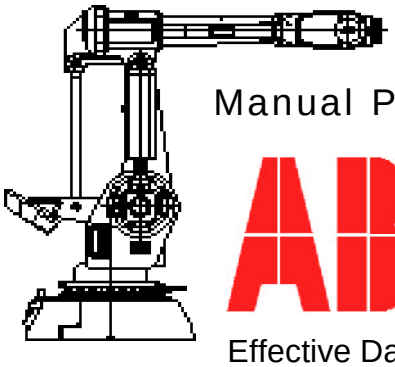
MECHANICAL DISASSEMBLY/ASSEMBLY GUIDELINES

FOR

IRB6400 INDUSTRIAL ROBOT



Manual Part #7000695-001

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SECTION 1

Introduction

INTRODUCTION

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HOW TO USE THIS MANUAL

This manual provides guidelines on how to disassemble and assemble major robot assemblies. In addition, safety, recommended maintenance procedures, and lifting is presented. The manual is directed toward the Machine Repairman and trained maintenance personnel with expertise in both mechanical and electrical systems. The manual does not in any way assume to take the place of the maintenance courses offered by ABB Flexible Automation.

Anyone reading this manual should also have access to the Robot Product Manual and User's Guide.

Section 1 - INTRODUCTION

Section 1 contains information on how to use this manual, a short summary on what is contained in each section, information on what you must know to use the robot, identification plates and labels on the robot, control, and diskettes, and explanation of the symbols used.

Section 2 - SAFETY

Section 2 contains safety information that is very important to know before working with or on the robot and its equipment. You should read and understand this information, and periodically review it to ensure you are working safely.

Section 3 - ROBOT HANDLING

Section 3 presents data and illustrations on how to lift the robot, how to manually release the robot axes brakes, and how to mechanically restrict axis movement.

Section 4 - MAINTENANCE

Section 4 contains the robot periodic maintenance schedule, detailed maintenance procedures for lubricating the components that require lubrication, and detailed instructions for the adjustment of components that require adjustment after reassembly during repairs. In addition, a tool list is presented listing the tools and ABB part numbers that aid in disassembly, assembly, and maintenance procedures.

Section 5 - AXIS 1 DISASSEMBLY/ASSEMBLY GUIDELINES

Section 5 contains the outlines you can use as guidelines when you disassemble and assemble components associated with the robot's Axis 1. These outlines are presented in a clear, step by step format. Each part involved in a procedure is identified by a number that is in a list and on an exploded illustration. For example, pinion (S18) is illustrated on the "S" exploded illustration and listed in the illustration's accompanying parts list in Section 12.

Section 6 - AXES 2 & 3 DISASSEMBLY/ASSEMBLY GUIDELINES

Section 6 contains the outlines you can use as guidelines when you disassemble and assemble components associated with the robot's Axes 2 & 3. These outlines are presented in a clear, step by step format. Each part involved in a procedure is identified by a number that is in a list and on an exploded illustration. For example, motor socket plate (S37) is illustrated on the "S" exploded illustration and listed in the illustration's accompanying parts list in Section 12.

Section 7 - AXIS 4 DISASSEMBLY/ASSEMBLY GUIDELINES

Section 7 contains the outlines you can use as guidelines when you disassemble and assemble components associated with the robot's Axis 4. These outlines are presented in a clear, step by step format. Each part involved in a procedure is identified by a number that is in a list and on an exploded illustration. For example, screw (U85) is illustrated on the "U" exploded illustration and listed in the illustration's accompanying parts list in Section 12.

Section 8 - AXIS 5 DISASSEMBLY/ASSEMBLY GUIDELINES

Section 8 contains the outlines you can use as guidelines when you disassemble and assemble components associated with the robot's Axis 5. These outlines are presented in a clear, step by step format. Each part involved in a procedure is identified by a number that is in a list and on an exploded illustration. For example, motor (W52) is illustrated on the "W" exploded illustration and listed in the illustration's accompanying parts list in Section 12.

Section 9 - AXIS 6 DISASSEMBLY/ASSEMBLY GUIDELINES

Section 9 contains the outlines you can use as guidelines when you disassemble and assemble components associated with the robot's Axis 6. These outlines are presented in a clear, step by step format. Each part involved in a procedure is identified by a number that is in a list and on an exploded illustration. For example, wrist assembly (U10) is illustrated on the "U" exploded illustration and listed in the illustration's accompanying parts list in Section 12.

Section 10 - CABLES GUIDELINES

Section 10 contains the outlines you can use as guidelines when you remove and install the electrical cables. These outlines are presented in a clear, step by step format. Each part involved in a procedure is identified by a number that is in a list and on an exploded illustration. For example, lower cable (B18) is illustrated on the "B" exploded illustration and listed in the illustration's accompanying parts list in Section 12.

Section 11 - ROBOT CALIBRATIO N

Section 11 contains the procedures and data required to calibrate the robot. Setting calibration marks, checking calibration positions, alternate calibration positions, and calibration equipment is also covered.

Section 12 - PARTS LIST & ILLUSTRATION S

Section 12 contains the lists and illustrations of the robot's parts. Each page in this section is oversize at 11" x 17" so it can be folded out, permitting the illu s-tration to be visible at all times while reading the guidelines. The illustrations are in exploded format for ease in reading how parts relate to each other. The parts lists show the part name and ABB part number, quantity, and exploded illustration reference number. The following assemblies are contained in this section:

B BASE components

S SHOULDER components

L LOWER ARM components

U UPPER ARM components

W WRIST components

F FACE components

SM SHELF MOUNTED SHOULDER components. Note that the Shelf mounted shoulder components DO NOT have disassembly and assembly guidelines in this manual. The exploded illustration and parts list are included for parts identification only.

LA EARLY MODEL LOWER ARM components. Note that the early model lower arm components DO NOT have disassembly and a s-sembly guidelines in this manual. The exploded illustration and parts list are included for parts identification only for those that might have this model robot.

BF BASE FAN components. This is an option that some robots will be equipped with. Note that the base fan option does not have disa s-sembly and assembly guidelines in this manual.

Section 13 - REFERENCE MECHANICAL LAYOUT S

Section 13 contains mechanical assembly drawings that you can refer to for added clarification of component relationship. The layouts are actual copies of working drawings and have reference numbers that DO NOT refer to reference numbers in the disassembly and assembly guidelines. However, they can help to clarify several procedures.

Section 14 - REFERENCE CABLE LAYOUT S

Section 14 contains electrical cables reference layouts that you can refer to for added clarification of component relationship. The layouts are actual copies of working drawings and have reference numbers that DO NOT refer to reference numbers in the disassembly and assembly guidelines. However, they can help to clarify several procedures.

WHAT YOU MUST KNOW TO USE THE ROBOT

Normal maintenance and repair work usually requires just standard tools.

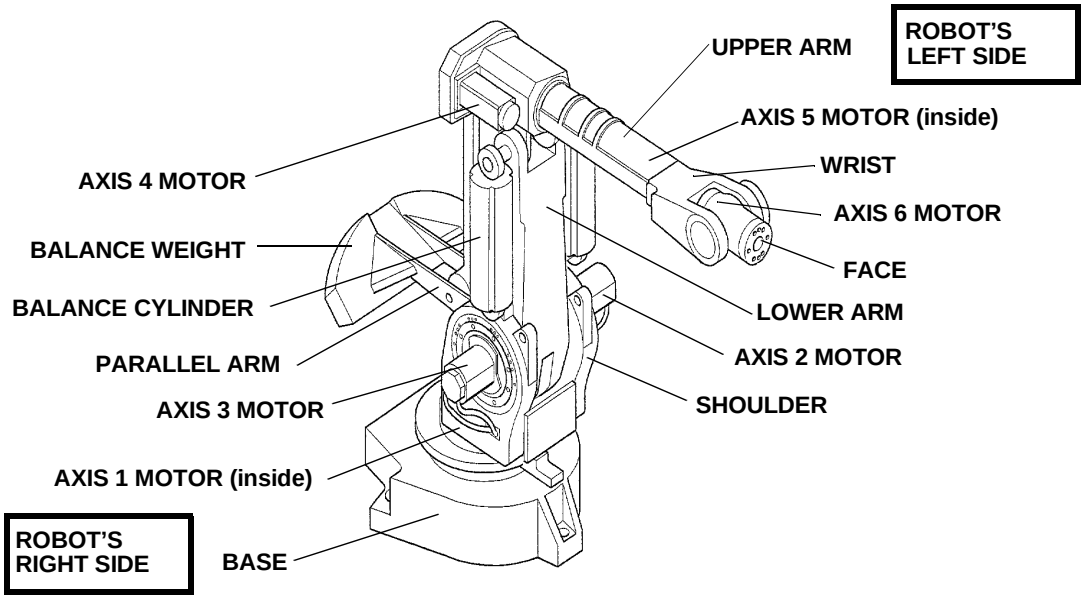
Some repairs, however, do require specific tools. These repairs and the type of tool required, where needed, are described in more detail.

The power supply must always be switched off whenever work is carried out. Note that even though the power is switched off, any orange-colored cables may be live. The reason for this is that these cables are connected to external equipment and are consequently not affected by the mains switch on the robot controller.

WARNING! ALL PERSONNEL WORKING WITH THE ROBOT SYSTEM MUST BE COMPLETELY FAMILIAR WITH THE SAFETY REGULATIONS OUTLINED IN THE SECTION ON SAFETY. UNSAFE OPERATION CAN DAMAGE THE ROBOT OR INJURE SOMEONE!

ROBOT COMPONENTS

The major components as referred throughout this manual are shown in the below illustration. Note that the left side of the robot is on your left side if you were standing behind and facing. In short, the robot's left side is the same as your left side.



ROBOT IDENTIFICATION

Identification plates indicating the type of robot and manufacturing number, etc., are located on the rear of the robot's lower arm (see) and on the front of the controller above the operator's panel (see Figure 2).
The installation and system diskettes are also marked with the robot type and manufacturing number (see Figure 3).

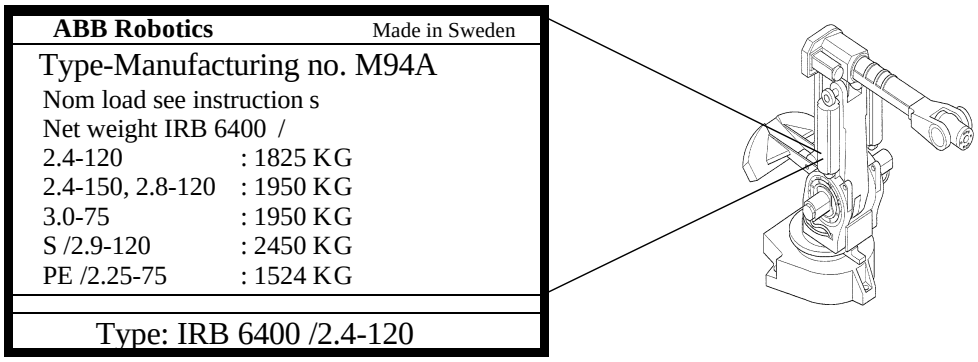


Figure 1 - Identification plate on the robot

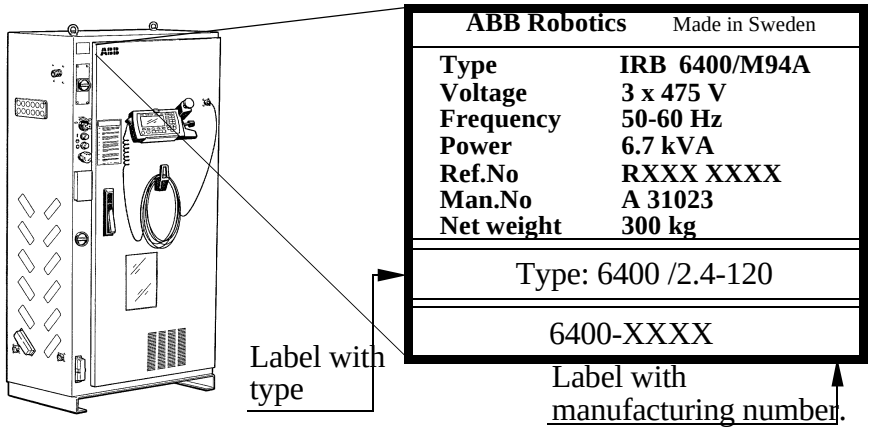


Figure 2 - Identification plates on the controller

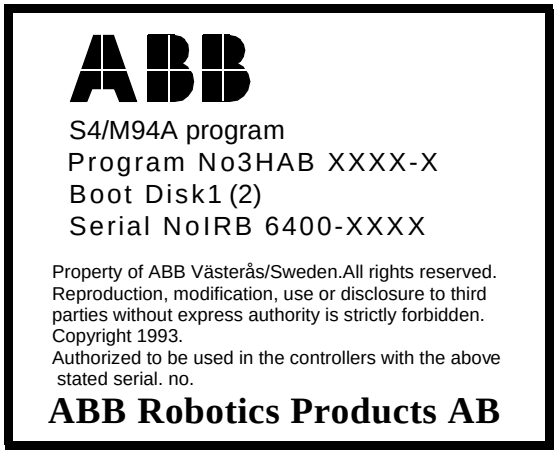
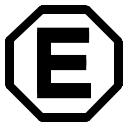


***Figure 2 - Identification labels on the** diskettes*

SYMBOLS USED IN THIS MANUAL

The symbols used throughout this manual are as follows:



EMERGENCY

This symbol warns you of dangers that can result in physical injury if great care is not followed.

CAUTION

This symbol warns you of conditions that can result in damage to equipment if care is not followed.

NOTE

This symbol calls your attention to added information worthy of your notation.

BULLET

The bullet is used to denote an item in a list of important items. It is also used to denote a step in a list of important steps to follow to perform a procedure.

MOTOR WEIGHS APPROX. 50 LB.

COMPONENT WEIGHT

The component weight box is used to give you a quick reference to the approximate weight of the component you are told to remove or lift. You can then decide what equipment you need to assist you, if any.

SECTION 2

Safety

SAFETY

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IMPORTANT

The following safety precautions for the ABB Flexible Automation IRB6400 Industrial Robot have been prepared to help the operator and maintenance personnel in practicing good shop safety procedure

Operating and maintenance personnel should read and understanding these precautions completely before operating, setting up, running, or performing maintenance on the machine.

These precautions are to be used as a guide to supplement the safety precautions and warnings in the following:

a) All other manuals pertaining to the robot.

b) Local, plant, and shop safety rules and codes.

c) Federal and National safety laws and regulations.

See the latest edition of the OCCUPATIONAL SAFETY AND HEALTH STANDARDS, available from the DEPARTMENT OF LABOR, WASHINGTON D.C.

Read all safety precautions before operating the robot. Failure to follow safety instructions may result in personal injury and/or damage to machine components.

The information in this manual does not discuss how to design, install or operate a complete system. It does not cover external equipment not supplied by ABB.

ABB has supplied the robot with numerous interfaces for external safety equipment. It is highly suggested that any place a safety device can be connected, should be. ABB is not responsible for the lack of external safety devices or any concerns if the external safety devices are manually bypassed.

The robot is designed in accordance with the requirements of ISO10218, Jan. 1992, Industrial Robot Safety. The robot also fulfills the ANSI/RIA 15.06-1992 stipulations.

WARNING! USE A CARBON DIOXIDE FIRE EXTINGUISHER (USED FOR ELECTRICAL FIRES) ON THE ROBOT MANIPULATOR OR CONTROLLER SHOULD A FIRE OCCUR!

GENERAL SAFETY

The user of an ABB robotic system has the final responsibility for the safety of personnel working with the system. The safety procedures used should be appropriate to the level of danger and risk associated with the particular installation. These safety procedures should include all of the precautions described below and any additional safety measures appropriate to the particular installation, including the shop or plant safety rules normally in effect.

The robot should be approached with the same caution as any other industrial machine. Although ABB robots are designed for the greatest possible safety, no machine is completely safe and it is impossible to entirely eliminate the human factor.

This robot was designed with safety in mind. It has a dedicated safety system based on a two-channel circuit which is monitored continuously. If an error occurs, the electrical power supplied to the motors shuts off and the brakes engage.

For additional information about robot safety, see American National Standard for Industrial Robots and Robot Systems, ANSI/RIA R15.06-1992.

WARNING! LOCK-OUT PROTECTION SHOULD BE USED WHENEVER POWER IS NOT REQUIRED ON THE ROBOT SYSTEM!

SAFETY FEATURES

- **Selection of Operating Mode**
  The robot can be operated either manually or automatically. In Manual mode, the robot can only be operated using the teach pendant, not by any external equipment.

- **Reduced Speed**
  The speed can be limited to a maximum of 250 mm/s. A speed limitation applies not only to the Tool Center Point (TCP), but to all parts of the robot. It is also possible to monitor the speed of equipment mounted on the robot.

- **Overspeed Protection**
  The speed of the robot is monitored by two independent computers.

- **Emergency Stop (E-Stop)**
  There is one emergency stop push button on the control panel, and another on the teach pendant. Additional emergency stop buttons can be connected to the robot's safety chain circuit.

- **Safeguarded Space Stop**
  These include: Manual Stop, Auto Stop, General Stop, E-Stop, Limit Stop. The robot has a number of electrical inputs which can be used to connect external safety equipment, such as safety gates and light curtains. This allows the robot's safety functions to be activated both by peripheral equipment and by the robot itself.

- **Delayed Safeguarded Space Stop**
  Such as a Hold circuit. A delayed stop gives a smooth stop. The robot stops in the same way as a normal program stop with no deviation from programmed path. After 1-2 seconds the power supplied to the motors shuts off.

- **Restricting the Working Space**
  The movement of each of the axes 1-6 can be restricted using software limits. Axes 1-3 can also be restricted by means of an adjustable mechanical stop. Axis 1 & 2 can be restricted using an Electrical Limit switch.

- **Enabling Device**
  You must use the Enabling Device on the Teach Pendant to start the motor before you can move the robot when in Manual modes. The Enabling Device has a switch with three positions, meaning that all robot movements stop when either the Enabling Device is pushed fully IN, or when it is released completely. This makes the robot safer to operate.

