1.3 Remove the 8 mounting bolts (M27).

3.1.4 Replace the worn pads with the new pads and press the pistons back into the caliper.

3.1.5 Re-assemble the brake and tighten the mounting bolts. Use the tightening torque specified in table 2.3.

3.1.6 Remount the pad retraction springs & bolts. Use the tightening torque specified in table 2.2.

3.1.7 Connect the pressure and drain lines.

3.1.8 Apply the oil pressure. Allow the pads to engage the brake disc.

3.1.9 Activate the brake a couple of times.

3.1.10 Remember to bed in the brake pads before taking the brake into full load situations - see section 2.8 - *Bedding in of the brake pads.*

3.2 Replacing other components

Some minor components may be replaced with the brake mounted on site, but it is highly recommended to take the brake to a workshop for repairs.

⚠ CAUTION

When lifting please note that the total weight of the complete brake is approx. 55kg. The caliper half itself weighs approx. 26kg.

⚠ WARNING

Always ensure there is no hydraulic pressure applied on the brake before starting work on the brake.

3.3 Dismantling the active caliper

General

The greatest possible cleanliness must be observed when working on a hydraulic system of any type.
Each part must be cleaned thoroughly with solvent cleaners.
Solvent cleaners could be clear methylated or white spirits or isopropyl alcohol.

⚠ WARNING

Solvent cleaners are flammable and poisonous and can cause burns.
See section 2.2 - *Cleaning the brake disc* for additional information.

Parts must be stored in a clean and dust free environment. All assembly work must also be carried out in clean and dust free environment.

Contamination with dirt shortens the lifetime of the seals considerably and may also damage the caliper.

The surface of the internal components i.e. piston (2-C) and the yoke (1-C) that are in contact with the seals are all ground or polished.

Please check that these surfaces are not damaged or scratched in any way and handle them with care to avoid damaging the surfaces.
A damaged/scratched piston will immediately ruin the seals resulting in leakage.

3.4 Replacing the seals

Our sealing solution has changed over time. However they are chosen with 'form, fit and function' which means that they are fully interchangeable.

In order to improve retraction performance for rotor brakes the current seal kit with stepseals use a PTFE main seal and wiper, both with back up o-ring.
When replacing the seal kit the PTFE seal & wiper is preferred for rotor brakes.

If the brake is leaking it is recommended to replace all seals at one time.

IMPORTANT

Make sure there is no pressure on the caliper.

3.4.1 Remove the piston (2-C) by hand. If it is not possible to get a good grip of the pistons, then try to move the pistons out of the yoke by applying compressed air to the pressure port. Be very careful to avoid the pistons being shot out of the caliper, when you apply the compressed air.

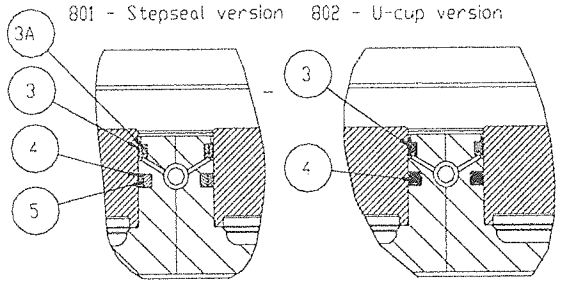
IMPORTANT

Handle the pistons carefully. A scratched piston can immediately destroy the new seals.

3.4.2 Store the pistons in a safe location while replacing the seals.

3.4.3 Remove the wiper (3-C) (or 3-C/3A-C) and the U-cup (4-C) (or the step seal: rod seal (4-C) and the O-ring (5-C)).

FIGURE 3.1



Use a screwdriver to lever the seal and the wiper out of the grooves.

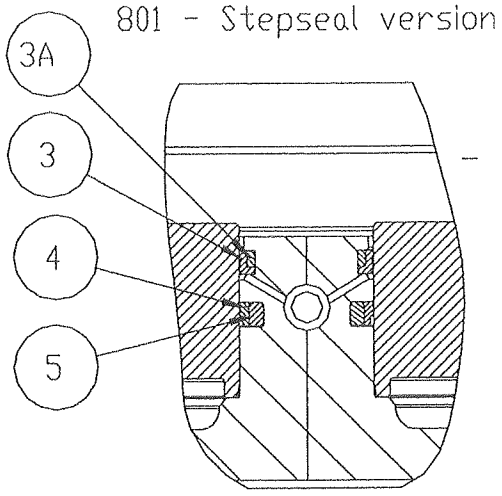
Be careful not to damage the edges of the grooves.

3.4.4 Clean and dry the involved parts, see section 2.2 - *Cleaning the brake disc* for details.

3.4.5 Open the seal kit and place the seals on the table in correct order.

3.4.6 <u>Mounting the new seals - Stepseal version</u>:
For the 801 seal kit refer to figure 3.2 for orientation of seals.

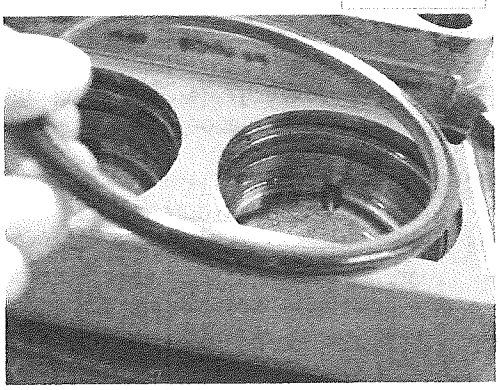
FIGURE 3.2



3.4.6.1 Mount the O-ring (5-C) in the groove before mounting the seal (4-C).

3.4.6.2 Mount the O-ring (3A-C) on the wiper (3-C) before mounting the wiper

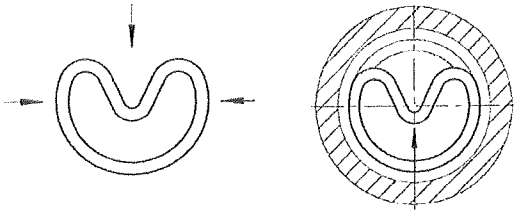
FIGURE 3.3



3.4.6.2 Ensure the orientation is correct and that the O-ring is fully in place.

3.4.6.3 It may be easier to mount the wiper if it is squeezed into a soft U-bend / kidney shape.

FIGURE 3.4



APPENDIX A

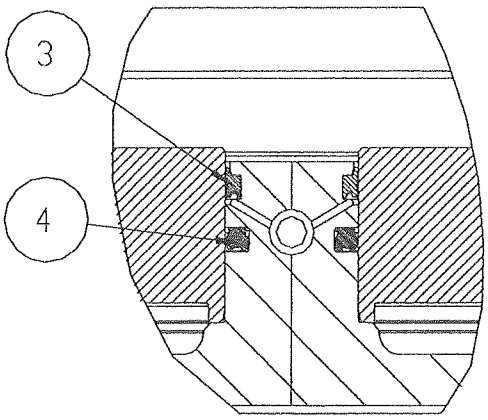
CAUTION

Only use your fingers to squeeze out any kinks. Be very careful with the edges on the piston rod seals as they are quite sensitive.