- **Hold-to-Run Control**
  "Hold-to-run" means that you must hold down the Program Start button or step (forward or backward) in order to move the robot. When the button is released, the robot will stop. The hold-to-run function makes programming test safer. This feature can be disabled for manual reduced speed mode.

SAFETY GUIDELINES

When working with any robot system, observe the following safety guidelines:

- Keep the operator work area clean at all times.
- Know the location of all EMERGENCY STOP buttons and POWER ON/ OFF switches that may have to be used quickly.
- Make sure that each person directly responsible for the operation of the robot system has a thorough knowledge of all safety procedures and practices. Keep all gate-access openings to the robot closed and properly secured during operation.
- Keep in mind that there is always an element of risk when approaching a moving robot. Robots exert considerable force even when moving slowly.
- Be aware that when the system is in the RUN mode, the robot may begin to move unexpectedly at any time. A robot program contains many instructions that control the movement of the robot. For example, a pause or slow movement pattern may be followed immediately by rapid acceleration to a high speed movement. Signals from peripheral equipment can also affect the sequence of instructions sent to the robot. A repeating pattern of movement can change abruptly without warning.
- Avoid working alone within the work envelope of the robot when the system is in the RUN mode. One person should remain outside the envelope with the sole responsibility of activating the EMERGENCY STOP button in case a dangerous situation should arise.

If you have to be within the work envelope of the robot:

- Make sure that the entire work cell has been prepared for safe operation before running the robot system. Correct all abnormal conditions of the robot system and peripheral equipment before start up. Notify your supervisor or trained maintenance personnel of any abnormal condition that you cannot rectify yourself.
- Make sure that the robot system is in the MOTORS OFF mode for as long as possible. MOTORS OFF mode means that drive power is removed from the robot's motors and the brakes are applied. Keep program execution to a minimum, and return to MOTORS OFF as soon as possible.
- Select Manual Reduced Speed with the operation mode selector switch on the front of the robot control cabinet. Remove the programming unit from its storage compartment in the control cabinet and carry it (with the Enable Device released) into the work envelope of the robot. This ensures that operating power to the robot motors is disconnected and the robot is in the MOTORS OFF mode.
- Always wear protective clothing and equipment specified by safety regulations. In general, loose-fitting clothes such as ties, scarves, arm bands, etc., should not be worn near the robot system.

SAFETY DURING MAINTENANCE

When performing maintenance on the robot system, all of the previous safety guidelines should be in effect as well as the following:

- Make sure that all persons within the work envelope are thoroughly familiar with the performance characteristics of the robot and its potential hazards.
- When working on the robot controller or while the robot is in the production mode, make sure that the work envelope is clear of personnel.
- Always disconnect main power and 'Lock-Out' the switch box before inspection.
- Replace all equipment/service covers after performing a maintenance procedure.
- Always have an escape path planned.
- Never slow or stop the robot with any body part or makeshift device.
- Removal or loss of air pressure may result in moving mechanisms. Appropriate precautions must be taken to prevent equipment damage or personal injury in such cases.

SAFETY DURING PROGRAMMING

When programming the robot, all of the above safety guidelines should be in effect as well as the following:

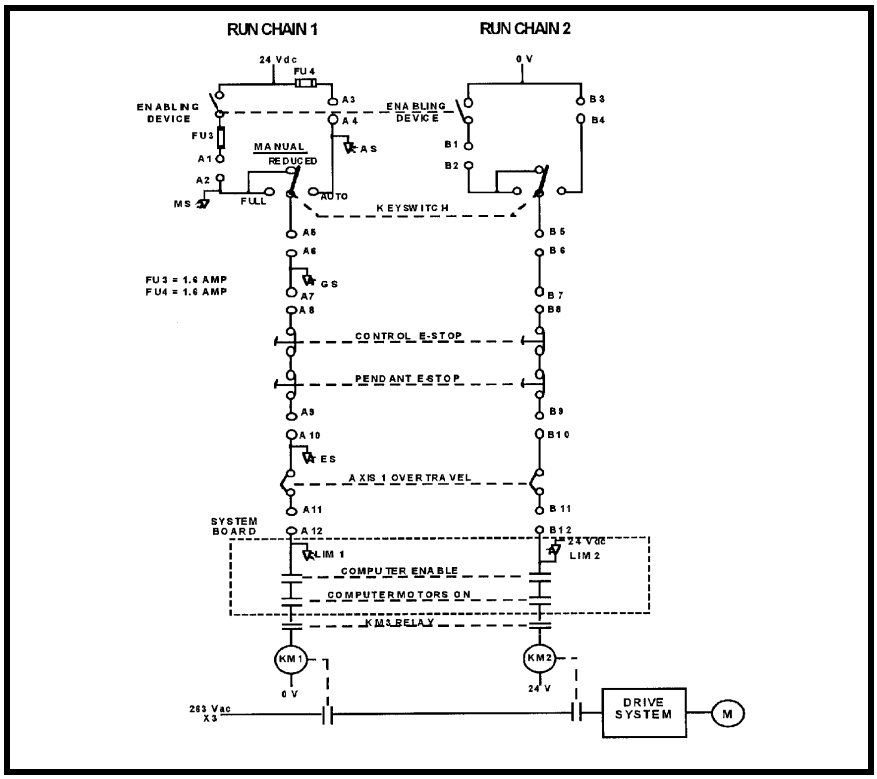
- The robot system must be under the sole control of the programmer.
- Only the programmer is allowed in the restricted work envelope.
- Movement of equipment into the work envelope must be under the sole control of the programmer.
- The robot must always be operated at slow speeds except when a higher speed is needed for program verification.
- The programmer must always be outside the restricted work envelope of the robot before initiating the automatic mode of operation.

SAFETY CONTROL CHAIN OF OPERATION

The safety control order of operation is based on dual electrical safety circuits (Run Chains) which interact with the robot computer and enable the **MOTORS ON** mode.

The electrical safety circuits consist of several switches connected in series so that ALL of them must be closed before the robot can be set to **MOTORS ON** mode. **MOTORS ON** mode means that power is supplied to the motors.

The electrical safety chains are continuously monitored and the robot reverts to the **MOTORS OFF** mode when a fault is detected by the computer. **MOTORS OFF** mode means that drive power is removed from the robot's motors and the brakes are applied.



The status of the switches are indicated by the LEDs on the front of the System board (DSQC 256A) in the Control Cabinet.

If any contact in the safety chain of operation is open, the robot always reverts to the **MOTORS OFF** mode.

After a stop, the switch must be reset at the specific unit which caused the stop.

After reset, the robot can be started again.

WARNING! THE SAFETY CHAINS MUST NEVER BE BYPASSED, MODIFIED OR CHANGED IN ANY OTHER WAY!.

RISKS ASSOCIATED WITH LIVE PARTS

Controller

A danger of high voltage is associated with the following parts:

- The mains supply/mains switch
- The power unit
- The power supply unit for the computer system (220 V AC).
- The rectifier unit (240 V AC and 340 V DC. **Especially Capacitors!**).
- The drive unit (340 V DC).
- The service outlets (110/220 VAC).
- The power supply unit for tooling, or special power supply units for the machining process.
- The external voltage connected to the control cabinet remains live even when the robot is disconnected from the mains.
- Additional connections.

Manipulator

A danger of high voltage is associated with the manipulator in:

- The power supply for the motors (up to 340 V DC).
- The user connections for tooling or other parts of the installation.

Tools, Material Handling Devices, etc.

Tooling, material handling devices, etc., may be live even if the robot system is in the OFF position. Power cables which are in motion during the working process may be damaged.

LIMITATION OF LIABILITY

The previous information regarding safety must not be construed as a warranty by ABB Flexible Automation that the industrial robot will not cause injury or damage even if all safety instructions have been complied with.

Related Information

	Described in:
Installation of safety devices	IRB 6400 Product Manual Chapter 7 - Installation and Commissioning ABB Part #3HAB 0009-55
Changing robot modes	S4 User's Guide Chapter 4 - Basic Operations ABB Part #3HAB 5805-1
Limiting the working space	S4 User's Guide Chapter 12 - System Parameters ABB Part #3HAB 5805-1 IRB 6400 Product Manual Chapter 7 - Installation and Commissioning ABB Part #3HAB 0009-55
Digital system signals	S4 User's Guide Chapter 12- System Parameters ABB Part #3HAB 5805-1

SECTION 3

Robot Handling

ROBOT HANDLING

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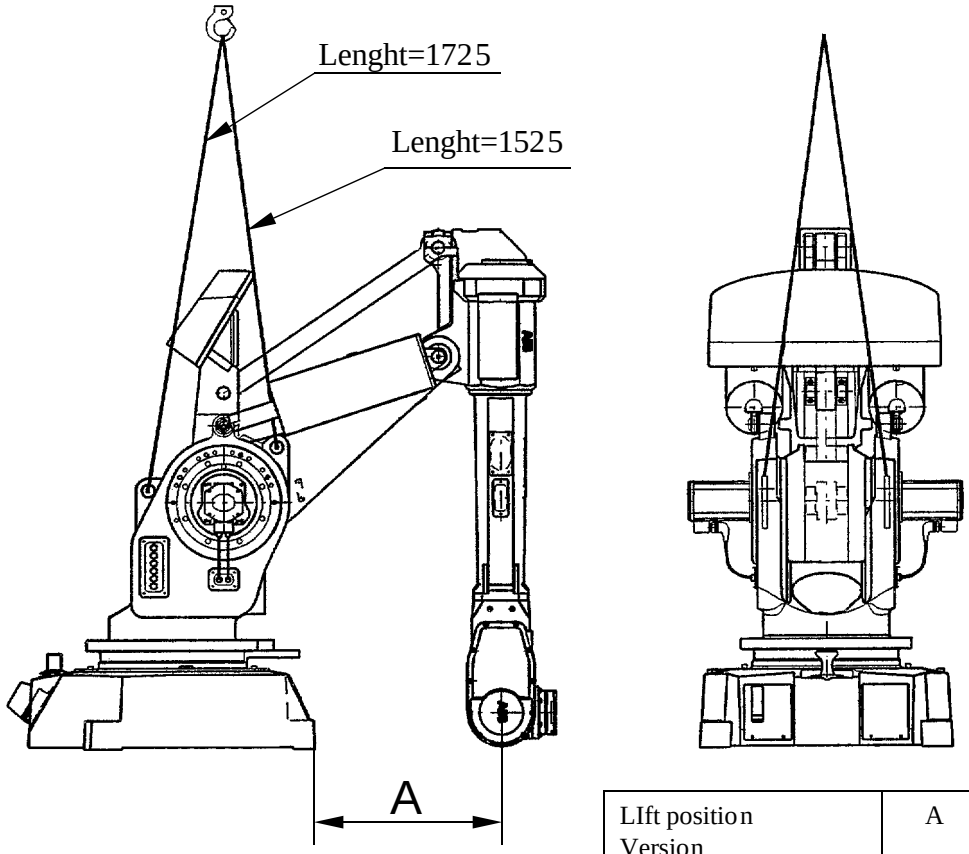
ROBOT LIFTING

The best way to lift the manipulator is to use lifting straps and a traverse crane. Attach the straps to the lifting eyes on both sides of the frame (see Figure 1). The lifting straps dimensions must comply with the applicable standards for lifting. It is also possible to mount two lifting devices (option) for use of a fork lift (see Figure 3).

WARNING! NEVER WALK UNDER A SUSPENDED LOAD!

Crane lift for:
2.4-120, 2.4-150, 2.8-120
and 3.0-75



LIft position Version	A
2.4-120	700
2.4-150	700
2.8-120	1350
3.0-75	1350

Figure 1 Lifting the manipulator using a traverse crane.

Crane lift , in calibation position for models:
2.4-120, 2.4-150, 2.8-120 and 3.0-7 5

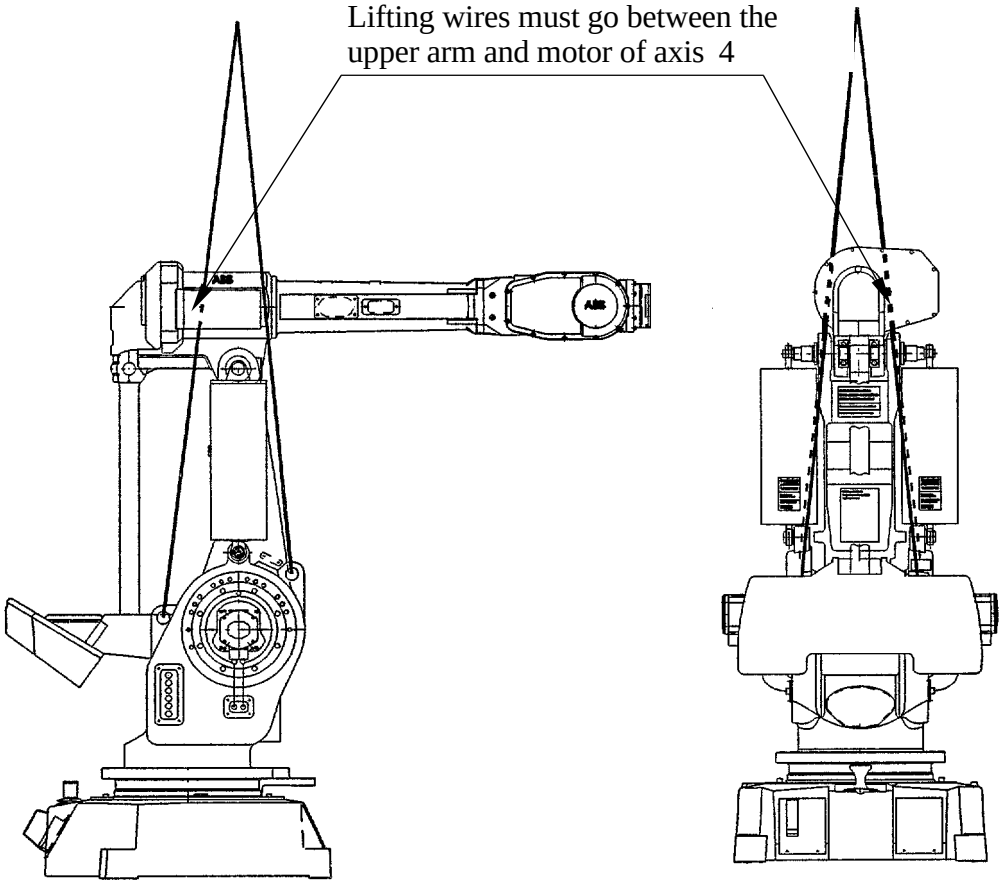
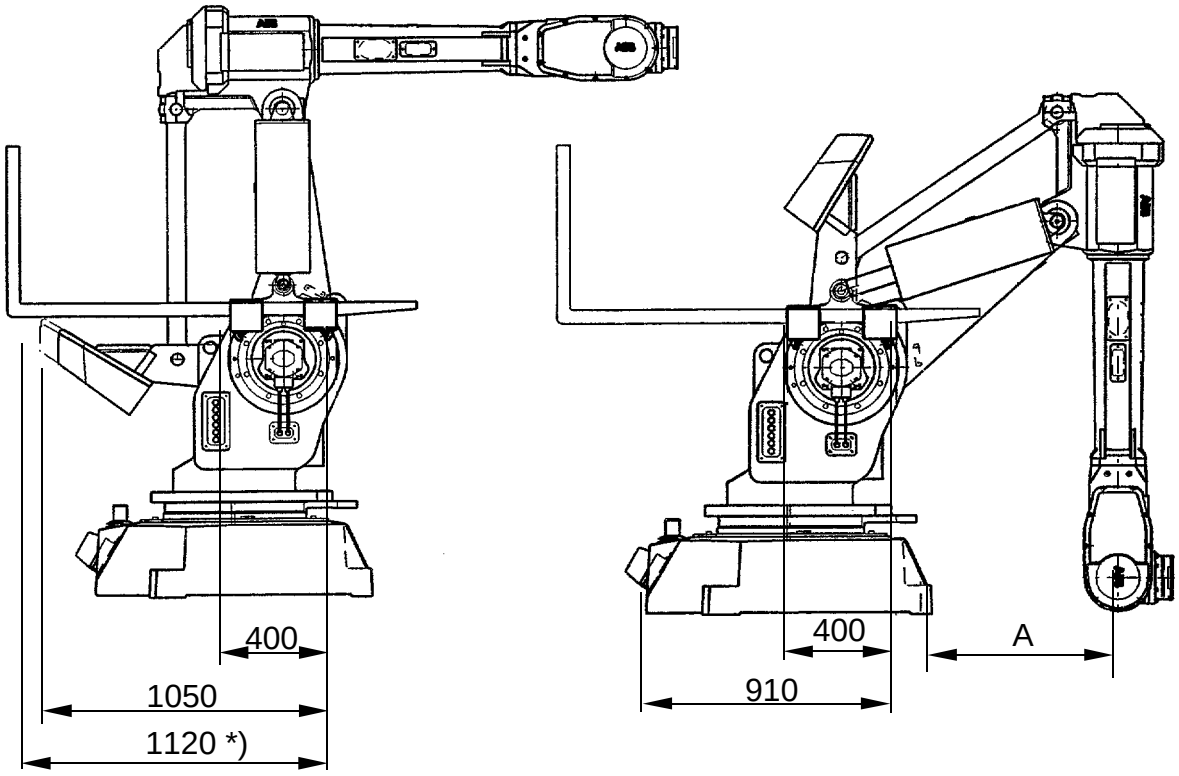


Figure 2 Lifting the manipulator with the arm system in the calibration position.

Fork lift for models:
2.4-120, 2.4-150, 2.8-120 and 3.0-7 5



*) valid for
2.4-150, 2.8-120,
3.0-75

Lift position Version	A
2.4-120	700
2.4-150	700
2.8-120	1350
3.0-75	1350

Figure 3 Lifting the manipulator using a fork lift.

WARNING! CRANE LIFT IS NOT ALLOWED WITH FORK LIFT ARRANGEMENT!

WARNING! FORK LIFT BRACKET MUST BE REMOVED BEFORE ROBOT IS OPERATED!