3.4.7 **Mounting the new seals – U-cup version:** For the 801 seal kit refer to figure 3.5 for orientation of seals.

FIGURE 3.5

802 - U-cup version



3.4.7.1 Mount the U-cup (4-C) in the groove, ensuring the orientation is correct.

3.4.7.1 Mount the wiper (3-C) with the dust lip of the wiper must be facing outwards.

3.4.8 Lubricate the seals and yoke according to the lubrication note in the Appendix C - *Spare parts drawing*. If the indicated lubricant is not available hydraulic oil may be used.

3.4.9 Place the pistons (2-C) in the yoke (1-C).

3.4.10 Push the pistons down as far as possible and fit the brake pads.

3.4.11 Use new bolts when mounting the calipers again. Apply the tightening torques from the spare-parts drawing or from Table 2.3 - *Mounting bolts for caliper half.*

NOTE

Mounting must in general ALWAYS be carried out using new bolts, nuts and washers; otherwise the required pre-tension force of the bolt connection may not be present.

Lubrication is only necessary after dismantling the active caliper for internal maintenance. Please see appendix C.

4. Maintenance schedule

The maintenance intervals on a brake system depend on the usage of the specific brake system and also the design of the application in which the brake system is used.
Frequent usage will result in an increased need for maintenance / inspection.
The checks listed are those that should be performed on a regular basis and are recommended as part of normal planned maintenance tasks.
For a new installation / design where the exact conditions are unknown it is recommended to start with quarterly maintenance / inspection of the brake system.
Once the system has proven to work perfectly the interval can be increased to twice a year, yearly or even longer.
If it turns out that the operating conditions are very good i.e. almost no brake dust, disc is perfectly clean etc. consider increasing the maintenance intervals.
For detailed information on your specific application please contact Svendborg Brakes.
In order to prevent unplanned stops we recommend annual maintenance as a minimum.

Visual checks

- Check for damaged brake lines / pipes / hoses and the hydraulic connections for leaking oil
- Check the calliper(s) for leaks
- Check the drain connection(s) for leaking oil (ideally drain bottles on every calliper)
- Check the callipers and brake disc for oil or grease contamination
- Check the brake pads for excessive wear
- Use the amount of brake dust near the brake as indication of correct maintenance intervals

Check the brake pads for wear

- Check for total pad wear (when to replace the pads) by measuring the remaining thickness of the brake pad lining or if the brake is provided with pad worn indicator(s) and the signal is still on during braking no replacement is needed
- Check the pads for excessive and uneven brake pad wear

Brake disc

- Corrosion on the disc – especially the area covered by the brake pads – must be removed as this can have a negative impact on the brake pads and brake performance
- Check for oil and grease contamination and/or water (e.g. from condensation)

Yaw / slewing brake systems

- Removal of all brake dust from the brake disc by manual cleaning – use protective measures and vacuum cleaner or similar
- Materials that stick harder to the surface should be grinded away / off
- Check hydraulic pressure during yawing and during holding and adjust if necessary
- Color changes of the metallic blank disc surface to yellowish or brownish color should be removed (by grinding)
- In order to remove debris occurring on the brake pads the yaw disc can be turned three revolutions (either direction) preferably running at 0bar hydraulic pressure (typical unwinding pressure) or running at 15bar hydraulic pressure (if 0bar is not possible) on the brakes as this will ease the removal – clean the dust away as previously listed
- A leakage in the drain connection of maximum 0,2litre per brake (2 halves) per year is acceptable

Function test

- Apply the brake in order to ensure the piston and pads can operate
- For yaw / slewing systems (very low speed) check pressure during yawing and during holding and adjust if necessary

Hydraulic oil

- If the brake is not connected to a hydraulic power unit with flushing capability or with a separate return line, it is highly recommended to replace the oil in the brake on a regular basis.
  If the oil inside the brake is not replaced the performance of the oil will be degraded over time.
  Replacement can be done by bleeding the brake.
- If the oil is dirty, replacement is recommended. Alternatively take an oil sample to check oil condition prior to replacing.

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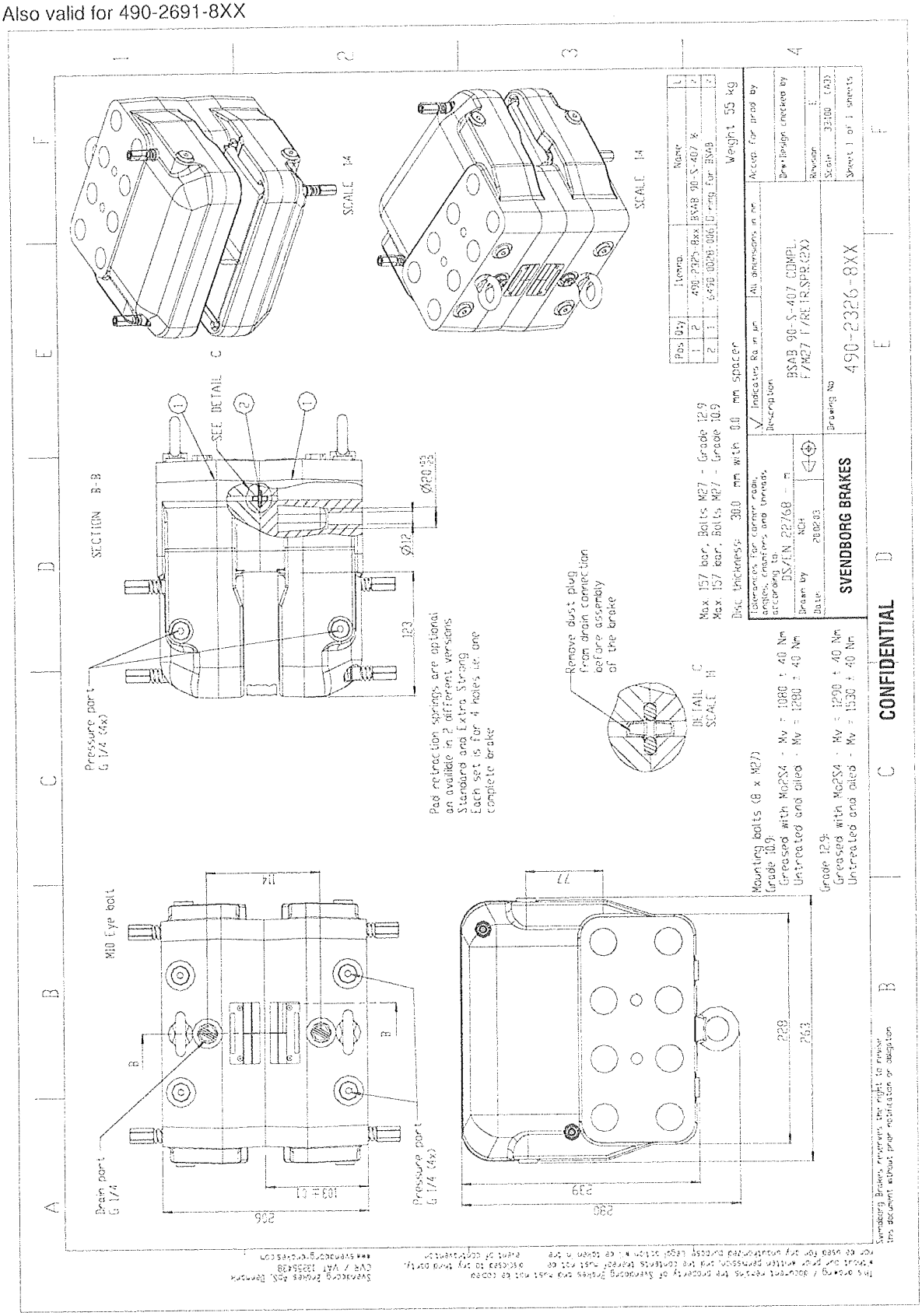
5. Trouble shooting