Crane lift for:
S /2.9-120

Fork lift for:
S /2.9-120

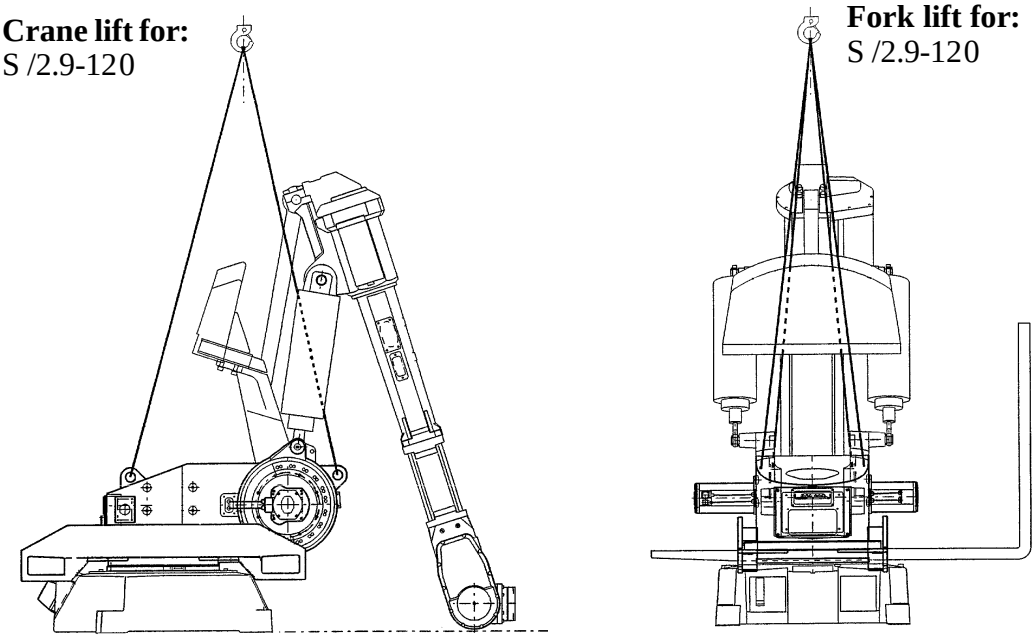


Figure 4 ***Lifting the manipulator using a crane or a fork lift.***

Fork lift for:
PE /2.25-75

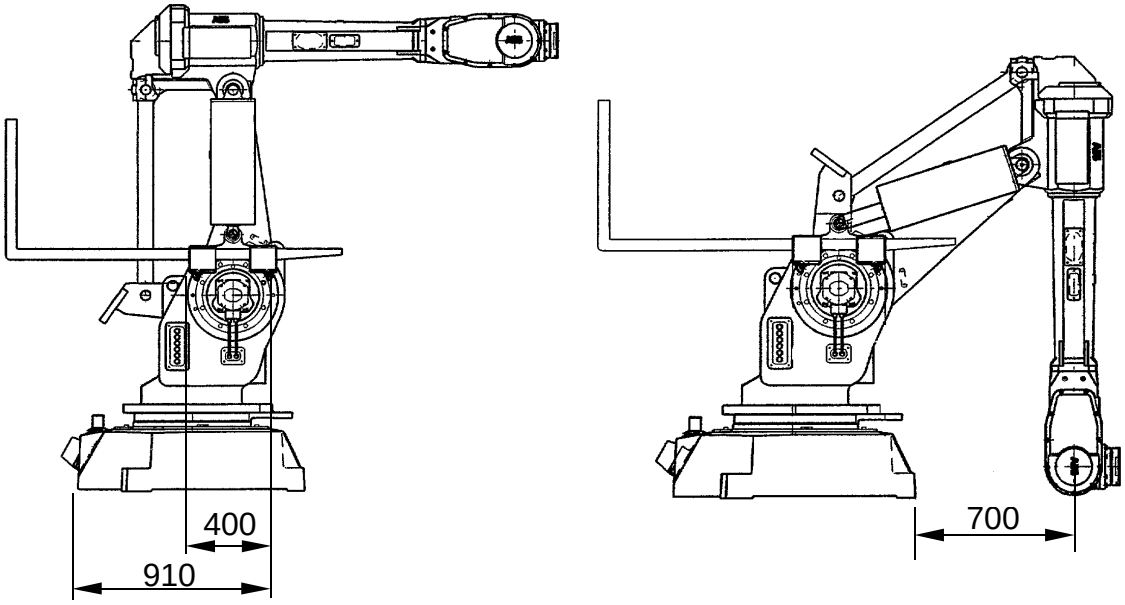


Figure 5 Lifting the manipulator using a fork lift.

RELEASING AXES BRAKES MANUALLY

All axes come equipped with holding brakes. If the position of the manipulator axes are to be changed without connecting the controller, an external voltage supply (24 V DC) must be connected to enable releasing of the brakes. The voltage supply should be connected to the contact at the base of the manipulator (see Figure 6).

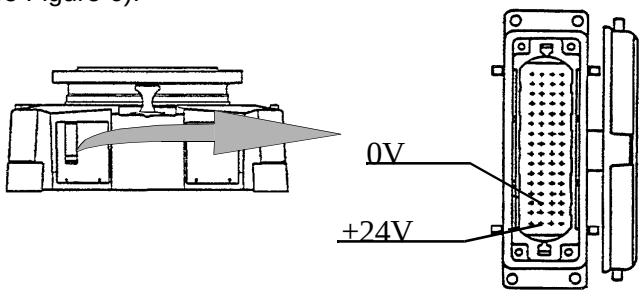


Figure 6 Connection of external voltage to enable releasing of the brakes.

When the controller or the voltage device is connected, illustrated above, the brakes can be released separately by means of the push-buttons on the brake release unit on the exterior of the axis 3 gear box. The push-buttons are marked with the appropriate axis name. The names of the axes and their motion patterns are illustrated in Figure 7.

WARNING: BE VERY CAREFUL WHEN RELEASING THE BRAKES. THE AXES BECOME ACTIVATED VERY QUICKLY AND MAY CAUSE DAMAGE OR INJURY!

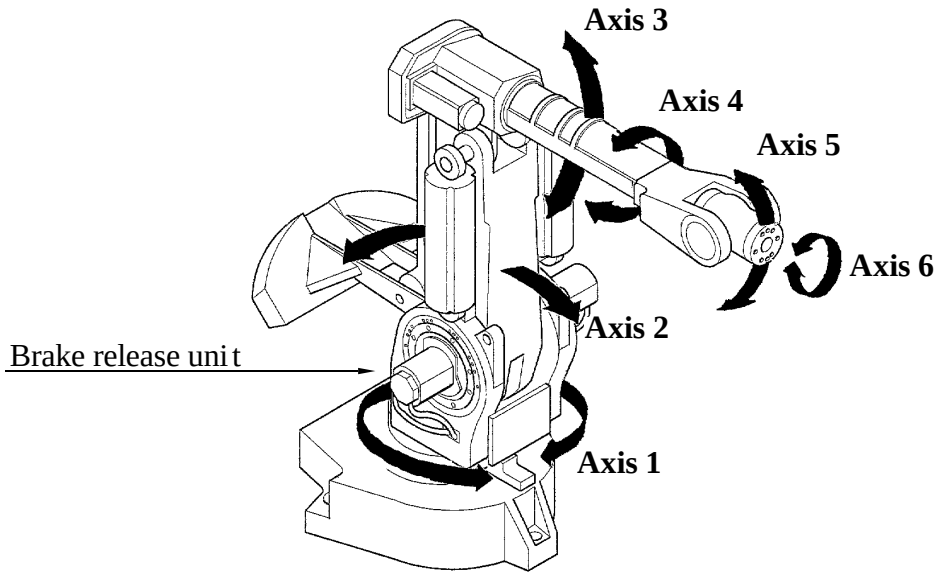


Figure 7 The robot axes and motion patterns.

RESTRICTING AXES MOVEMENT MECHANICALLY

When installing the manipulator, make sure that it can move freely within its entire working space. If there is a risk that it may collide with other objects, its working space should be limited, both mechanically and using software. Installation of an optional extra stop for the main axes 1, 2 and 3 is described below.

Limiting the working space using software is described in the System Parameters in the User's Guide.

Axis 1

The range of rotation for axis 1 can be limited mechanically by fitting extra mechanical stop arms (3HAB 4224-001). Instructions for doing this are supplied with the kit.

CAUTION: THE MECHANICAL STOP PIN AND THE EXTRA MOVABLE MECHANICAL STOP ARM FOR AXIS 1 BE REPLACED AFTER ANY HARD COLLISION TYPE STOP, IF THE PIN OR ARM HAS BEEN BENT OR DAMAGED IN ANY WAY.

Axes 2 and 3

The working range of axes 2 and 3 is limited by mechanically stops and can be reduced by adding fixed mechanical stops (3HAB 4087-001). The stops are mounted on the inside of the frame to each axis. Extra stops must be mounted in a row, with starting-point from the fixed stop.

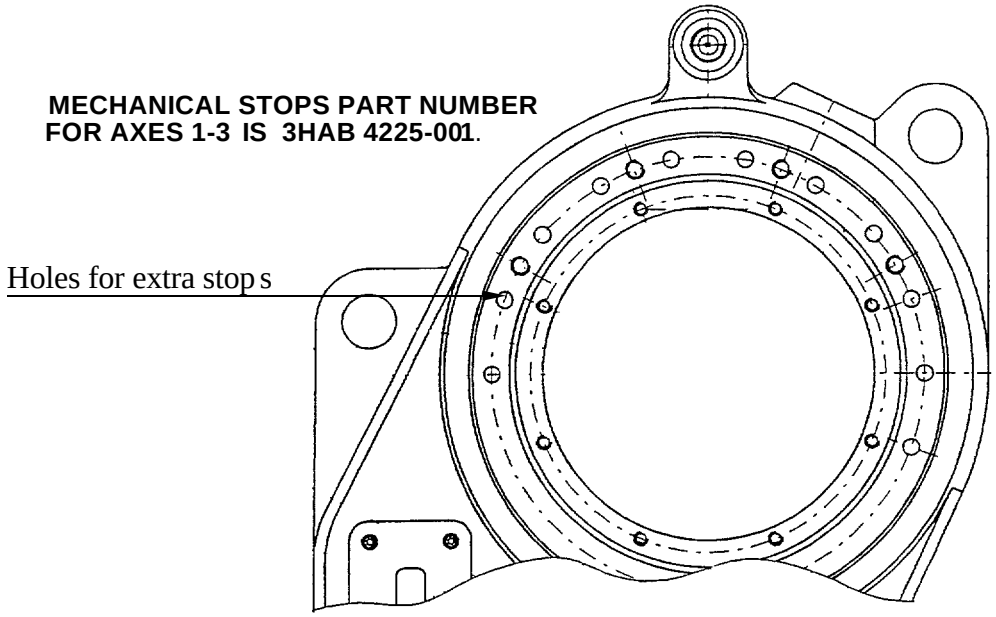


Figure 8 Mechanically limiting axes 2 and 3.

SECTION 4

Maintenance

MAINTENANCE

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GENERAL MAINTENANCE

The robot is designed to be able to work under very demanding conditions with a minimum of maintenance. Nevertheless, certain routine checks and preventative maintenance must be carried out at specified periodic intervals.

- The exterior of the robot should be cleaned as required. Use a vacuum cleaner or wipe it with a cloth. Compressed air and harsh solvents that can damage the sealing joints, bearings, lacquer or cabling must not be used.
- The control system is completely enclosed, which means that the electronics are protected in a normal working environment. In very dusty environments, nevertheless, the interior of the cabinet should be inspected at regular intervals. Use a vacuum cleaner, if necessary.
- Check that the sealing joints and cable bushings are really airtight so that dust and dirt are not sucked into the cabinet.

MAINTENANCE SCHEDULE

	PRESCRIBED MAINTENANCE	CHECK ONCE A YEAR	MAINTENANCE INTERVALS			
			4000 HRS OR 2 YEARS	6000 HRS OR 3 YEARS	5 YEARS	PAGE NO.
ROBOT	Cabling	X [2]				
	Mechanical Stop Axis 1	X [3]				
	Oil Level in Gear 4 & 5	X				
	Cooling Motor Axis 1 FILTER CHANGING	X [5]	X [5]			
	Large Diameter Bearing GREASING		X [1]	X		
	Gearbox Axis 1 GREASE CHANGING		X [4]			
	Gearbox Axes 2-3 GREASE CHANGING		X			
	Gearbox Axis 6 GREASE CHANGING		X			
	Gearbox 1,2,3,6 GREASE CHANGING			X		
	Measuring System Battery CHECK/EXCHANGE			3 yrs		
	Gearbox 4 OIL CHANGING			X	X	
	Gearbox 5 OIL CHANGING			X	X	
CONTROL SYSTEM	Cooling Device FILTER CHANGING		X [6]			
	Memory Backup BATTERY CHANGING			3 yrs		

1 - Recommended interval for large movements on axis 1 (over ±45°). Typical for materals handling.

2 - Inspect all visible cabling. Change if damaged.

3 - Check the mechanical stop devices for deformation and damage. If the stop pin or the adjustable stop arm is bent, it must be replaced.

4 - For press-tending (refers to grease changing and opera;ting life for gearboxes 1 & 6) and heavy duty operation, axis 1 (option 5x is installed).

5 - For robot with option 51 or 5x installed. Recommended interval for filter change is every 3 months.

6 - Interval strongly dependent on the enviroment around the control system.

MAINTENANCE INSTRUCTIONS

General Instructions

Check regularly:

- for any oil leaks. If a major oil leak is discovered, call for service personnel.
- for excessive play in gears. If play develops, call for service personnel.
- that the cabling between the control cabinet and robot is not damaged.

Cleaning:

Clean the robot exterior with a cloth when necessary. Do not use aggressive solvents which may damage paint or cabling

Checking Oil and Grease Levels

Axes 1, 2, 3 and 6

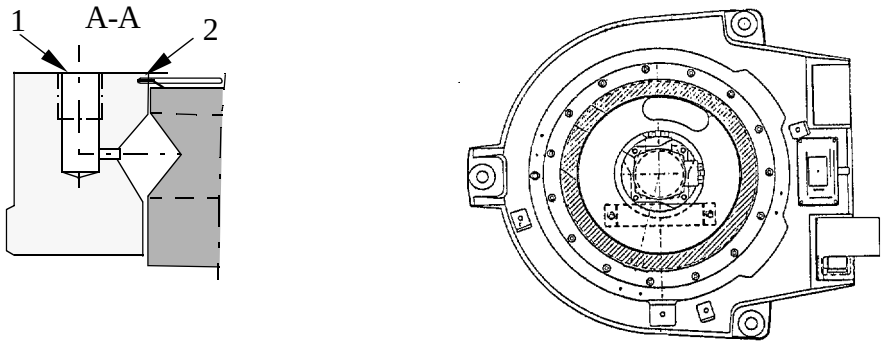
The level in the gearboxes is checked by adding new grease, until grease comes out through the special draining holes. See pages 4-5, 4-6, 4-11.

Axes 4 and 5.

The level is checked by opening the oil plugs. See pages 4-7, 4-9.

Lubricating Axis 1 Large Bearing (S46)

- Remove the two plugs.
- Install the grease nipples (R1/8” art. No. 2545 2021-26) into the two plug holes
- Grease through the two nipples (1). Turn the axis 1 $\pm 90^{o}$ while greasing is in progress.
- Continue greasing until new grease exudes from the rubber seal (2).
- Remove excess grease with a cloth.



Type of grease:

ABB art. no. 1171 4013-301, quality 7 1401-301
ESSO Beacon EP 2
Shell Alvanina EP Grease
SKF Grease LGEP 2
BP Energrease LS-EP 2

Tools:

See Tool List, page 4-25.

Lubricating Axis 1 Gear Reduction Unit (S59)

- Remove the cover on the base (4). (See figure below.)
- Remove the plug (3).
- Fit an R1/2” grease nipple and drain tube.
- Grease through the nipple (1).
- Continue greasing until new grease exudes from the drain tube. See Volume below.
- Axis 1 should be slowly moved backwards and forwards while greasing.
- Move the axes backwards and forwards a couple of times before the plugs are replaced, so that excess grease is pressed out. This is to prevent overpressure in the gearbox, with risks for leakage.

Volume:

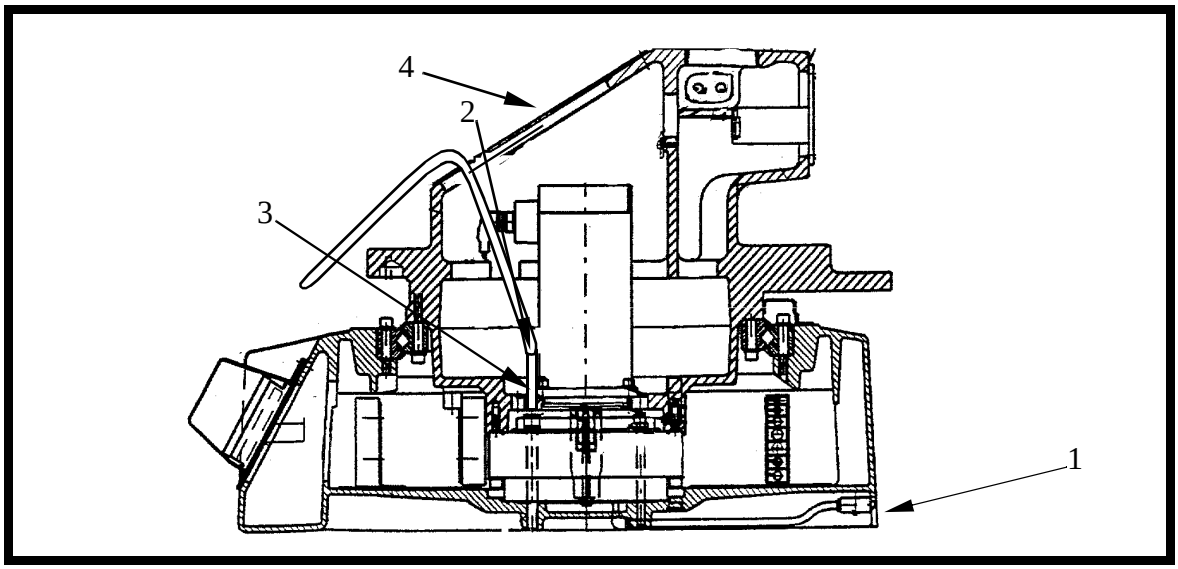
1.3 litres (0.36 US gallon).
About 3.0 litres (0.82 US gallon) should be used when changing the grease.

Type of grease:

ABB 3HAA 1001-294
Optimol Longtime PD 0

Tools:

See Tool list, page 4-25.



Lubricating Axes 2 & 3 Gear Units (S35)

The lubricating procedures are the lame for axis 2 and axis 3. Axis 2 is on the robot right side. Axis 3 is on the robot left side.

- Remove the filler (1) and drain (2) plugs. See figure below.
- Grease through the filling hole (1).
- The axes 2 and 3 shall be moved slowly backwards and forwards several times while greasing.
- Continue greasing until new grease exudes from the drain hole (2). See Volume below.
- Move the axes backwards and forwards a couple of times before the plugs are replaced, so that excess grease is pressed out. This is to prevent over-pressure in the gearbox, with risks for leakage.

Volume:

1.3 litres (0.36 US gallon).
About 2.0 litres (0.82 US gallon) should be used when changing the grease.

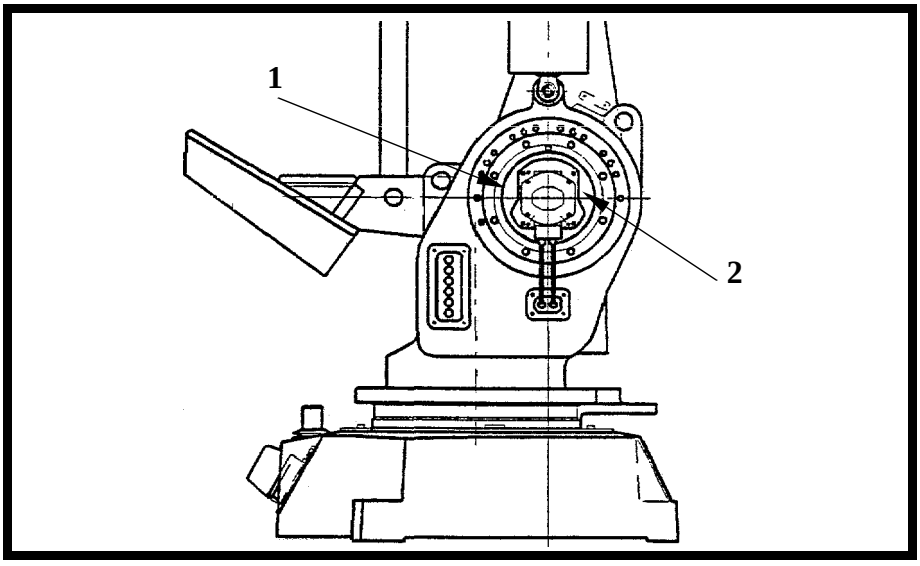
Type of grease:

ABB 3HAA 1001-294
Optimol Longtime PD 0

Tools:

See Tools List, page 4-25.

CAUTION: IT IS IMPORTANT THAT THE DRAIN PLUG IS REMOVED DURING LURICATION.

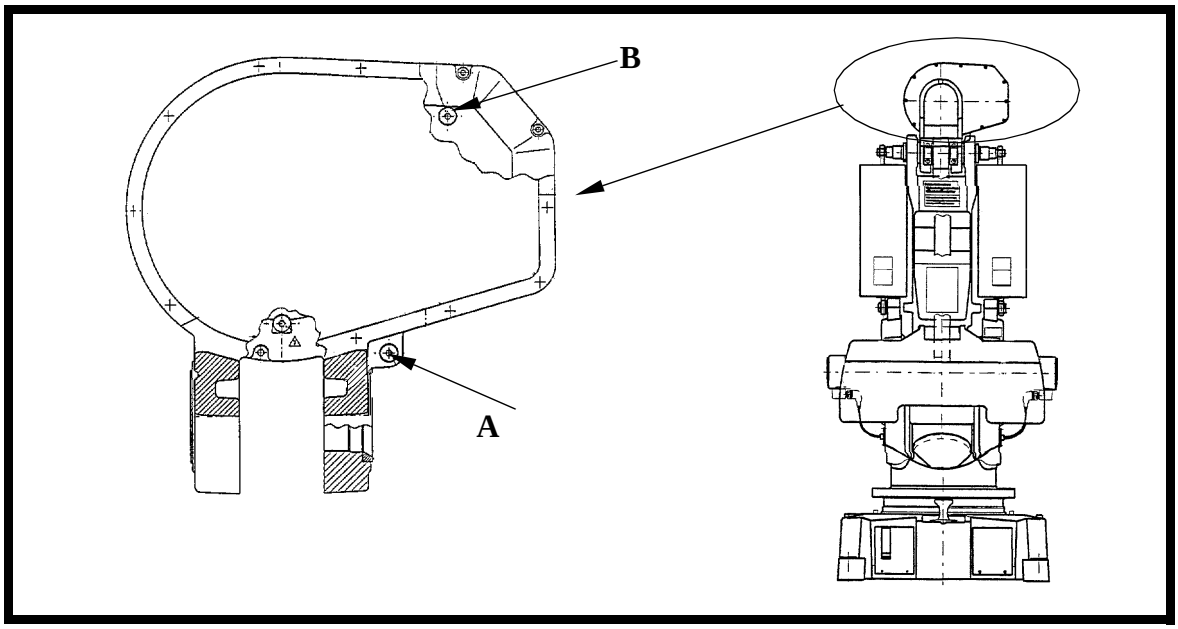


Oil Change Gearbox, Axis 4 (U61)

- Move the upper arm to the horizontal position.
- Remove the plugs (A) and (B).
- Drain off the old oil through the hole (A). See figure below.
- Clean the magnetic drain plug before refitting.
- Refit the drain plug (A).
- Fill up with new oil until the oil level reaches the lower edge of the filling hole (B).

For S/2.9 - 120 robots only:

- Move the upper arm to the maximum upper position before draining the oil.
- Move the upper arm to the vertical position before filling oil.
- Fill up with new oil until the level is 30-35 mm below the upper side of the cover.



Volume approx.:
6 litres (1.75 US gallon).
Correct oil level for axis 4 is to the lower edge of the upper oil-level plug (B).

Type of oil:

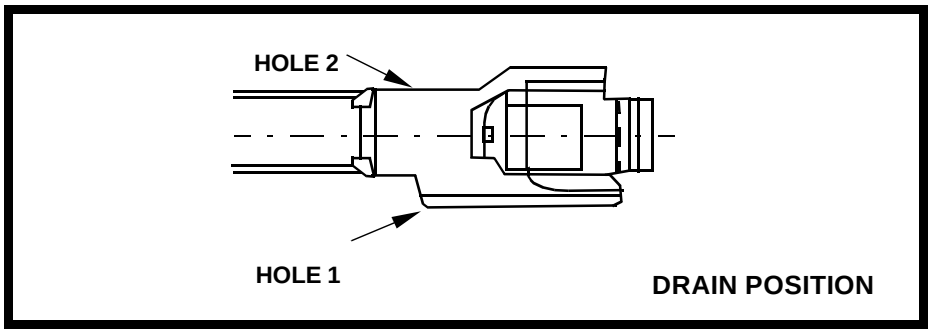
ABB 1171 2016-604

Equivalents:

BP Energol GR-XP 320
Castrol Alpha SP 320
Esso Spartan EP 320
Klüber Lamora 320
Mobil Mobilgear 632
Optimol Optigear 5180
Shell Omala Oil 320
Texaco Meropa 320

Oil Change for Axis 5 Gearbox (W8)

- Move the upper arm to the horizontal position with axis 4 turned +90^{o}.
- Open the oil plug 1, and then oil plug 2 so that air can enter.
- Manually release Axis 4 brake (see page 3-5) and rotate axis 4 manually backwards and forwards to drain the oil, after first releasing the brake on Axis 4.
- Clean the magnetic drain plug 1 before refitting.
- Turn Axis 4 90^{o} before filling oil. Fill the oil through hole 1, until the oil is level with the lower edge of the filler hole.

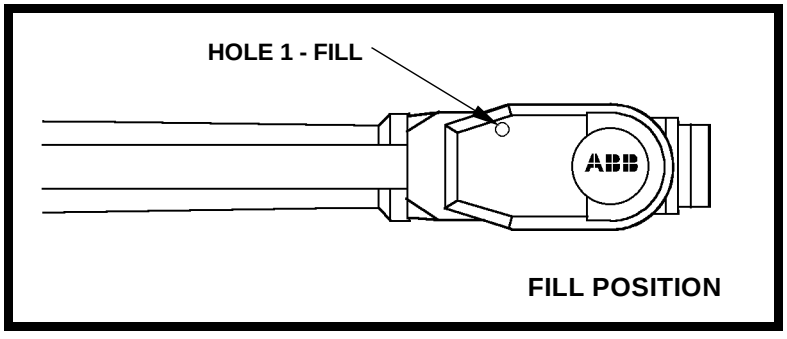


For S/2.9-120 Robots:

- Move the upper arm to the max. upper position before draining the oil.
- Move the upper arm to the vertical position before filling oil.
- Fill up with new oil until the oil is level with the edge of hole 1.

Volume:

5 litres (1.38 US gallon).
Correct oil level for axis 5 is to the lower edge of the oil level plug.



Type of oil:

ABB 1171 2016-604

Equivalents:

BP	Energol GR-XP 320
Castrol	Alpha SP 320
Esso	Spartan EP 320
Klüber	Lamora 320
Mobil	Mobilgear 632
Optimol	Optigear 5180
Shell	Omala Oil 320
Texaco	Meropa 320

Lubricating Axis 6 Gearbox (F17)

- Remove the plug from the drain hole (1). See figure below.

NOTE! Version with only middle hole, remove all the tools that are fitted on the turning gear.

WARNING! IT IS IMPORTANT THAT THE DRAIN PLUG IS REMOVED!

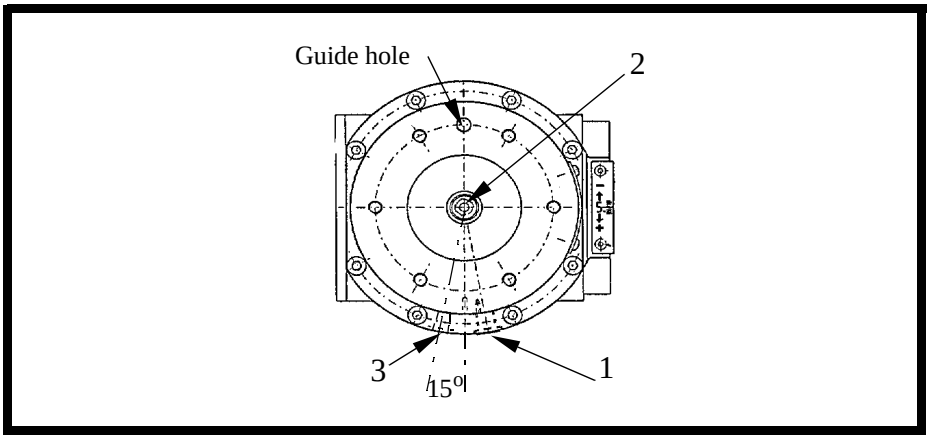
- Grease through the nipple (2) in the middle of the turning gear or radiell nipple of turning gear (3).
- Rotate axis 6 while greasing.
- Continue to grease until new grease exudes from the drain hole (1). See Volume below.
- Move Axis 6 backwards and forwards a couple of times before the plugs are replaced, so that excess grease is pressed out. This is to prevent overpressure in the gearbox, with risks for leakage.

Volume:

0.25 litres (0.07 US gallon).
About 0.4 litres (0.11 US gallon) should be used when changing the grease.

Type of grease:

• ABB 3HAA 1001-294
Optimol Longtime PD 0



Checking Axis 1 Mechanical Stop

Check regularly as follows:

Stop pin:

- that the rubber cover is not damaged.
- that the stop pin can move in both directions.
- that the stop pin is not bent.

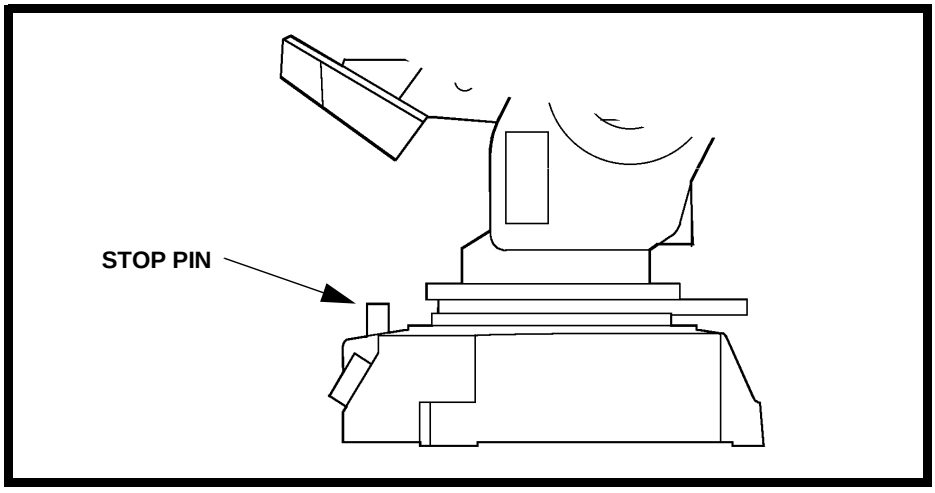
Adjustable stop arms:

- that the arms are not bent. If any of the adjustable stop arms is bent, it shall be replaced by a new one.

WARNING! IF THE STOP-PIN IS BENT, A COLLISION BETWEEN THE SWINGING STOP ARM AND THE STOP PIN HAS PROBABLY OCCURRED. A BENT STOP PIN SHALL ALWAYS BE REPLACED BY A NEW ONE!

Article number:

Stop pin 3HAB 4082-1
Adjustable stop arm 3HAB 4533-3 (Option)



Changing Measuring System Battery

The battery to be replaced is located in the control cabinet, under the cover, in the front of the frame. The article number of the battery is 4944 026-4.

Type:

Rechargeable Nickel-Cadmium battery.

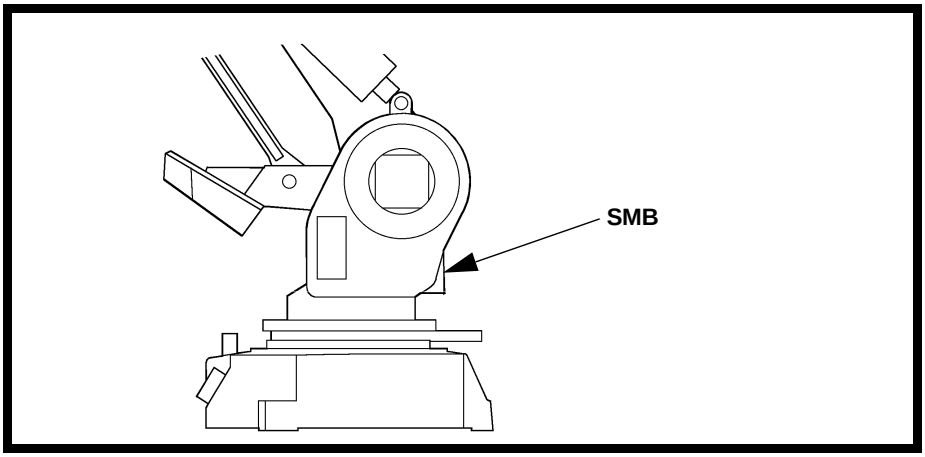
The battery must never be thrown away, it must always be handled as hazardous waste.

Set the robot to the MOTORS OFF operating mode. (This means that it will not have to be coarse-calibrated after the change.)

Unplug the battery connector (R2.G) from the serial measuring board and cut the tie wraps that keep the battery unit in place.

Install a new battery with two new tie wraps and connect the plug to the serial measuring board.

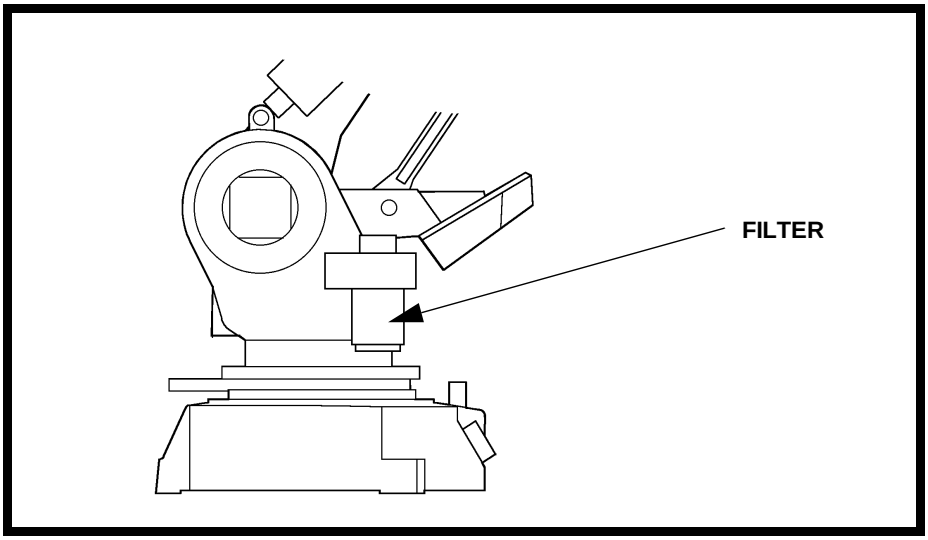
NOTE! It takes 18 hours to recharge a new battery. The main electrical disconnect must be switched ON during this time.



Changing Axis 1 Cooling Filter

- Loosen the filter holder at the intake and remove filter.
- Insert the new filter and replace the filter holder.

The article number of the filter is 3HAA 1001-612.



Changing Control Air Conditioner Filte r

- Remove the grating on the left side of the refrigerating machine.
- Remove the old filter and insert a new one.
- Replace the grating.
- The article number of the filter is 7820 004-3.