Fault	Cause	Action
The brake applies slowly.	Air in the hydraulic system	Bleed system at highest point and at brake
	Abnormal throttling in the hydraulic system or valve in wrong position	Check that all valves are in the correct position.
	Abnormal throttling in the hydraulic system caused by dirt	Clean and check pipes, hoses and valves.
	The hydraulic oil in pressure lines between brake and tank has too high viscosity (too thick)	Check that the oil is of the recommended grade and the temperature is not too low.
Long braking time or long braking distance or insufficient braking force.	Load too heavy or speed too high	Check the load and speed values.
	Oil, paint or grease on brake disc or brake pad.	Clean the brake disk - see section Replace or clean the brake pad Check the hydraulic system does not leak.
	Not all brakes are braking/connected.	Check valves where applicable - check that the individual brake is working.
Leakage	Worn seals	Replace seals - check sealing surfaces
Uneven wear on pad.	The brake/bracket is incorrectly aligned	Check the alignment
	Excessive disc run out or shaft deflection	Replace the brake disc and check the shaft run out.
Abnormally heavy wear on pad.	Increased brake utilisation	Check that the load speed and frequency do match specified values
	The brake does not lift the brake pad/piston properly.	Check for remaining hydraulic pressure in the brake.

Appendix A - Dimension drawing

Also valid for 490-2691-8XX



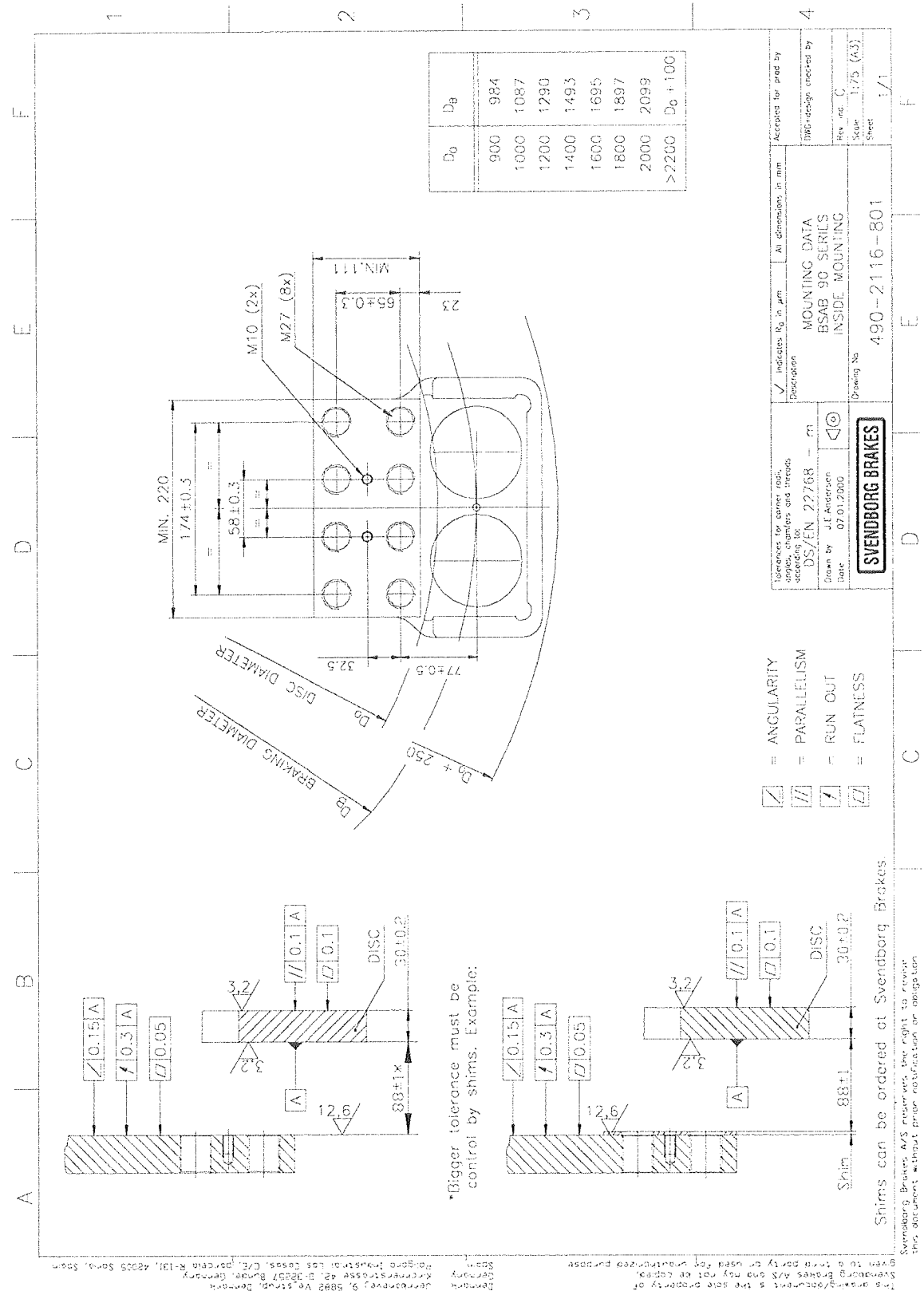
Appendix A - Parts list for complete brake

① 490 2326-801 BSAB 90-S-407 COMPL. D30 F/M27 F/2X RETR. /U-CUP
② 490-2326-802 BSAB 90-S-407 COMPL. D30 F/M27 F/2X RETR. /STEPSEAL
③ 490-2691-801 BSAB 90-R-407 COMPL. D30 F/M27 F/2X RETR. /U-CUP
④ 490-2691-802 BSAB 90-R-407 COMPL. D30 F/M27 F/2X RETR. /STEPSEAL

Pos no.	Qty/pcs				Item no.	Description
	①	②	③	④		
1	2	-	-	-	490-2325-801	BSAB 90-S-407 ½ F/M27 D30 F/2X RETR./U-CUP
1	-	2	-	-	490-2325-802	BSAB 90-S-407 ½ F/M27 D30 F/2X RETR./STEPSEAL
1	-	-	2	-	490-2690-801	BSAB 90-R-407 ½ F/M27 D30 F/2X RETR./U-CUP
1	-	-	-	2	490-2690-802	BSAB 90-R-407 ½ F/M27 D30 F/2X RETR./STEPSEAL
2	1	1	1	1	6490-0028-006	O-RING Ø6X5