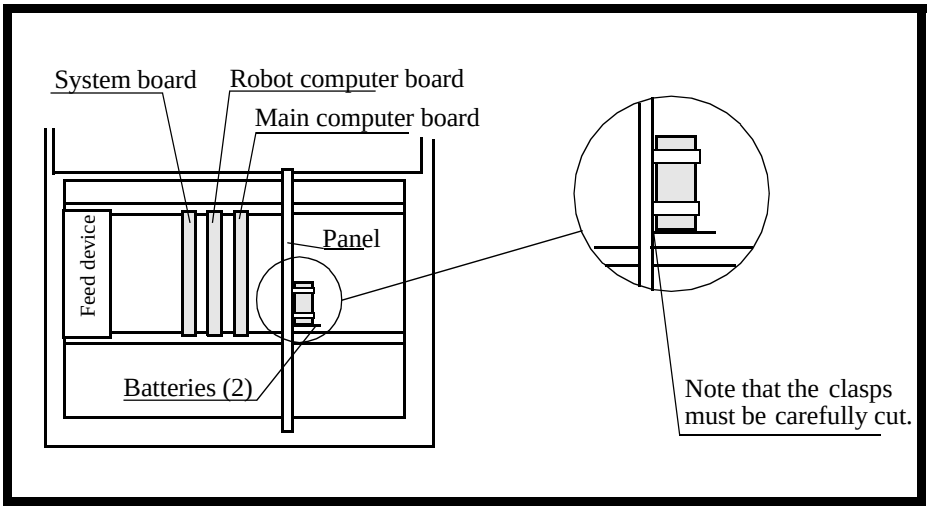
Changing Control Memory Battery Backu p

Type: Lithium Battery.

The article number of the battery is 4944 026-5

The batteries (two) are located on the right side of the computer rack (see Figure 12).

WARNING! Do not charge the batteries! An explosion could result or the cells could overheat. Do not open, puncture, crush, or otherwise mutilate the batteries; an explosion could occur and toxic, corrosive, and inflammable liquide could be exposed. Do not short negative and positive terminals together because cells could overheat. Do not burn or dispose of batteries in normal trash collection; batteries should be collected for disposal in a proper and safe way for disposing of lithium batteries.



- Store the parameters and the program on a diskette, in order not to lose important information from the memory.
- Turn the main electrical disconnect switch OFF.
- Unplug the battery connectors from the backplane.
- Remove the battery by cutting the tie wraps.
- Insert the new battery and fasten using new tie wraps.
- Plug the battery connectors to the backplane.
- Turn the main electrical disconnect switch ON.
- Load the parameters and program from the diskette.

ADJUSTMENTS

Adjusting Axis 4 Gear Play

REFERENCE DRAWINGS

Exploded View:

"U" (pg 12-4)

Assemblies:

3HAA 0001-AP (page 13-15)
3HAA 0001-CS (page 13-14)
3HAA 0001-CS (page 13-17)

REQUIRED TOOLS

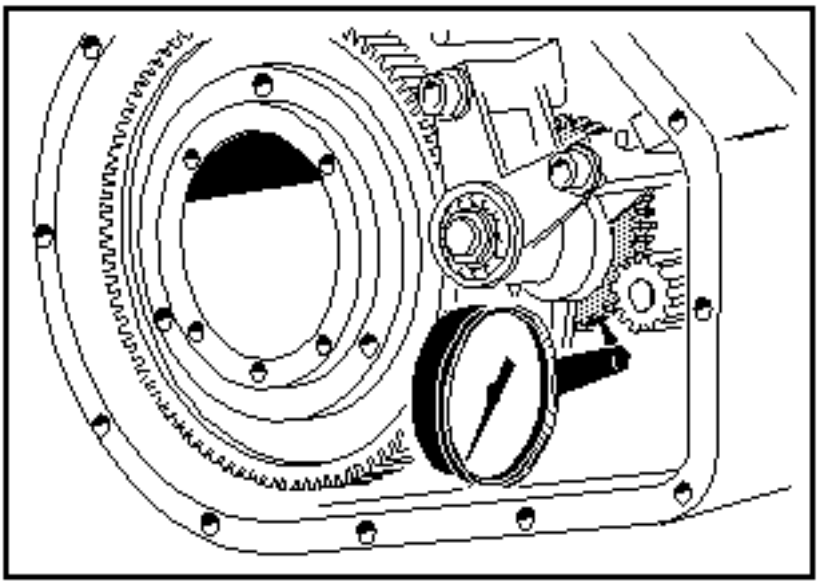
Torque Wrench (9-52 ft-lb)
Loctite 242
Dial Indicator

The following conditions are to exist before play is adjusted

1. Oil for axis 4 (U83) gearbox is removed.
2. Axis 4 (U83) motor is removed.
3. Axis 4 (U54) gearbox cover is removed.
4. Intermediate gear steel wedges (U78) are placed at even depths with spring washers (U77) (concave sides facing) and hex nuts just hand tightened.
5. Intermediate gear hub scres (U67) are just hand tightened.
6. Final gear (U41) and axis 4 tube shaft are mechanically locked from rotating.

Adjusting Play Between Intermediate Gear (U74) and Final Gear (U41):

1. Attach magnetic base of dial indicator to machined surface where the axis 4 motor mount to the upper casting.
2. Set dial indicator to read on large diameter intermediate gear (U74) tooth slot.
3. Shift hub (U72) around until play is between 0.0004-0.001 in.
4. Tighten three screws (U67) to a torque of 52ft-lbs.
5. Tighten hex nuts (U76) to a torque of 9 ft-lbs..
6. Recheck play and re-adjust if necessary.
7. Check a minimum of 4 places around the intermediate gear for high or low spots.



Adjusting Play Between Axis 4 Motor Pinion (U42) and Intermediate Gear (U74):

1. Place motor at point where motor pinion teeth start to mesh with intermediate gear teeth.
2. Release the brake for the axis 4 motor using a 24VDC power supply.
3. Use the mounting screws to pull the motor into place.
4. After motor is firmly in place, remove 24VDC power supply for the brakes and then remove one mounting screw at a time, apply Loctite 242, re-insert, and torque to 16.2 ft lbs.
5. Replace the axis 4 gearbox cover.
6. Refill axis 4 gearbox with oil, 1.75 US Gallons.

Checking Axis 5 Gear Play

REFERENCE DRAWINGS

Exploded View:

"W" (pg 12-5)

Assemblies:

3HAA 0001-GX (pg 13-18)
3HAA 0001-GX (pg 13-21)

REQUIRED TOOLS

ABB #6896 134-CE
Torque Wrench (9-70 ft-lb)
Loctite 242
Dial Indicator

The following conditions are to exist before play is checked

- Oil drained from gear case (W8).
- Gear case cover (W68) and gasket (W67) removed.
- Axis 5 motor (W52) brake engaged holding axis 5 from turning.

Checking play:

- Mount fixing plate tool ABB# 6896 134-CE in three cover screw holes.
- Mount a magnetic dial indicator to the fixing plate tool.
- Measure play against front part of turning disc, at D=160 mm, B=8 mm.
- Play is to be 0.00-0.30 mm at a distance of 196 mm from center of axis 5.
- If checking the gear play of a new wrist, play is to be 0.00 0.15 mm at a distance of 196 mm from center of axis 5.

Adjusting Axis 5 Gear Play

REFERENCE DRAWINGS

Exploded View:
"W" (pg 12-5)

Assemblies:
3HAA 0001-GX (pg 13-18)
3HAA 0001-GX (pg 13-21)

REQUIRED TOOLS

ABB #6896 134-CE
Torque Wrench (9-70 ft-lb)
Dial Indicator
Loctite 242

The following conditions are to exist before play is adjusted

- Oil drained from gear case (W8)
- Gear case cover (W68) and gasket (W67) removed.
- Axis 5 motor (W52) brake engaged holding axis 5 from turning.
- Intermediate gear wedges (W64) removed, along with spring washers (W65) and hex nuts (W66).
- Intermediate gear hub (W38) center mounting screw (W48) loosened.
- Tool ABB# 6896 134-CE mounted.
- Dial indicator with magnetic base mounted.

Adjusting play between intermediate gear and pinion gear :

- Shift the intermediate gear hub (W38) to obtain a play 0.00-0.08 mm between the intermediate gear (W41) and the pinion (W76). Measure the play at three different places.
- Tighten the intermediate gear hub (W38) with the center screw (W48) and torque to 70 ft-lb.
- Install wedges (W64).
- Install spring washers (W65). Concave surfaces face each other.
- Install hex nuts (W66) using Loctite 242. Torque 9 ft-lb.
- Recheck play and readjust, if necessary.

Adjusting Axis 5 Bearings Pre-Tensio n

REFERENCE DRAWINGS

Exploded View:

"W" (pg 12-5)

Assemblies:

3HAA 0001-GX (pg 13-18)
3HAA 0001-GX (pg 13-21)
3HAA 0001-GX (pg 13-20)

REQUIRED TOOLS

ABB #3HAB 1022-1
Torque Wrench (52-64 ft-lb)
Loctite 290

- Remove the stop screws (W45) and the bearing locknut (W43).
- Clean the threads in the hub (W38) and the locknut (W43).
- Apply Loctite 290 on the threads in the hub and the locknut (W43).
- If new bearings are being installed, tighten the locknut (W43) to a torque of 64 ft-lb ±5%. Use tool ABB# 3HAB 1022-1 together with the torque wrench.
- If the old bearings are being re-installed, tighten the locknut (W43) to a torque of 52-56 ft-lb. Use tool ABB# 3HAB 1022-1 together with the torque wrench.

Checking Axis 6 Gear Reduction Unit Pla y

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

REFERENCE DRAWINGS

Exploded View:

"U" (pg 12-4)
"F" (pg 12-6)

Assemblies:

3HAA 0001-APJ (pg 13-15)
3HAA 0001-AP (pg 13-14)
3HAA 0001-CS (pg 13-17)
3HAB 4172-1 (pg 13-22)

REQUIRED TOOLS

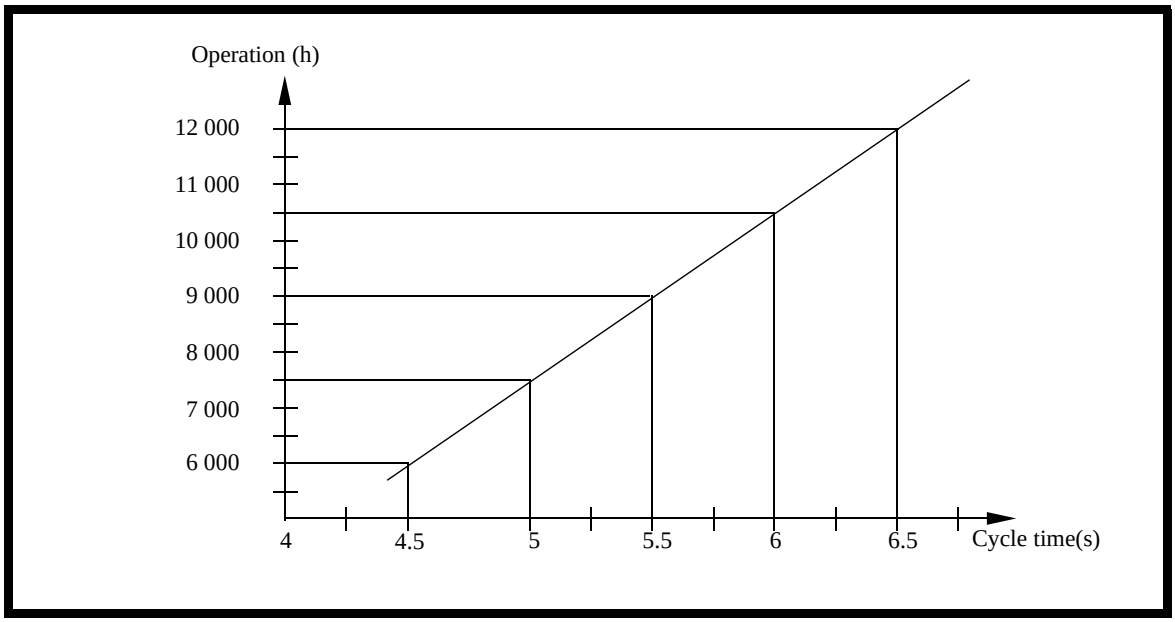
Dial Indicator
ABB #6896 134-CF

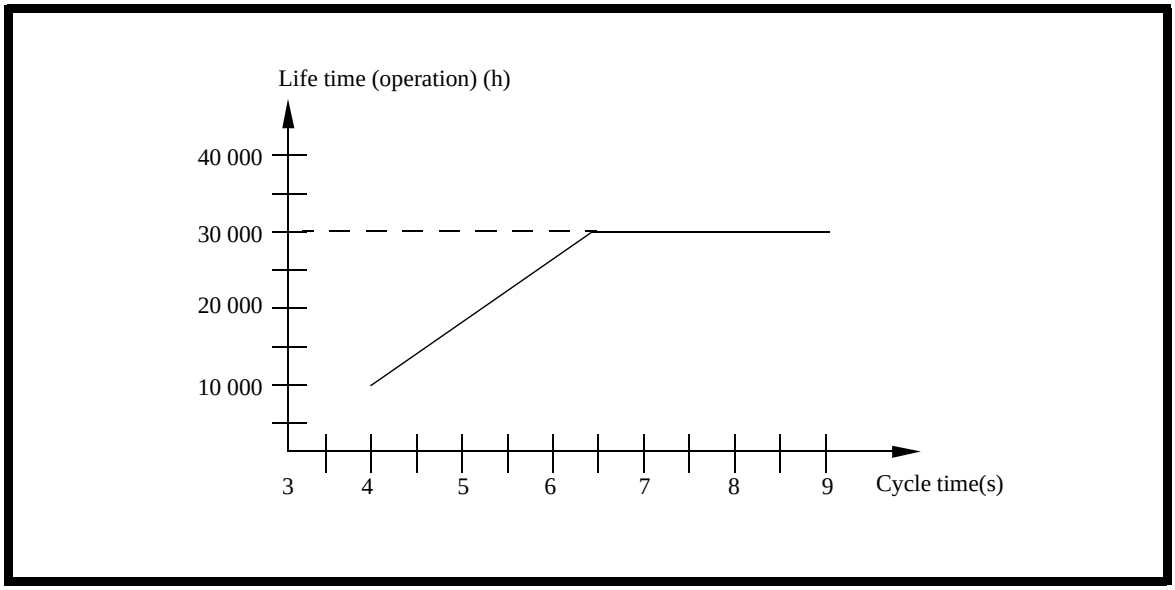
- Mount tool ABB# 6896 134-CF.
- Measure play with a dial indicator 190 mm from center of axis 6.

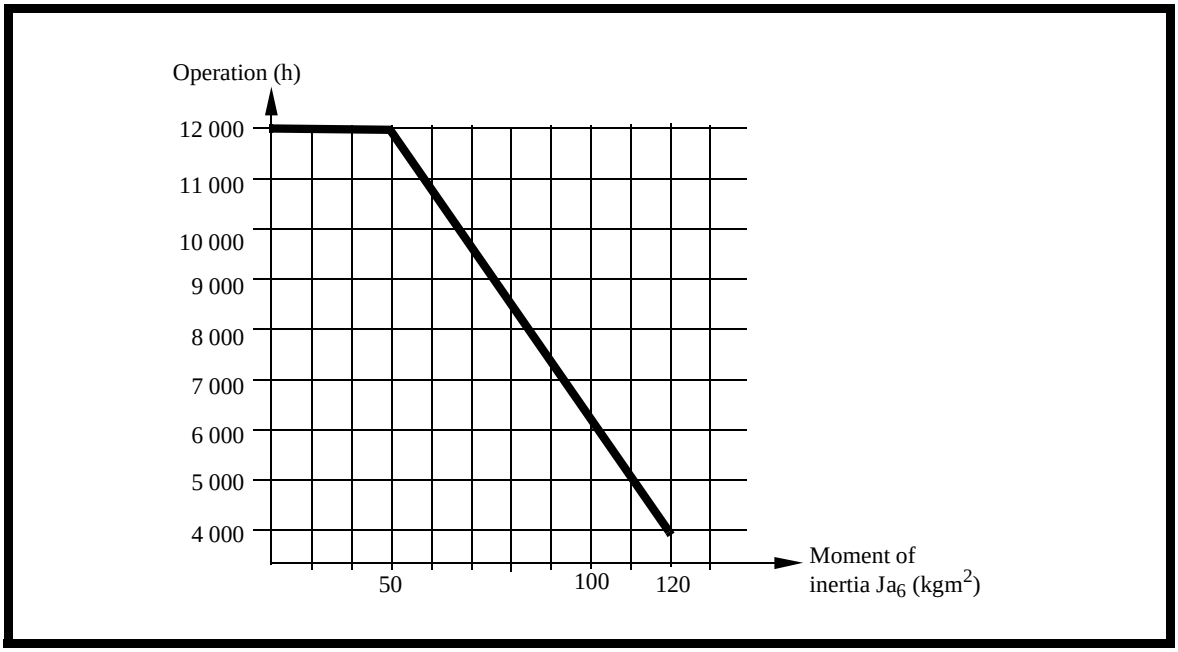
Maximum play allowed is 0.06 mm. Play cannot be adjusted. Complete gear reduction unit must be replaced if play exceeds the allowed amount.

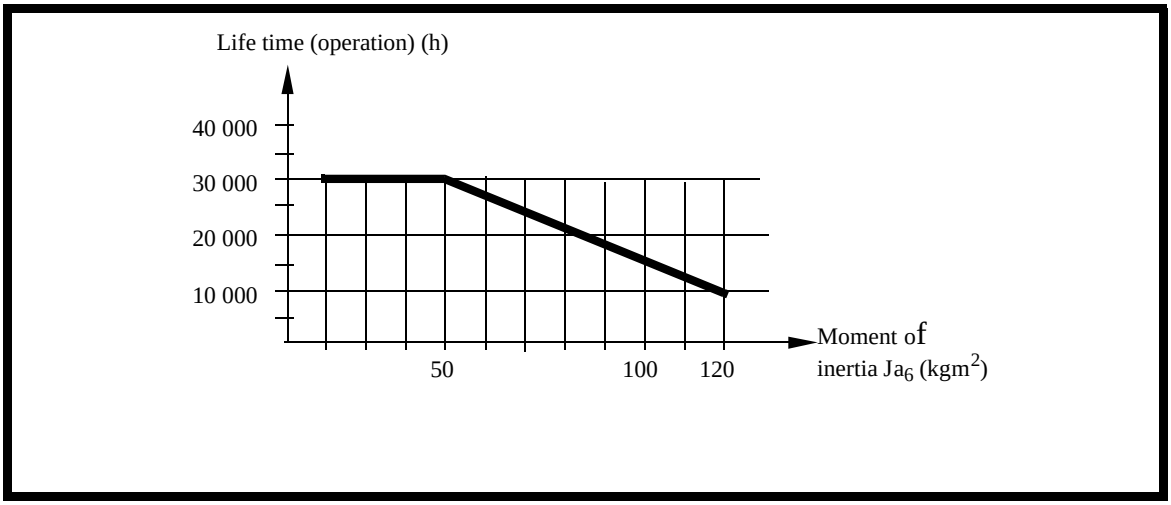
MAINTENANCE INTERVALS FOR GEAR AXIS 1 FOR PRESS TENDING & HEAVY DUTY OPERATIO N

- Option 51 PT adaptation for IRB 6400/2.8-120
- Hreavy duty axis 1 (option 5X installed)






Operation (h)
12 000
11 000
10 000
9 000
8 000
7 000
6 000
5 000
4 000
50
100
120
Moment of
inertia Ja6 (kgm2)


Life time (operation) (h)
40 000
30 000
20 000
10 000
50
100
120
Moment of
inertia Ja6 (kgm2)

TOOL LIST

The need for special tools has been reduced to a minimum. When tools are needed for disassembly/assembly work, a description is given in the Product Manual.

During the ordinary service training courses arraned by ABB Flexible Automation, detailed descriptions of the tools are given together with their use.

Rotating Gear3HAB 1067-6
Dismounting, gear motor axis 4SKF Oil injector 226 270
Support for motor shaft axis 46896 134-EA
Adjustment of intermediate wheelDial indicator, magnetic foot
Pressing tool, final gear6896 134-AT/-AN

ValveSKF 234 063
Hydraulic cylinderNIKE I-CH 612
Hydraulic pumpNIKE I-PP6
Two-way valveNIKE I-VAD 2
Regulating valve with pressure gaugeI-VRF 31

Holding tool, tube shaft end6896 134-BU
Holding tool, final gear6896 134-FK
Pressing tool, tube shaft6896 0011-YJ
Pressing tool, housing and rear bearing6896 134-FL
Hydraulic cylinderNIKE CLF 50-10

HoseNIKE LS 150
HoseNIKE SL 51, 2 units
Pressure gaugeNIKE AMT 150
Lifting device for bearing axis 16896 134-XD
Lifting device gear/coupling disc6896 134-FW/-FX

Hydraulic cylinderNIKE I CH-606
Pressing tool support brg, parallel arm6896 134-FN
pressing tool bearing, lower arm6896 134-FJ
Pressing tool, support bearing/seal6896 134-FR/-FP
Pull rod6896 134-FH

Pressing tool, brg & seal, parallel bar6896 134-FM
Dismounting rear brg & housing axis 46896 134-YJ
Pressing tool, seal inside housing6896 134-FA
Pressing tool, front bearing, tube shaft6896 134-S
Pressing tool, seal, cover housing6896 134-BX

NippleSKF 725 870
Nipple dismounting gear/motor shaft axis 56896 134-AA

Puller gear motor axis 63HAA 7601-043
3HAA 7601-047

Pressing tool, gear on motor axis 4 6896 134-AC
Pressing tool, gear on motor axis 5 6896 134-AD
Measurement fixture, gear mtr shaft axis 5 6896 134-GN

Play measurement tool, wrist 6896 134-CE
6896 134-CD
6896 134-CF

Screw for locking axis 2 M16x150
Distance, support bearing parallel arm M16x60
Lifting gear axes 2 & 3, chain hoist 6896 0011-YL
Tubular KM socket 4-KM 6
Tubular KM socket, ext. for S/2.9-120 3HAA 7601-038

Guide pins, 2 M12x200
Guide pins, 2 M12x300
Tightening tool 3HAB 1022-1

Calibration Tool for TCP Check

Tool for TCP adjustment 3HAA 1001-UA
X=15 mm, Z=150mm

Calibration set for Vision 3HAA 0001-XR

Tools for Grease Replacement, Axis 1-3

Axis 1

Socket 3HAB 156-1
Nipple 3HAA 7601-090
Hose D=18/12 mm, L=1000 mm
Hose Clip D=15-20 mm
Socket Square 1/2” hexigon 10 mm
Extender 1/2” / L=250 mm
Ratchet Wrench

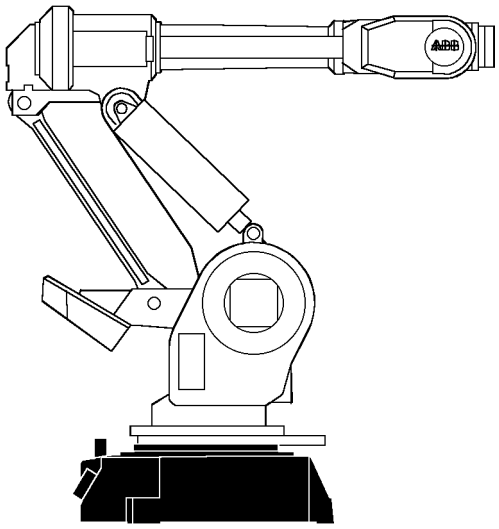
Axes 2, 3, 6

Nipple 3HAA 7601-091
Hose D=18/12 mm, L=1000 mm
Hose Clip D=15-20 mm
Allen key 6 mm

See also Section 11 for robot calibration equipment and tools

SECTION 5

Axis 1
Disassembly/Assembly



Disassembly/Assembly
Guidelines
IRB 6400

AXIS 1

Table of Contents

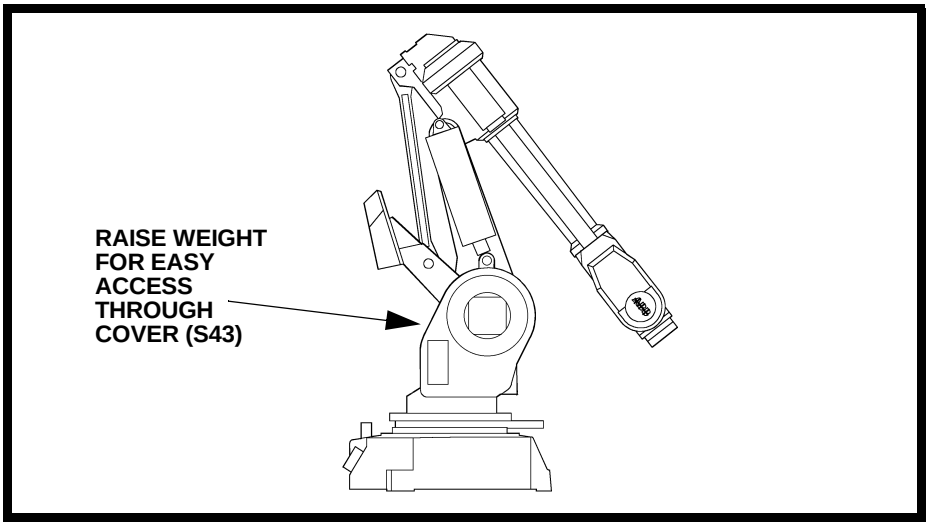
MOTOR (S16) Removal

REFERENCE DRAWINGS
Exploded Views:
"B" (pg 5-17,12-1)
"S" (pg 5-18,12-2)

Assembly:
3HAB4161-4 (pg 13-1)

REQUIRED TOOLS
Hand Tools
Small 3-Jaw Puller
Strap Wrench
M10x150 Screw
M8x40 Screws (2)
Torque Wrench (52-224 ft-lb)

1. **POSITION ROBOT SO COUNTERBALANCE WEIGHT IS RAISED UP HIGH ENOUGH TO GAIN EASY WORKING ACCESS THROUGH COVER (S43).**



2. **TURN ELECTRICAL DISCONNECT SWITCH OFF AND LOCK IT IN THE OFF POSITION.**

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

3. **REMOVE SCREWS (S42) AND COVER (S43).**
4. **REMOVE TIE WRAP (S23), SCREW (S24), AND HOLDER (S25).**
5. **DISCONNECT MOTOR SIGNAL CABLE R3.FB1 (S22) AND MOTOR POWER CABLE R2.MP1 (B18) FROM MOTOR (S16).**
6. **REMOVE MOTOR (S16) FROM ROBOT.**

MOTOR WEIGHS APPROX. 50 LB.

a. Remove (4) screws (S13) and (4) washers (S15).
b. Use two M8 x 40 screws in threaded holes in motor mounting flange to loosen motor mounting. Permatex (S17) was used to install motor and mounting joint will be hard to break free.
c. Carefully lift motor (S16) straight up and out of robot.

CAUTION: DO NOT TAP OR HIT MOTOR SHAFT.

d. Cover cavity to prevent objects from falling in.

7. REMOVE PINION (S18) FROM MOTOR (S16)

NOTE:Pinion (S18) is matched to gear reduction unit (S59). If a new motor (S16) is being installed, mount the old pinion on the new motor shaft. If a new gear reduction unit (S59) is to be installed, mount that new pinion on the motor (S16) shaft.

a. Remove screw (S19). Use a strap wrench to hold pinion from rotating while removing screw.

b. If pinion (S18) is tight on motor (S16) shaft, screw an M10x150 screw into threaded hole and pull pinion from motor shaft with the help of a small 3-jaw gear puller. Use the key slot hole in the side of the pinion to engage one jaw of the puller.

c. Pinion (S18) is matched to gear reduction unit (S59), so keep it for re-assembly. If a new motor is to be installed, mount old pinion on new motor shaft. If new gear reduction unit (S35) is to be installed, use pinion from that unit.

MOTOR (S16) Installation

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

REFERENCE DRAWINGS
Exploded View:
"B" (pg 5-17,12-1)
"S" (pg 5-18,12-2)
Assembly:
3HAB 4161-4 (pg 13-1)
3HAB 4162-2 (pg 13-23)
3HAA 0001-AAS (pg 14-A)
3HAB 4248-2 (pg 14-G)
3HAB 4250-1 (pg 14-H)

REQUIRED TOOLS
Hand Tools
M10x150 Threaded Rod (1)
Strap Wrench
M10 Washer (1)
M10 Hex Nut (1)
Loctite 242
Permatex 3
Torque Wrench (37-52 ft-lb)

1. CLEAN ALL COMPONENTS.

a. Cover gear reduction unit (S59) bore from stuff falling in.

b. Clean permatex from housing (S21) and motor (S16) mounting surfaces.

2. MOUNT PINION (S18) ONTO MOTOR (S16) SHAFT.

NOTE: Pinion (S18) is matched to gear reduction unit (S59). If a new motor (S16) is being installed, mount the old pinion on the new motor shaft. If a new gear reduction unit (S59) is to be installed, mount that new pinion on the motor (S16) shaft.

a. Slide pinion (S18) onto motor (S16) shaft as far as it will go with hand pressure. (Often, it will go all the way on with only hand force.)

b. If pinion (S18) needs to be pressed on, screw a fully threaded M10x150 rod into threaded end of motor (S16) shaft, slide a washer over the M10x150 Rod, thread on an M10 hex nut, and wind the nut down the stud, pressing on the pinion (S18).

CAUTION: DO NOT TAP OR HIT MOTOR SHAFT.

d. Remove the threaded rod, washer, and nut.

e. Apply Loctite 242 (S20) to screw (S19) and insert in end of motor (S16) shaft. Torque to 52 ft-lb. Use strap wrench to hold pinion from turning.

3. APPLY PERMATEX 3 (S17) TO MOTOR (S16) MOUNTING SURFACE

MOTOR WEIGHS APPROX. 50 LB.

4. CAREFULY SET MOTOR (S16) INTO PLACE, ENGAGING PINION (S18) INTO REDUCTION DRIVE UNIT (S59). BE SURE ELECTRICAL CONNECTORS POINT TOWARD THE REAR OF THE ROBOT

5. INSTALL MOUNTING SCREWS (S13) AND WASHERS (S15).

a. Use Loctite 242 (S14) on screws (S13) and insert into motor (S16) mounting flange.

b. Torque screws (S13) to 37 ft-lb.

6. **CONNECT MOTOR CABLES (S22)**
    a. Connect signal cable R3.FB1 (S22).
    b. Connect power cable R2.MP1 (B18).

7. **INSTALL HOLDER (S25) WITH SCREW (S24). USE TIE WRAP (S23) TO SECURE CABLES TO HOLDER**

8. **INSTALL COVER (S43) WITH SCREWS (S42)**

9. **CALIBRATE AXIS 1 as outlined in Section 11**

GEAR REDUCTION UNIT (S59) Removal

REFERENCE DRAWINGS
Exploded Views:
"B" (pg 5-17,12-1)
"S" (pg 5-18,12-2)
Assemblies:
3HAB 4161-4 (pg 13-1)
3HAB 4162-2 (pg 13-23)
3HAA 0001-AAS (pg 14-A)
3HAB 4248-2 (pg 14-G)

REQUIRED TOOLS
Hand Tools

1. TURN MAIN ELECTRICAL DISCONNECT SWITCH OFF AND LOCK IT IN THE OFF POSITION.

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

2. REMOVE AXIS 1 MOTOR (S16) as outlined on page 5 - 1

3. REMOVE COVER (B9):

a. Remove screws (B8).

b. Remove cover (B9).

c. Remove air hose, if installed to cover.

4. DISCONNECT AIR HOSE & UNPLUG CONNECTOR R2.SMB

a. Remove screws (S12).

b. Pull measure card unit (S10) out, rotate down and back, and use two screws (S12) to temporarily hold in place against frame housing (S21).

c. Unplug connector R2.SMB (X2) at serial measuring board on measure card unit (S10).

d. Disconnect air hose in the base casting, near the axis 1 motor.

5. SLIDE CABLE GUIDE RAIL (B16) OUT OF WAY:

a. Remove screw (B13) and washer (B15) on right side that is holding cable guide rail (B16).

b. Just loosen screw (B13) on left side. Leave it engaged to hold plate (B23) in place.

c. Slide cable guide rail (B16) away from cable to provide for working room and clearance to remove cable.

6. DISCONNECT LOWER CABLE (B18) FROM SUPPORT RAIL:

a. Rotate robot forward.

b. Remove screws (B20) and washers (B19) holding lower cable (B18) to support rail. Screws are Locktited.

7. DISCONNECT LOWER CABLE (B18) CONNECTORS

a. Disconnect the following connectors:

R2.CS & R2.CP (if customer connections)

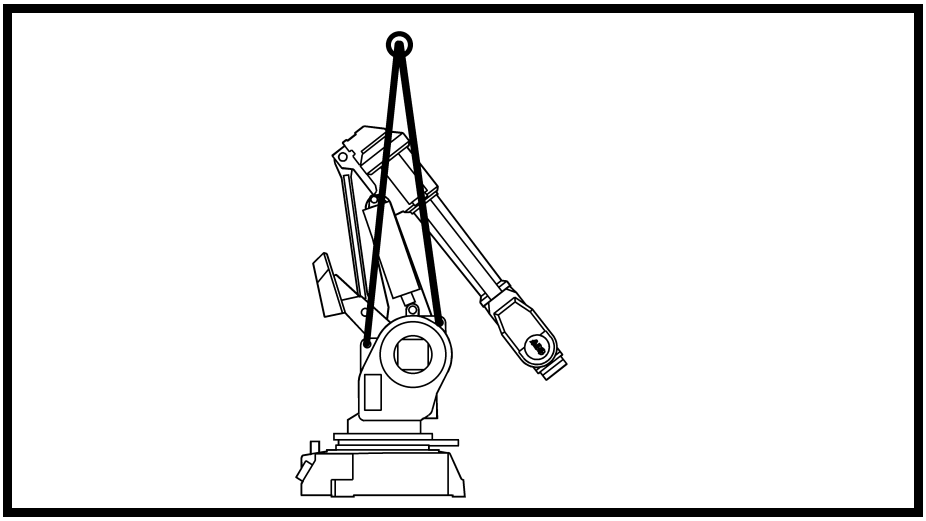
R2.MP2, R2.MP3, R2.MP4, R2.MP5-6

R2.FAN (if fan installed).

Keep connectors out of grease.

b. Remove screws (S65) and pull out brake release unit (S64). Disconnect the following connectors: R3.BU4-6, (X10), R3.BU1-6 (X8), R3.BU1-3 (X9).Keep connectors out of grease.

8. POSITION ROBOT & ATTACH LIFTING EQUIPMENT as shown in the figure. Take up all slack in lifting cables, but do not actually lift.



NOTE: It is important to adjust cable lengths so lift action is straight up and down to keep bearing (S46) alignment square to its bore.

CAUTION: ROBOT MUST BE LIFTED STRAIGHT UP IN A BALANCED CONDITION! BE SURE SLING LENGTHS ARE CORRECT FOR LIFTING STRAIGHT UP.

9. DISCONNECT GEAR REDUCTION UNIT (S59) FROM BASE HOUSING (B24):

a. Remove screws (S50). Access to screws is through access holes in frame housing (S21). Rotate frame (S21) to align holes to screws.

b. Remove screws (S53). Access to screws is through access holes in frame housing (S21). Rotate frame (S21) to align holes to screws.

10. DISCONNECT BEARING (S46) FROM BASE HOUSING (B24)

a. Remove screws (S44) and washers (S45) holding bearing (S46) to base housing (B24).

11. REMOVE SYNC PLATE BRACKET FROM LEFT SIDE, TOP OF BASE HOUSING (B24).

ROBOT WEIGHS APPROX. 3500 LB.

12. LIFT ROBOT OFF BASE HOUSING (B24)

a. Carefully lift robot straight up, pulling bearing (S46) out of its bore in base housing (B24).

b. Set robot on safe supports that allow access to remove gear reduction unit (S59) from underneath.

c. DO NOT remove lifting equipment. Use it to add to the safety of supporting the robot.