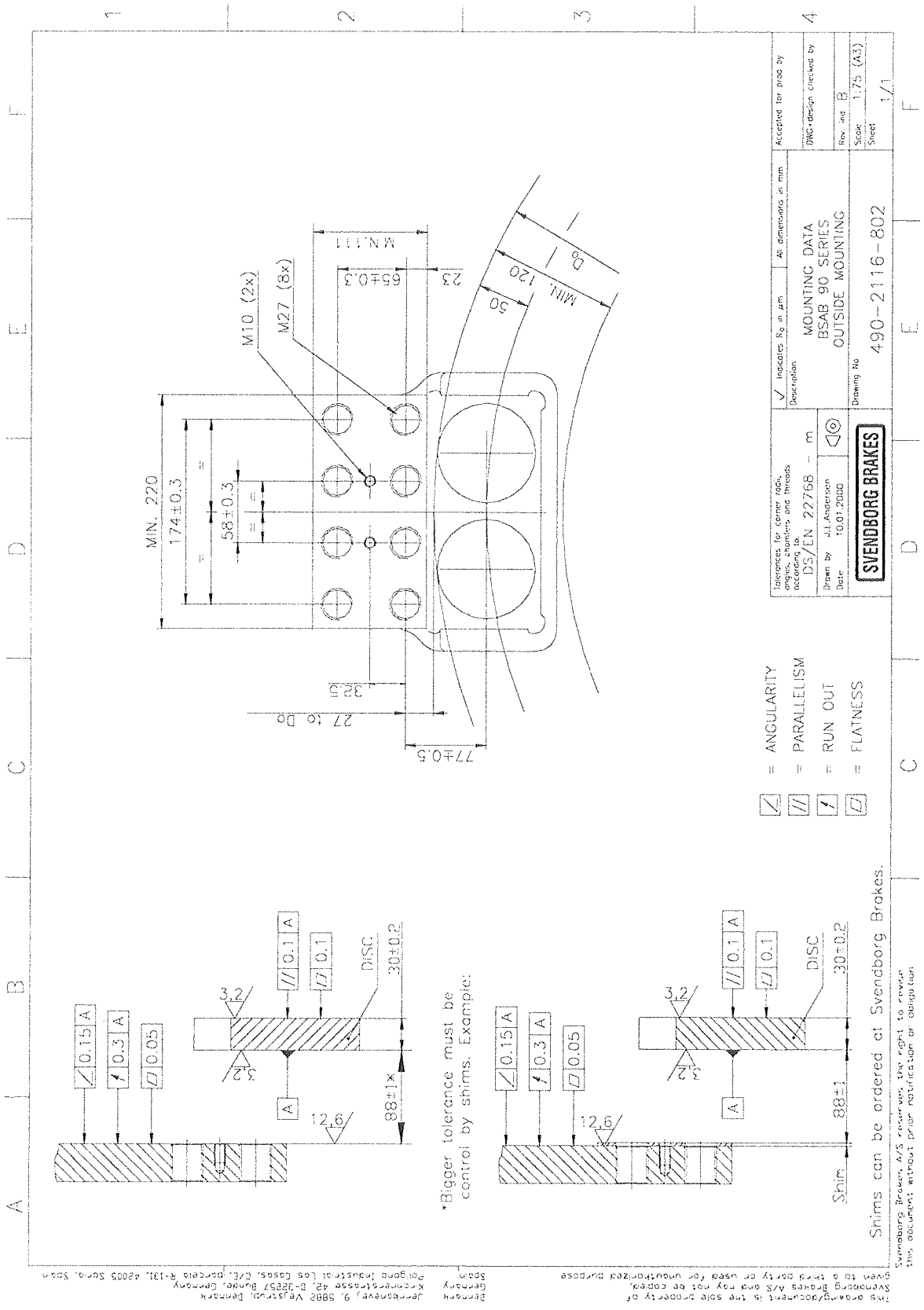
The following parts must be ordered separately, Please see Appendix G	
PAD RETRACTION SPRING SET.	Available in three qualities: Standard, strong and short
BRAKE PAD SET	Brake pad sets for BSAB 90-X-407 are available in different types and qualities. Please contact Svendborg Brakes for selection/order no

Appendix B - Mounting data, inside mounting



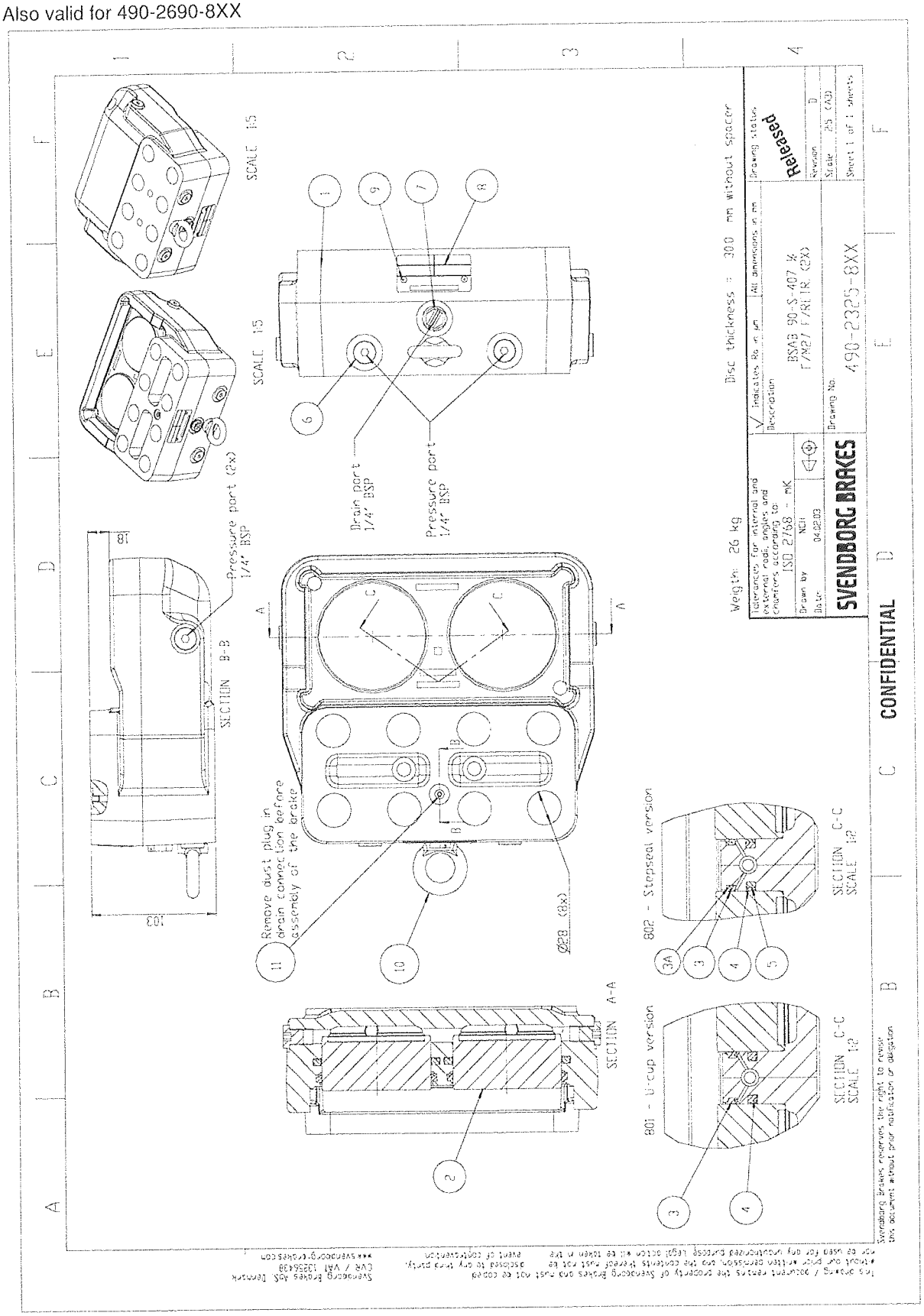
D_b	D_B
900	984
1000	1087
1200	1290
1400	1493
1600	1695
1800	1897
2000	2098
>2200	D_b +100

Appendix B - Mounting data, outside mounting



Appendix C - Spare parts drawing

Also valid for 490-2690-8XX



Appendix C - Spare parts list

①	490-2325-801	BSAB 90-S-407 ½ F/M27 D30 F/2X RETR./U-CUP
②	490-2325-802	BSAB 90-S-407 ½ F/M27 D30 F/2X RETR./STEPSEAL
③	490-2690-801	BSAB 90-R-407 ½ F/M27 D30 F/2X RETR./U-CUP
④	490-2690-802	BSAB 90-R-407 ½ F/M27 D30 F/2X RETR./STEPSEAL

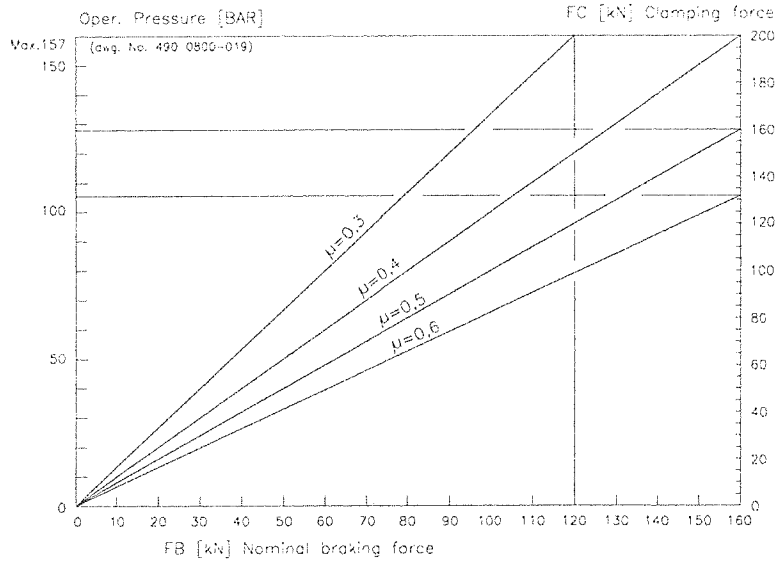
Pos no.	Qty/pcs				Item no	Description
	①	②	③	④		
1	1	1	1	1	490-2324-001	YOKE BSAB 90-X-407
2	2	2	-	-	490 2029-001	PISTON BSAB 90-S-XXX HARD CHROMIUM
2	-	-	2	2	490-2029-004	PISTON BSAB 90-R-XXX HARD CHROMIUM
3	2	-	2	-	6490-0015-009	WIPER Ø90x7.3
3	-	2	-	2	6490-0015-017	WIPER Ø90 EXCLUTER
3A	-	2	-	2		O-RING
4	-	2	-	2	6490-0023-014	ROD SEAL Ø90X6.3
5	-	2	-	2	6490-0024-006	O-RING Ø94.62X5.33
4	2	-	2	-	6490-0051-001	ROD SEAL Ø90X6.3 U-CUP
6	4	4	4	4	2522-2111-110	HYDR PLUG 1/4"BSP W/SEAL
7	1	1	1	1	2522-4525-110	PLUG 1/4"BSP PLASTIC
8	1	1	1	1	490-1263-001	NAMEPLATE W/2 HOLES
9	2	2	2	2	4490-0676-001	BLIND RIVET Ø2,4X6 RH AL/ST
10	1	1	1	1	4490-0610-001	EYEBOLT M10
11	1	1	1	1	6490-0004-008	DBI-DUT no.3

Appendix D - Technical Datasheet

DATA SHEET

Name:	DEB-0090-001
Date:	25.09.2013
Revision:	C

TECHNICAL DATA AND CALCULATION FUNDAMENTALS FOR
DISC BRAKE BSAB 90-X-4XX WITH M27 MOUNTING BOLTS



BRAKING TORQUE

The braking torque M_B is calculated from following formulas:

$$M_B = a \cdot F_B \cdot \frac{(D_0 - 0{,}102)}{2} \text{ [Nm]}$$

$$F_B = F_C \cdot 2 \cdot \mu \text{ [N]} \qquad F_C = A \cdot P \cdot 10 \text{ [N]}$$

Where:
a is the number of callipers acting on the disc
$\mathbf{F_B}$ is the braking force according to table above [N]
$\mathbf{D_0}$ is the disc outer diameter [m]
$\mathbf{F_C}$ is the clamping force [N]
A [cm^2], **P** [bar] and μ see values below

The actual braking torque may vary, depending on friction coefficient.

CALCULATION FUNDAMENTALS

Weight of caliper (without brake pads):		Approx. 55kg
Overall dimensions:		220 x 240 x 260mm
Pad width:		102mm
Pad area:	(organic)	20.300mm^2 (*)
Max. wear of pad:	(organic)	10mm / 8mm (with 10mm backplate) (*)
Pad area:	(sintered)	16.350mm^2 (*)
Max. wear of pad:	(sintered)	6mm (*)
Nominal coefficient of friction:		μ = 0.4
Total piston area - each caliper half:		A=127cm^2
Total piston area - each caliper:		254cm^2
Volume for each caliper at 1 mm stroke:		25cm^3
Volume for each caliper at 3 mm stroke:		76cm^3
Actuating time (guide value for calculation):		0,4sec.
Pressure connection/port:		1/4" BSP
Drain connection port R:		1/4" BSP
Max. operating pressure:		P=157bar
Recommended pipe size:		10/8mm
Operating temperature range		
General usage:		-20°C to +70°C
For brake applications in wind turbines:		-40°C to +60°C

(For temperatures outside this range contact Svendborg Brakes)
(*) On each brake pad

Appendix F - Recommended fluid

DATA SHEET

Name:	DEB-DIVE-005
Date:	19.05.2014
Revision:	I

RECOMMENDED FLUID FOR DISC BRAKES & HYDRAULICS

PRESSURE FLUIDS / OIL TYPES

The following oil types are recommended by Svendborg Brakes – other types corresponding to these can be used.

The general temperature range for our standard ranges of products using hydraulic oil are -20°C to +60°C (-4°F to +140°F) however the BSAK and BSAB brake series are generally approved for lower temperatures.
These are approved for usage at -40°C in wind turbines and for -30°C in other applications.