13. REMOVE GEAR REDUCTION UNIT (S59)

GEAR UNIT WEIGHS APPROX. 125 LB.

a. Remove screws (S61) and washers (S60).

b. Remove gear reduction unit (S59).

c. Remove friction ring (S57), O-Ring (S68), friction ring (S57), and O-Ring (S63).

GEAR REDUCTION UNIT (S59) Installation

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

REFERENCE DRAWINGS
Exploded View:
"B" (pg 5-17,12-1)
"S" (pg 5-18,12-2)
Assembly:
3HAB 4161-4 (pg 13-1)
3HAB 4162-2 (pg 13-23)
3HAA 0001-AAS (pg 14-A)
3HAB 4248-2 (pg 14-G)

REQUIRED TOOLS
Hand Tools
M10x150 Threaded Rod (1)
M10 Washer (1)
M10 Hex Nut (1)
Strap Wrench
ABB #3HAB 1067-6
Lubricating Grease
Molycote 1000
Loctite 242
Loctite 577
Permatex 3
Torque Wrench (90-224 ft-lb)

GEAR UNIT WEIGHS APPROX. 125 LB.

1. **CLEAN ALL COMPONENTS**

2. **THREAD TWO M12x200 GUIDE PINS INTO TWO SCREW HOLES that are for screws (S61) in frame housing (S21). Pick two holes that are diametrically opposite each other. Pins help align and support assembly of components.**

3. **MOUNT GEAR REDUCTION UNIT (S59) TO FRAME HOUSING (S21)**
   a. Lightly grease O-Ring (S58) with lubricating grease (S74). Position O-Ring in place on gear reduction unit (S59).
   b. Position friction ring (S57) in place on gear reduction unit (S59).
   c. Slip gear reduction unit (S54) up over guide pins and into position on the frame housing (S21).
   d. Put Molycote 1000 grease on screws (S61) and washers (S60).
   e. Insert six of the eight screws (S61) with washers (S60) through gear reduction unit (S59) and into frame housing (S21). Just finger tighten screws at this time.
   f. Remove threaded guide pins.
   g. Insert remaining two screws (S61) with washers (S60).
   h. Progressively tighten all screws (S61). Torque to 90 ft-lb.

4. **SET ROBOT ONTO BASE (B24)**
   a. Lightly grease O-Ring (S63) with lubricating grease (S74). Set O-Ring in place in base housing (B24).
   b. Position friction ring (S62) and set in place in base housing (B24).
   c. Insert two M12x200 threaded rods into threaded holes in base that are for screws (S53). These rods are used for alignment.

ROBOT WEIGHS APPROX. 3500 LB.

   d. Carefully lower robot until bearing (S46) is just about to enter its seat in base housing (B24).

CAUTION: BE CAREFUL AND DO NOT DAMAGE CABLE HARNESS.

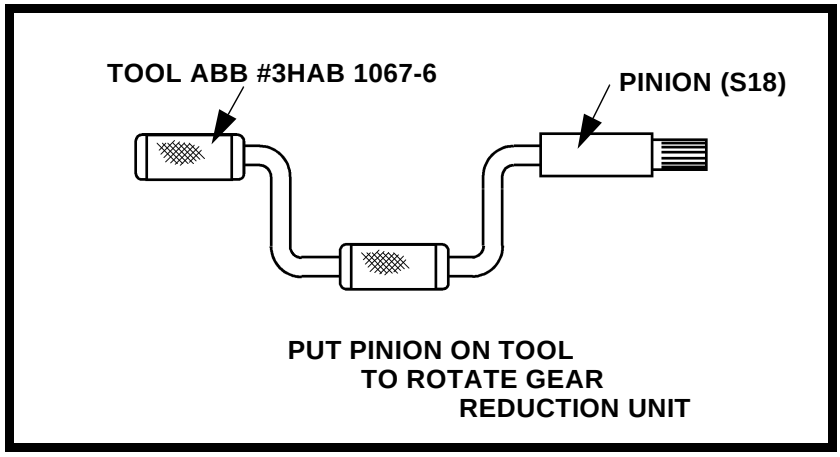
   e. Align bearing screw holes using two screws (S44).
   f. Continue to lower robot until bearing (S46) is fully seated.

5. MOUNT GEAR REDUCTION UNIT (S59) TO BASE HOUSING (B24)

a. Remove M12 x 200 threaded rods.

b. Loctite 577 (S51) to (S50) and (S53), and insert with washers (S52) & (S55). Just finger-tighten screws.

c. Put motor pinion on tool ABB# 3HAB1067-6 and rotate input shaft of gear reduction unit ten times back and forth.



6. MOUNT BEARING (S46):

a. Lubricate all screws (S44) and washers (S45) with Molycote 1000 grease.

b. Insert screws (S44) and washers (S45). Progressively tighten and torque to 90 ft-lb.

c. Tighten screws (S50). Torgue to 224 ft-lb.

d. Tighten screws (S53). Torque to 90 ft-lb.

SEE MOTOR INSTALLATION PAGE 5-3

7. RE-MOUNT SYNC PLATE BRACKET AT LEFT SIDE, TOP OF BASE HOUSING (B24).

8. REMOVE LIFTING EQUIPMENT.

9. CONNECT LOWER CABLE (B18) CONNECTORS

a. Connect the following connectors: R2.CS, R2.CP, R2.MP5-6, R2.MP4, R2.MP3, R2.MP2, R2.FAN (if fan installed).

b. Connect the following connectors to brake release unit (S64): R3.BU4-6(X10), R3.BU1-6(X8), R3.BU1-3(X9).

c. Mount brake release unit (S64) with screws (S65).

10. CONNECT LOWER CABLE (B18) TO SUPPORT RAIL

a. Apply Loctite 242 (B21) to screws (B20).

b. Insert screws (B20) with washers (B19) and tighten.

11. INSTALL CABLE GUIDE RAIL (B16)

a. Slide cable guide rail (B16) into position on left side screw (S14).

b. Apply Loctite 242 (S14) to right side screw (S14), insert, and tighten.

c. Remove left side screw (S14), apply Loctite 242 (S12), and re-insert. Tighten screw.

12. CONNECT AIR HOSE & PLUG IN CONNECTOR R2.SMB

a. Plug in connector R2.SMB (X2) at serial measuring board on measure card unit (S10).

b. Install air hose, as required.

c. Position serial measurement board in mounted position and secure with screws (S12).

13. INSTALL COVER (B9):

a. Mount air hose connection to cover (B9).

b. Mount cover (B9) to base housing (B24) and secure with screws (B8).

14. GREASE GEAR REDUCTION UNIT (S59) as outlined in Section 4.

15. INSTALL COVER (S43) WITH SCREWS (S42)

16. CALIBRATE AXIS 1 as outlined in Section 11

BEARING (B47) Removal

REFERENCE DRAWINGS
Exploded Views:
"B" (pg 5-17, 12-1)
"S" (pg 5-18, 12-2)

Assemblies:
3HAB 4161-4 (pg 13-1)
3HAB 4162-2 (pg 13-23)
3HAA 0001-AAS (pg 14-A)
3HAB 4248-2 (pg 14-G)
3HAB 4250-1 (pg 14-H)

REQUIRED TOOLS
Hand Tools

1. TURN MAIN ELECTRICAL DISCONNECT SWITCH OFF AND LOCK IT IN OFF POSITION.

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

2. REMOVE AXIS 1 MOTOR (S16) as outlined on page 5 - 1

3. REMOVE COVER (B9):

a. Remove screws (B8).

b. Remove cover (B9).

c. Remove air hose, if installed to cover.

4. DISCONNECT AIR HOSE & UNPLUG CONNECTOR R2.SMB

a. Remove screws (S12).

b. Pull measure card unit (S10) out, rotate down and back, and use two screws (S12) to temporarily hold in place against frame housing (S21).

c. Disconnect air hose, if installed.

d. Unplug connector R2.SMB (X2) at serial measuring board on measure card unit (S10).

5. SLIDE CABLE GUIDE RAIL (B16) OUT OF WAY:

a. Remove screw (B13) and washer (B15) on right side that is holding cable guide rail (B16).

b. Just loosen screw (B13) on left side. Leave screw to hold plate (B23) in place.

c. Slide cable guide rail (B16) away from cable to provide working room and clearance to remove lower cable (B18).

6. DISCONNECT LOWER CABLE (B18) FROM SUPPORT RAIL:

a. Remove screws (B20) and washers (B19) holding lower cable (B18) to support rail. Screws are Locktited.

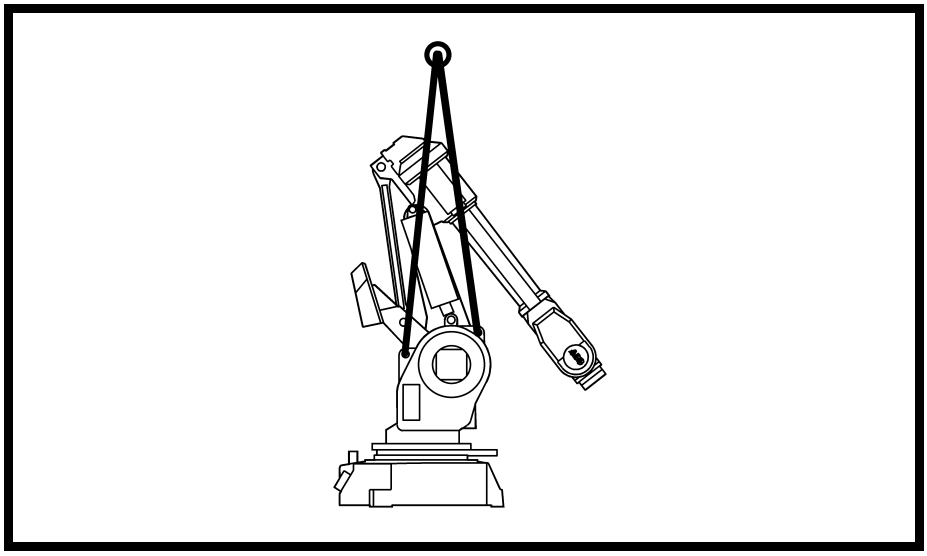
7. DISCONNECT LOWER CABLE (B18) CONNECTORS

a. Disconnect the following connectors: R2.CS, R2.CP, R2.MP5, R2.MP4, R2.MP3, R2.MP2, R2.FAN (if fan installed). Keep connectors out of grease.

b. Remove screws (S65) and pull out brake release unit (S64). Disconnect the following connectors:

R3.BU4-6 (X10), R3.BU1-6 (X8), R3.BU1-3 (X9). Keep connectors out of grease.

8. ATTACH LIFTING EQUIPMENT as shown below. Take up all slack in lifting cables, but do not actually lift yet. It is important to adjust cable lengths that result in the lift action being straight up and straight down to keep bearing (S46) squared to its bore in base housing (B24).



CAUTION: ROBOT MUST BE LIFTED STRAIGHT UP IN A BALANCED CONDITION! BE SURE SLING LENGTHS ARE CORRECT FOR LIFTING.

9. DISCONNECT GEAR REDUCTION UNIT (S59) FROM BASE HOUSING (B24):

a. Remove screws (S50). Access to screws is through access holes in frame housing (S21).

b. Remove screws (S53). Access to screws is through access holes in frame housing (S21). Rotate frame (S21) to align holes to screws.

10. DISCONNECT BEARING (S46) FROM BASE HOUSING (B24).

a. Remove screws (S44) and washers (S45) holding bearing (S46) to base housing (B24).

11. REMOVE SYNC PLATE BRACKET AT LEFT SIDE, TOP OF BASE HOUSING (B24).

12. LIFT ROBOT OFF BASE HOUSING (B24).

a. Carefully lift robot straight up, pulling bearing (S46) out of its bore in base housing (B24). If necessary, adjust lifting cable lengths to ensure robot is lifted up with bearing square to its bore in base.

b. Set robot on safe supports that allow access to remove bearing (S46) from underneath.

c. DO NOT remove lifting equipment. Use it to add to the safety of supporti6g the robot.

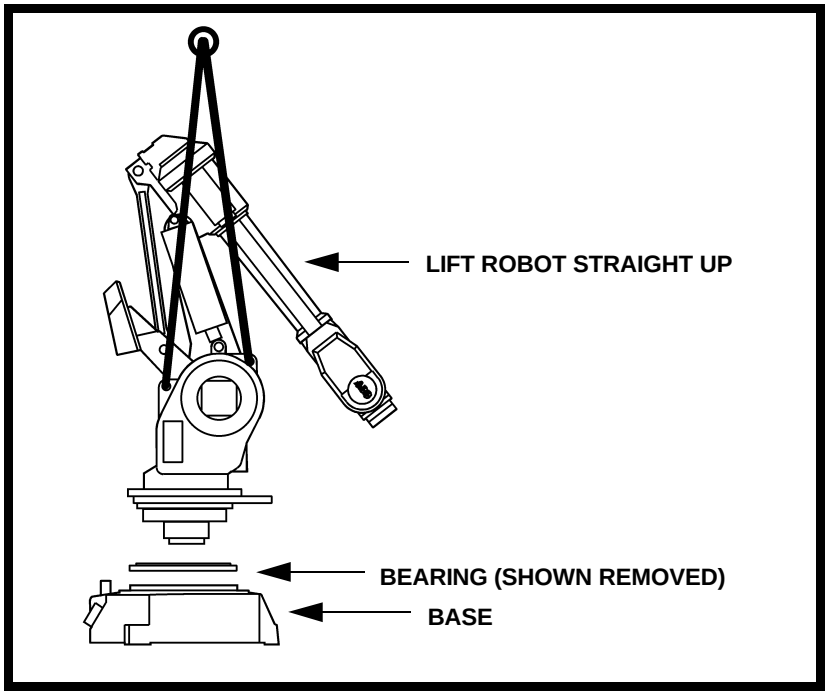
BEARING WEIGHS APPROX. 50 LB.

13. REMOVE BEARING (S46) FROM FRAME HOUSING (S21).

a. Prepare to catch bearing (S46) when it comes loose.

b. Remove screws (S48) and washers (S46).

c. Remove bearing (S46).



BEARING (B47) Installation

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

REFERENCE DRAWINGS
Exploded Views:
"B" (pg 5-17, 12-1)
"S" (pg 5-18, 12-2)
Assemblies:
3HAB 4161-4 (pg 13-1)
3HAB 4162-2 (pg 13-23)
3HAA 0001-AAS (pg 14-A)
3HAB 4248-2 (pg 14-G)

REQUIRED TOOLS
Hand Tools
Lubricating Grease
Molycote 1000
Loctite 242, 577
Torque Wrench (90-224 ft-lb)
3HAB-1067-6

1. CLEAN ALL COMPONENTS

2. MOUNT BEARING (S46) TO FRAME HOUSING (S21):

a. Apply lubricating grease (S74) to bearing seat on frame housing (S21).

b. Apply Molycote 1000 grease to screws (S48) and washers (S47).

c. Position bearing (S46) in place on frame housing (S21). Hold bearing in place with two screws (S48). Lightly tighten screws only.

d. Insert all screws (S48) and lightly tighten to seat bearing.

e. Torque screws (S48) to 90 ft-lb.

BEARING WEIGHS APPROX. 50 LB.

3. SET ROBOT ONTO BASE (B24):

a. Lightly grease O-Ring (S63) with lubricating grease (S75). Set O-Ring in place in base housing (B24).

b. Insert friction ring (S62) and set in place in base housing (B24).

c. Insert two guide rods M16x300 into base of robot to hold friction ringsin position.

ROBOT WEIGHS APPROX. 3500 LB.

d. Carefully lower robot until bearing (S46) is just about to enter its seat in base housing (B24).

e. Align bearing screw holesusing two screws (S44).

f. Continue to lower robot until bearing (S46) is fully seated.

4. MOUNT BEARING (S46):

a. Lubricate all screws (S44) and washers (S45) with Molycote 1000 grease.

b. Insert screws (S44) and washers (S45). Torque to 90 ft-lb.

5. MOUNT GEAR REDUCTION UNIT (S59) TO BASE HOUSING (B24)

a. Remove guide rods.

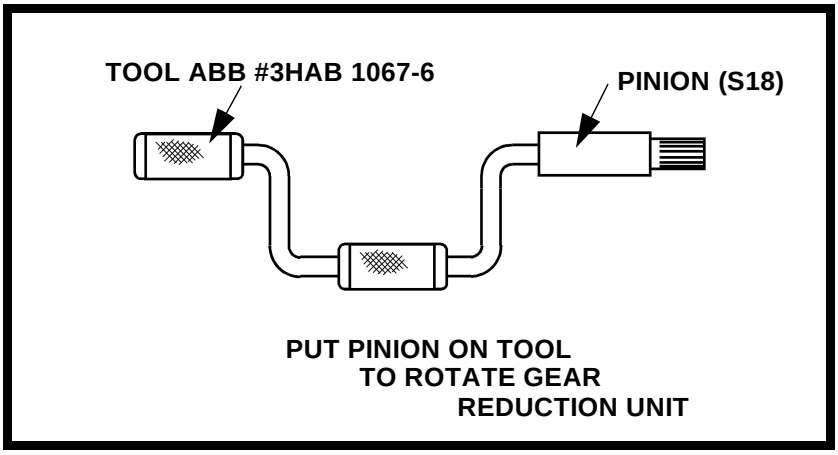
b. Insert screws (S50) and (S53) apply Loctite 577 (S51).

c. Remove screws (S50), apply Loctite 577 (S51), and re-insert with washers (S52). Just touch-tighten screws.

d. Rotate input shaft of gear reduction unit ten times back and forth using tool (#3HAB 1067-6).

e. Tighten screws (S50). Torgue to 224 ft-lb.

f. Tighten screws (S53). Torque to 90 ft-lb.



6. RE-MOUNT SYNC PLATE BRACKET AT LEFT SIDE, TOP OF BASE HOUSING (B24).

7. REMOVE LIFTING EQUIPMENT.

8. CONNECT LOWER CABLE (B18) CONNECTORS

a. Connect the following connectors: R2.CS, R2.CP, R2.MP5-6, R2.MP4, R2.MP3, R2.MP2, and R2.FAN (if fan installed).

b. Connect the following connectors to brake release unit (S64): R3.BU4-6(X10), R3.BU1-6(X8), R3.BU1-3(X9).

c. Mount brake release unit (S64) with screws (S65).