When quick brake reaction times are critical and operating at temperatures below 0°C (+32°F) it is recommended to use the oil types listed in the Cold section as these types provides the most constant reaction times.
Extreme temperature applications may require special options. Please contact Svendborg Brakes.

	Cold / special option	Standard		Special option
Mineral oil	-40°C - +60°C -40°F - +140°F	-20°C - +40°C -4°F - +104°F	+10°C - +60°C +50°F - +140°F	+30°C - +70°C +86°F - +158°F
Shell	**Tellus S4 VX 32**	**Tellus S2 V32**	**Tellus S2 V46**	**Tellus S2 V68**
Mobil / EXXON	-	DTE 10 Excel 32	DTE 10 Exel 46	DTE 10 Exel 68
Texaco	Rando Ashless 8401	Rando HDZ32	Rando HDZ46	Rando HDZ68
Valvoline	-	Ultramax HVLP32	Ultramax HVLP46	Ultramax HVLP68
Synthetic oil	-40°C - +50°C -40°F - +122°F	-20°C - +40°C -4°F - +104°F	+10°C - +60°C +50°F - +140°F	+30°C - +70°C +86°F - +158°F
Mobil	-	SHC 524	SHC 525	SHC 526
Bio Oil(1) (Ester or Colza oil)	-40°C - +50°C -40°F - +122°F	-20°C - +30°C -4°F - +86°F	+10°C - +60°C +50°F - +140°F	+30°C - +70°C +86°F - +158°F
Shell	-	Naturelle HF-E15	Naturelle HF-E32	Naturelle HF-E46

General: Mineral Pressure Fluids according to DIN 51524 Part 3
(1) There must be less than <200PPM water in the oil, due to the seals.

Viscosity
Recommended viscosity range: 20-200 cSt at working temperature. Generally Svendborg Brakes systems are designed to allow higher viscosity in short periods.

Filtration
The oil in a hydraulic system and the oil added to the hydraulic system must always be filtered. The level of cleanliness in a hydraulic system is an important factor to the lifetime of the system.
When refilling the hydraulic tank, it is stipulated that the oil added to the system is filtered through a 10-micron purity off-line filter unit to the classes listed below.

The hydraulic system, supplied by Svendborg Brakes, has a build-in oil filter with a standard 10-micron purity filter. To maintain a reliable system it is recommend that only hydraulic oil of the following classes of purity is used: NAS 1638, Class 8, or ISO 4406, Class 19/17/14.
It is recommended that the filter is changed at a minimum, once every six months or more often depending on the level of exposure to contamination.

Service life of pressure fluids
Mineral oil: 8.000 Hours or at least once a year.
Other fluids: 2.000 Hours or at least once a year.

Change of pressure fluid
Note: The mixing or blending of different brands or types of pressure fluid can cause unintended chemical reactions, such as sludging, gumming etc. The complete hydraulic system should be thoroughly flushed prior to changing from one oil type to another.
The respective manufactures should be contacted prior to changing from one pressure fluid to another.

Seal material
Brakes from Svendborg Brakes are normally supplied with PUR-seals (PolyURethane)
PTFE (PolyTetraFlourEthylene) seals can be delivered on request for most of the brake types.
Note: the BSFG 400 brake series are supplied with NBR rubber fabric seals (acrylNitrile Butadiene Rubber).

Appendix G - U-cup information

DATA SHEET

Name:	DEB-DIVE-008
Date:	22.11.2012
Revision:	C

U-CUP INFORMATION

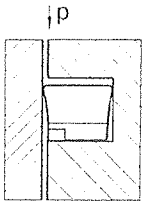
Svendborg Brakes is constantly optimizing the performance of components used in our systems to fit to the applications where our products are used.

For the majority of applications the optimum sealing system is polyurethane seals (PU) and the profile is typically called a U-cup seal as this is softer and is normally more gentle to the piston / moving parts. The polyurethane seal can be either with or without an o-ring in the seal depending on the configuration – see illustration below.

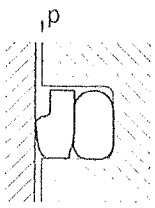
The older seal types are typically based on rubber fabric materials or in some cases a PTFE based seal (Stepseal).

This information is to inform how the U-cup seals shall be mounted when replacing your seals and your documentation does not correspond to the seals.

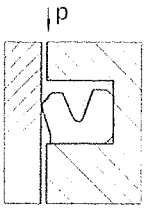
The "↓p" refers to the pressure side.



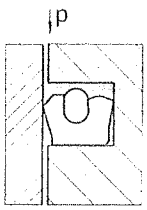
Rubber fabric Seals



Stepseal (PTFE & o-ring)

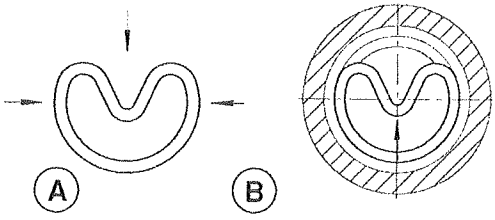


U-cup without o-ring



U-cup with o-ring

To mount the seals - gently form it into a U–shape / kidney-shape without any sharp bends and fit it into the groove

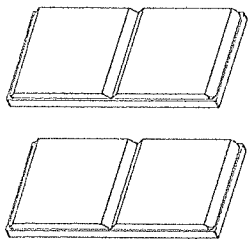
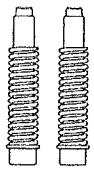
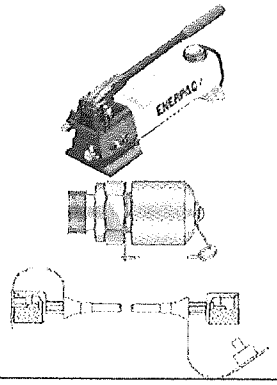
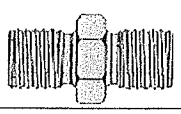


NOTE:
The polyurethane U-cup type is fully interchangeable with the old types with exception of special applications with special temperature ranges and special hydraulic oil types where other types may be recommended.
The standard U-Cup seals are only to be used within an ambient temperature range of -30°C to +80°C. Please make sure that this temperature range corresponds to the ambient temperature range of your brake.

Please do not hesitate to contact Svendborg Brakes if any doubt about the sealing type to be used or if the temperature range is outside the mentioned limits you must specify, that you need step seals.

Appendix G - Recommended spare parts

Recommended spare parts for one brake

Item	Item number	
Brake pad set Organic SB1001 (dynamic) Organic D2013 (dynamic/static) Organic BE3521 (dynamic) Order 1pcs PER brake (1 set contains 2 brake pads)	 491-0013-801 490-2138-001 490-3015-801	
Pad retraction spring set Pad retraction spring set (standard) Pad retraction spring set (strong) Pad retraction spring set (short)	 490-1127-801 490-2610-801 590-0735-801	
Seal kit Seal kit (step seal) Seal kit (U-cup) Order 1set of seal kit PER brake (1 set contains seals for 4 pistons)	 490-2722-806 490-2722-803	
Tools	Used for pressurizing the brake manually)	
Hand pump with 800mm test point hose **Test point connectors (Mini mess)** Test point male 1/4" BSP (pressure) Test point male 1/4" BSP(drain) Test point hose 800mm	0350-1019-801 9009-1010-040 9009-1010-040 9009-3010-008	
Other parts		
Drain kit Drain bottle with tubing and fittings Drain bottle 0,5L plastic Drain bottle 1,0L plastic	 - 9640-0999-001 9640-0999-002	
Adaptor(BSP on brake) **Male BSP to male NPT** 1/4" BSP to 3/8" NPT (pressure and drain)	 9040-1200-802	

APPENDIX B

SVENDBORG BRAKES	TITLE	Guidelines for bedding in process – BE3521 pads	NAME: INS -099
			DATE: 05/02/08
			REV: -

Purpose: Guide lines for the brake pad bedding in process

Extent: Material type BE3521 / Spring applied brakes

How:

The bedding in process is vital to achieve a good contact area and therefore optimal friction.
Pads that are not bedded may only achieve less than 80% of the expected fiction coefficient.
Each application is different so these guide lines must be reviewed in relation to the actual machine and its capabilities.

The process can be applied to both new and used pad sets.
Check the brake or system manuals for details about installation of the brake and pads and adjustment of the brake calliper before proceeding.

Bedding in consists of grinding / rubbing the pads against the disc under controlled conditions until the highest spots in the material are reduced and the contact area is more than 75%

The recommended process is to let the pads trail against the disc at reduced pressure for approx. 500 to 800meters.

Apply hydraulic pressure to the calliper from the main system or with use of a hand pump.
The hydraulic pressure should be calculated to reduce the pad pressure that the brake is applying to the disc to approx 25-30% of the rated clamping force.

This brake clamping force value for the calliper is obtained from the brake nameplate or the calliper data sheet.

For small callipers (or low force callipers) this force may need to be increased to achieve sufficient friction and temperature.

Towards the end of this operation the disc temperature should (ideally) reach a temperature of 150-180^{o}C. This temperature should be held for approx 10-20 seconds.

At this temperature friction coal (pad burning) develops and there will be a burning smell.

After the process, check that the pads have achieved the required minimum 75% area contact.

The process may need to be repeated.
Be careful to control the temperature level, especially with multiple tries.

This hydraulic unit has been performance tested before shipment. It should require no additional field adjustments other than filling reservoir with clean recommended oil and connecting to a proper electrical supply. Disassembly of the unit components in the field is not recommended, in that satisfactory performance of the components is dependent on precision machining and on factory assembly using special equipment.

START UP PROCEDURE

(Do Not Run Unit Without Oil Under Any Circumstances)

Fill the reservoir with clean hydraulic oil (see recommendations below). Use a clean funnel fitted with a fine mesh wire screen. Do not use a cloth strainer. **NOTE: The most common cause of hydraulic system failures, valve malfunctions, and reduced unit life is contamination of the hydraulic fluid (water, chips, lint, dirt, etc.) getting into or already in the hydraulic system through improper maintenance or installation.** When starting the motor for the first time, liberally squirt some clean oil into the pressure port of the hydraulic unit before making the connection to the cylinder line. Disconnect the pressure line as close to the cylinder as possible and place in a suitable container. Alternately start and stop hydraulic unit several times (two seconds on, two seconds off) until pump is primed and full flow begins. Be sure to bleed all air from the system (preferably at highest point with system under pressure) to prevent pump cavitation and erratic operation of the hydraulic unit and cylinder. Connect the pressure line to the cylinder and refill reservoir.

RECOMMENDED HYDRAULIC FLUIDS

To properly perform the function of lubrication and transmission of power, we recommend the use of a good quality SAE 10 Grade Hydraulic Oil for systems having an operating temperature range from 0°F minimum to 160°F maximum, or an SAE 20 Grade Hydraulic Oil for 32°F minimum to 200°F maximum. Operation at fluid temperatures below 160°F is recommended to obtain the maximum unit and fluid life.

FILTER

This hydraulic unit is equipped with an inlet screen filter. The area of the filter is quite adequate and the hydraulic unit should operate for a long period of time using clean oil before the filter is restricted to the point where it would affect the operation of the hydraulic unit. Periodic inspection and cleaning of the filter is recommended. The balance of the hydraulic system (hose and pipe, cylinders, valves, etc.) must be as thoroughly cleaned to prevent contamination problems. To gain access to the filter, drain the reservoir of oil and remove the screws that attach the reservoir to the endhead/manifold. The filter is screwed onto the plumbing elbow that leads to the pump. **CAUTION: Use care while removing filter as not to collapse it.** Wash in suitable solvent and blow out with air from inside out. Reassemble the filter to the plumbing elbow and the tank to the endhead/manifold. **NOTE: Overtightening of the reservoir screws on reassembly can strip the threads in the endhead/manifold.**

PUMP AND MOTOR

Neither the pump nor motor requires any attention under normal operating conditions. The motor bearings are life lubricated and the pump bearings are lubricated by circulating oil internally during unit operation.

TROUBLE SHOOTING

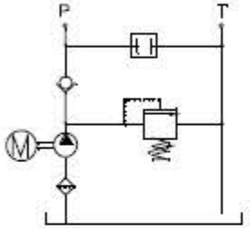
(Little or No Oil Being Pumped, or Low Pressure)

The Following list of items is to check for proper performance of the pump unit only. Remember that many apparent failures in the pump performance may be caused by other components in the system.

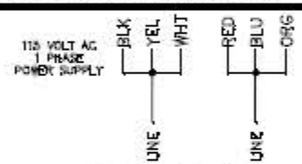
1. Verify that motor is running in the proper direction and wired correctly with secure connections, and proper voltage.
2. Check and maintain reservoir oil level.
3. Check for air or contamination in the system.
4. Check relief valve for proper setting with pressure gauge in outlet line.
   NOTE: Relief valve starts to bypass at approximately 85% of full bypass setting.
5. Check system components for possible internal or external leakage.
6. Check filter for restrictions (indicated by a noisy pump)

** NAMEPLATE INFORMATION **

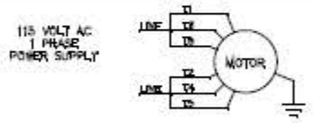
** HYDRAULIC CIRCUIT **



** ELECTRIC CIRCUIT OPTION 1**



** ELECTRIC CIRCUIT OPTION 2**



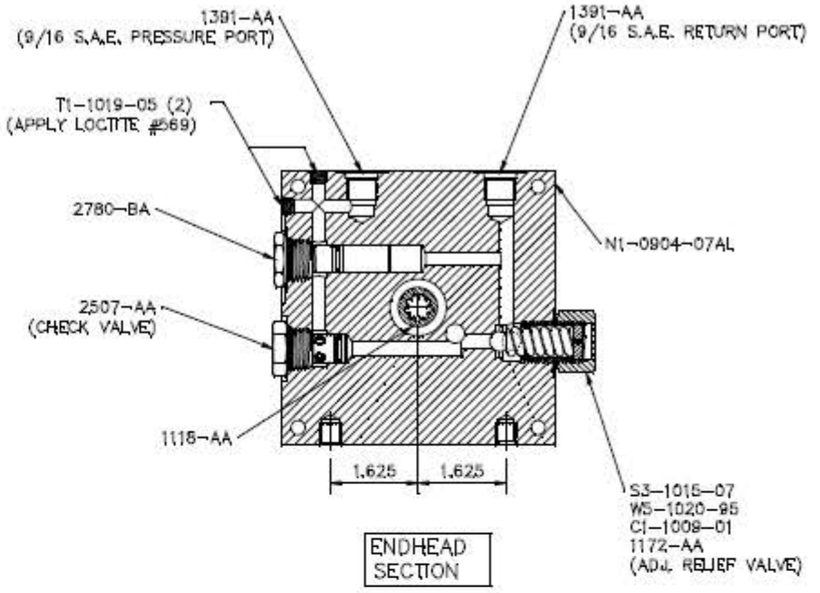
** UNIT SPECIFICATION **

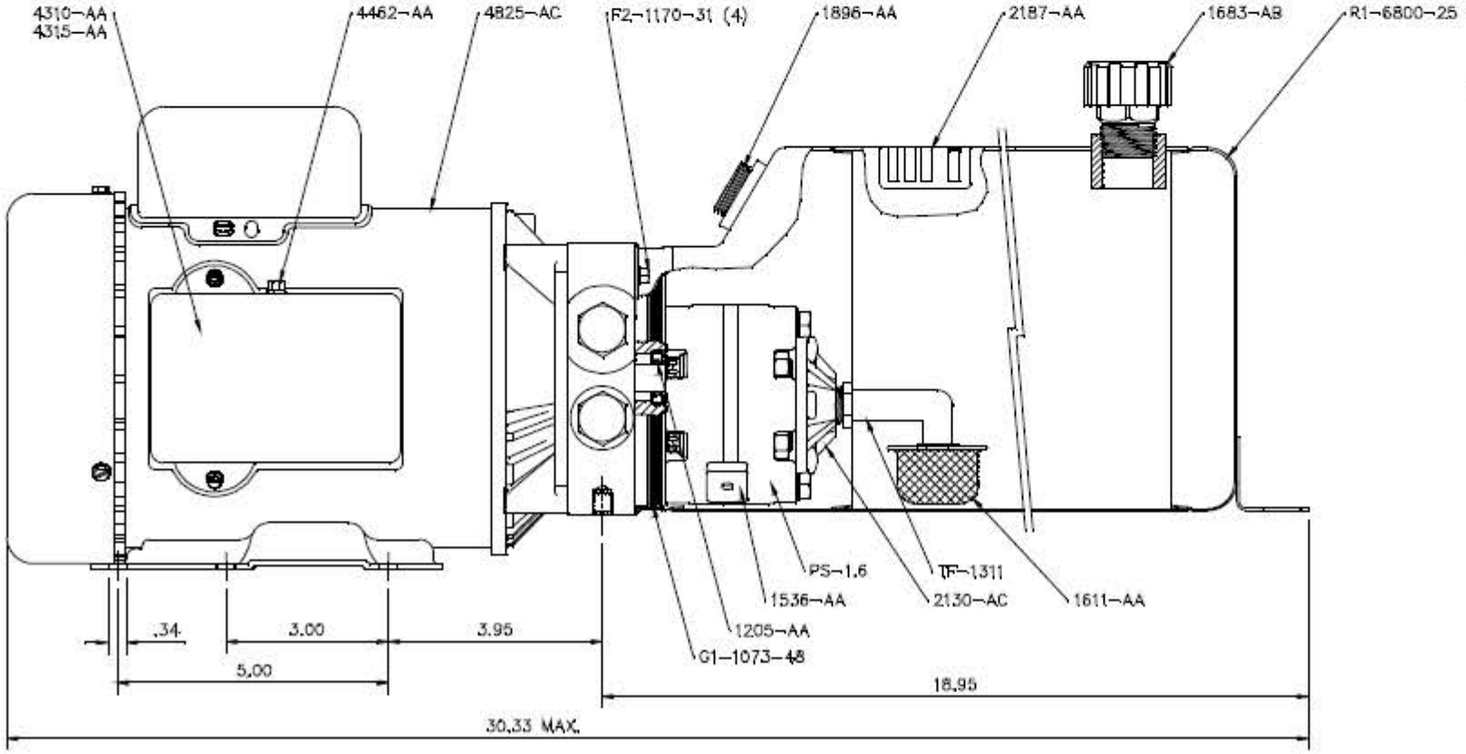
MOTOR	115/208-230 VOLTS AC, 22/11.5-11 AMPS, 3450 R.P.M., 1PH, 60HZ, 3HP, 56FR., CONT. DUTY, T.E.F.C.
PUMP	A.P.C. 1.6 CC/REV. (.098 CU.IN./REV.)
RELIEF	ADJUSTABLE RELIEF VALVE SET AT 2500 P.S.I.
ENDHEAD	9/16 S.A.E. PRESSURE PORT 9/16 S.A.E. RETURN PORT (2) 3/8-16 TAP x .38 DEEP MTG. HOLES
TANK	2.5 GALLON (380 CU.IN USABLE) HORIZONTAL MOUNT WITH BREATHER-FILL PORT
VALVING	CHECK VALVE
WIRING	115 VOLTS A.C. TO MOTOR
ASSEMBLY/ FINISHING	WIPE UNIT CLEAN OF OIL APPLY NAMEPLATE TO TANK
PACKING SHIPPING	SHIP 54-1000-00 LOOSE IN CARTON UNIT INDIVIDUALLY PACKED ONE PER CARTON CARTONS ON PALLET

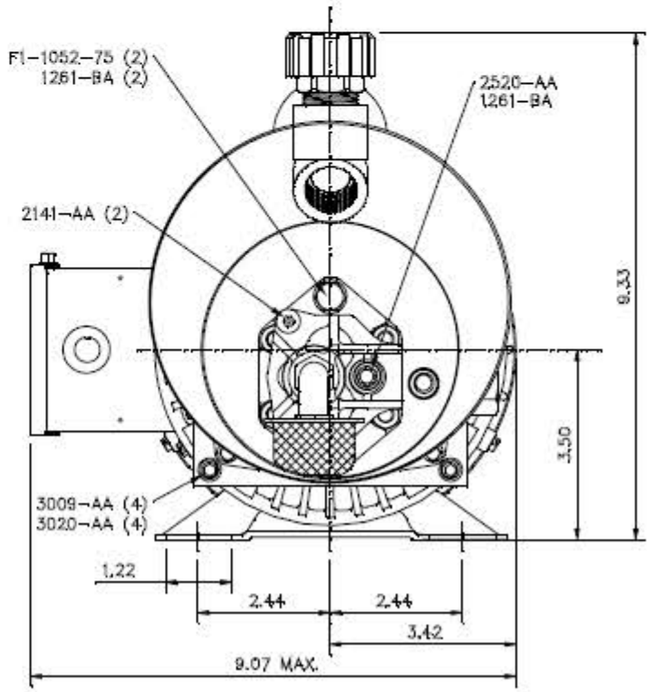
** UNIT PERFORMANCE **

1.6 G.P.M. AT 2000 P.S.I.
AT 115 VOLTS A.C. & 24 AMPS
AT 46 CENTISTOKES (200 SSU)

REFERENCE ONLY







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