9. CONNECT LOWER CABLE (B18) TO SUPPORT RAIL.

a. Apply Loctite 242 (B21) to screws (B20).

b. Insert screws (B20) with washers (B19) and tighten.

10. INSTALL CABLE GUIDE RAIL (B16)

a. Slide cable guide rail (B16) into position on left side screw (S14).

b. Apply Loctite 242 (S14) to right side screw (S14), insert, and tighten.

c. Remove left side screw (S14), apply Loctite 242 (S12), and re-insert. Tighten screw.

11. CONNECT AIR HOSE & PLUG IN CONNECTOR R2.SMB

a. Plug in connector R2.SMB (X2) at serial measuring board on measure card unit (S10).

b. Install air hose, as required.

c. Position measure card unit in mounting position and secure with screws (S12).

12. INSTALL COVER (B9):

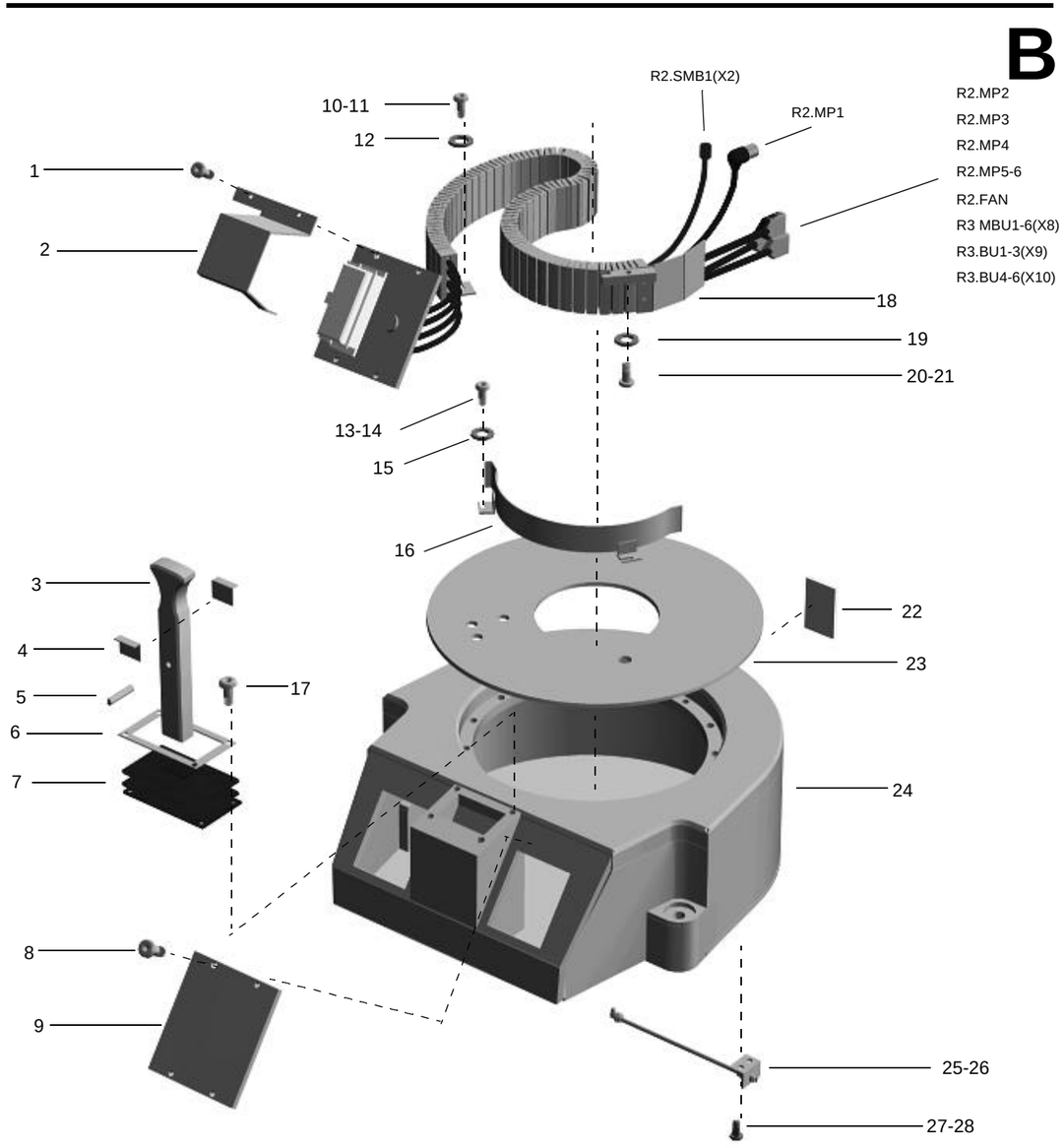
a. Mount air hose connection to cover (B9).

b. Mount cover (B9) to base housing (B24) and secure with screws (B8).

13. GREASE BEARING (S46) as outlined in Section 4

14. CALIBRATE AXIS 1 as outlined in Section 11

ITEM	QTY.	DESCRIPTION	ABB PART NO
1	4	Screw - M6x20	2121 2411-370
2	1	Cable Protector	3HAA 1001-718
3	1	Stop Shaft	3HAB 4082-1
4	2	Angle	3HAA 1001-154
5	1	Roll Pin	2111 2835-389
6	1	Bellows Plate	3HAA 1001-136
7	1	Bellows	3HAA 1001-135
8	4	Screw - M6x20	2121 2411-370
9	1	Cover	3HAA 1001-700
-	1	Nipple (If used)	2524 0256-1
-	1	Protective Hood (if used)	2522 2101-15
10	2	Screw - M6x16	2121 2416-368
11	-	Loctite 242	1209 0014-410
12	2	Washer - 6.4x12x1.6	3151 2062-153
13	2	Screw - M6x16	2121 2416-368
14	-	Loctite 242	1269 0014-410
15	2	Washer - 6.4x12x1.6	2151 2062-153
16	1	Cable Guide Rail	3HAA 1001-691
17	4	Screw - M6x8	2121 2416-368
18	1	Lower Cable Assembly:	
		without cust connect.	3HAB 4248-1
		with cust. connection & S/2.9-120	3HAB 4249-1
-	1	Earth sign	2940 0412-1
-	1	Screw - M6x20	2121 2411-370
-	1	Washer - 6.4x12x1.6	2151 2062-153
19	2	Washer - 8.4x16x1.6	2151 2062-165
20	2	Screw - M8x40 8.8	2121 2519-459
21	-	Loctite 242	1269 0014-410
22	3	WARNING Label	3HAA 0001-SL
23	1	Frictionless Plate	3HAA 1001-695
24	1	Base Housing	3HAA 1001-653
25	1	Grease Tube Assembly	3HAA 1001-716
26	-	Loctite 577	1269 1907-1
27	2	Screw - M6x16	2121 2411-368
28	-	Loctite 577	1268 1907-1
		Base Sync Plate:	
-	1	Sync Bracket	3HAB 4135-1
-	1	Sync Plate	3HAA 1001-73
-	4	Screw - M4x8	2121 2411-287
-	1	Sync Plate	2155 0187-11
-	4	Washer - 4.3x9x0.8	2151 2062-136
-	1	Bracket	3HAA 1001-144
-	-	Loctite 242	1269 0014-410
		Protective Plate:	
-	1	Protective Plate	2155 0187-11
-	1	Screw	2121 0596-31



ITEM	QTY.	DESCRIPTION	ABB PART NO .
1	2	Screw - M6x12	2321 2416-366
2	1	Bracket	3HAA 1001-104
3	1	Sync. Plate	3HAA 1001-79
4	2	Washer - Plain 4.3x19x0.8	2151 2062-136
5	2	Screw - M4x6	2121 2416-285
6	1	Cover	3HAA 0001-ZK
7	2	Screw - M6x16 2.8	2121 2411-368
8	1	Cable Guide	3HAA 1001-721
9	2	Screw - M6x30	2121 2411-374
10	1	Measure Card Unit	3HAB 4259-1
-	1	Serial Measurement Board	3HAB 2213-1
11	1	Battery Pack	4944 026-4
12	4	Screw - M6x16 8.8	2121 2411-368
13	4	Screw - M10x25	2121 2519-493
14	-	Loctite 242	1269 0014-410
15	4	Washer - Plain 10.5x22x2	2151 2062-173
16	1	Motor - Axis 1	3HAB 4039-1
-	1	Motor - Axis 1 PE/2.25-75	EHAB 4043-1
17	-	Permatex 3	1236 0012-202
18	1	Pinion	(Incl. in item 59)
19	1	Screw - M10x100 12.9	3HAB 3409-62
20	-	Loctite 242	1269 0014-410
21	1	Frame Housing	3HAB 4150-1
22	1	Cable - Axis 1 Signal	3HAB 4250-1
23	7	Strap	2166 2055-3
24	1	Screw M6x16	2121 2411-368
25	1	Holder	3HAA 1001-668
26	6*	Washer - Spring	3HAA 1001-181
27	6*	Screw- M16x140 12.9	3HAB 3409-95
28	6*	Washer - 12.5x24x5.9	3HAA 1001-200
29	6*	Screw - M12x140 12.9	3HAB 3409-200
30	16*	Washer - Plain 13x21x2	3HAA 1001-632
31	16*	Screw - M12x80 12.9	3HAB 3409-74
32	2*	Friction Ring	3HAA 1001-613
33	2*	O-Ring - 234.54x3.53	2152 0431-17
34	2*	Friction Ring	3HAA 1001-616
35	2*	Reduction Gear RV-250A	3HAB 4080-1
36	2*	O-Ring 269.3x5.7	2152 2012-550
37	2*	Plate - Motor Socket	3HAB 4056-1
38	2*	O-Ring 124.5x3	2152 2012-437
39	4*	Washer 13.5x18x1.5	2152 0441-1
40	4*	Magnetic Plug 1/4”	2522 122-1
41	3	Cap	3HAA 1001-199
42	3	Screw M6x20	2121 2411-370
43	1	Cover	3HAA 0001-SZ
44	15	Screw - M12x70 12.9	3HAB 3409-73
45	15	Washer - Plain 13x24x2.5	3HAA 1001-632
46	1	Bearing	3HAA 1001-1
47	15	Washer - Plain 13x24x2.5	2551 2062-177
48	15	Screw - M12x70 12.9	3HAB 3409-73
49	1	Plug - KR 1/2”	2522 2021-113
50	3	Screw - M16x140 12.9	3HAB 3409-95
51	-	Loctite 577	1269 1907-1
52	3	Washer - Spring	3HAA 1001-181
53	3	Screw - M12x140 12.9	3HAB 3409-200
54	-	Loctite 577	1269 1907-1
55	3	Washer - Support	3HAA 1001-200

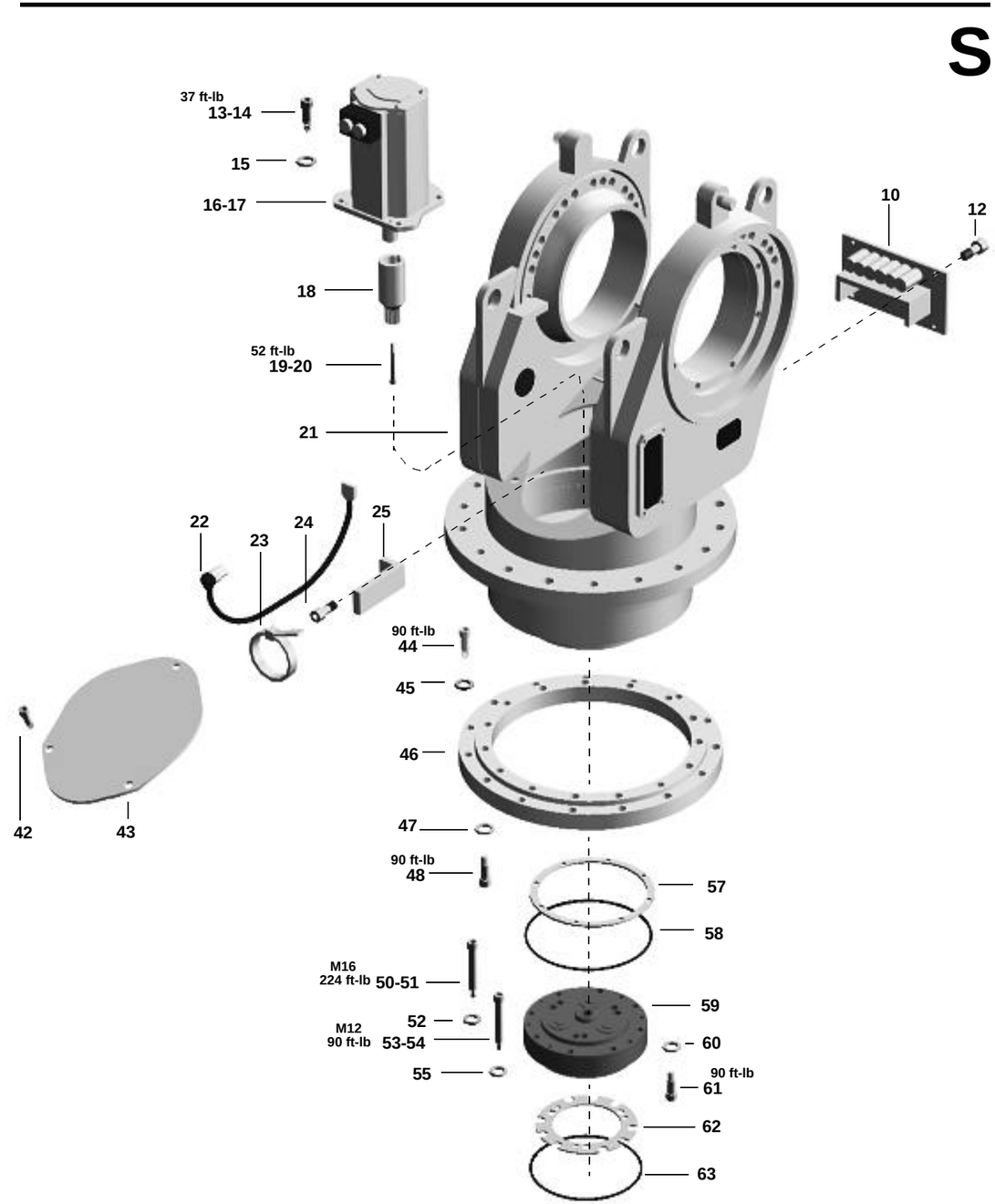
ITEM	QTY.	DESCRIPTION	ABB PART NO .
56	Ref	Installation Aid Tool	3HAB 1067-6
57	1	Friction Ring	3HAA 1001-614
58	1	O-Ring 245.0x3.0	2152 0431-15
59	1	Gear Reduction Unit	3HAB 4079-1
60	8	Washer - Plain 13x24x2.5	2551 2062-177
61	8	Screw - M12x90 12.9	3HAB 3409-75
62	1	Friction Ring	3HAA 1001-613
63	1	O-Ring 234.54x3.53	2152 0431-17
64	1	Brake Release Unit	3HAA 0001-ADY
65	4	Screw M6x16 8.8	2121 2411-368
66	1	Cable - Axis 2	3HAB 4252-1
	1	Cable - Axis 3	3HAA 0001-YY
67	4	Screw - M6x16	2121 2411-368
68	2*	Screw - M10x100 12.9	3HAB 3409-62
69	-*	Loctite 242	1269 0014-410
70	2*	Pinion	(Incl. in Item 35)
71	2*	Motor - Axis 2 & 3	3HAB 4040-1
-	2*	Motor - Axis 2&3 PE/2.25-75	3HAB 4226-1
72	4	Washer - Plain 10.5x22.2	2151 2062-173
73	4	Screw - M10x25 8.8	2121 2419-493
74	-	Lubricating Grease	1171 4012-201

* The left side drive components for Axis 2 are the same as the same as the right side drive components for Axis 3. Quantities shown are for both sides combined, Axis 2 plus Axis 3.

FORK LIFT BRACKETS (not shown on drawing)			
		2.4-120, 2.4-150, 2.8-120,3.0-75: Lifting Device Set Compl.	3HAA 0001-SY
	8	Screw - M16x60 8.8	2121 2518-632
	8	Washer - 17x30x3	3HAA 1001-186
	2	Lifting Bracket	3HAA 1001-257
	2	Lifting Bracket	3HAA 1001-258

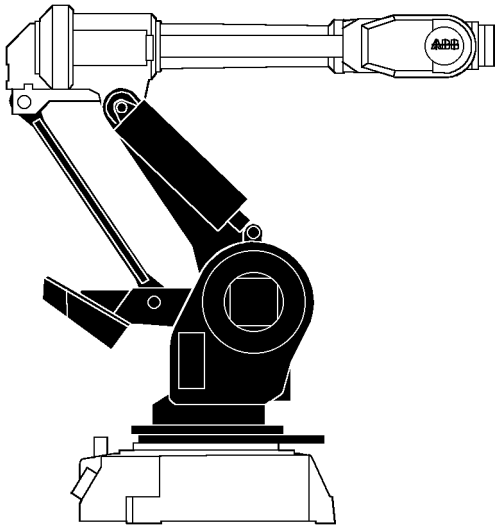
		Axis 1 Complete :	
		No Cust. Connections	3HAB 4161-1
		With Cust. Connections	3HAB4161-2

NOTE: See Section 12 for the illustration of all shoulder parts.



SECTION 6

Axes 2 & 3 Disassembly/Assembly



AXES 2 & 3

Table of Contents

MOTOR (S71) Removal

REFERENCE DRAWINGS

Exploded View:
"S" (pg 6-23, 12-2)

Assemblies:
3HAA 0001-EP (pg 13-10)
3HAA 0001-RB (pg 13-6)
3HAA 0001-RB (pg 13-7)
3HAA 0001-RB (pg 13-4)
3HAB 4162-2 (pg 13-9)
3HAB 4162-2 (pg 13-8)
3HAB 4163-2 (pg 13-23)
3HAB 4167-2 (pg 13-11)
3HAA 0001-AAS (pg 14-A)
3HAA 0001-AAO (pg 14-E)
3HAB 4252-2 (pg 14-I)

REQUIRED TOOLS

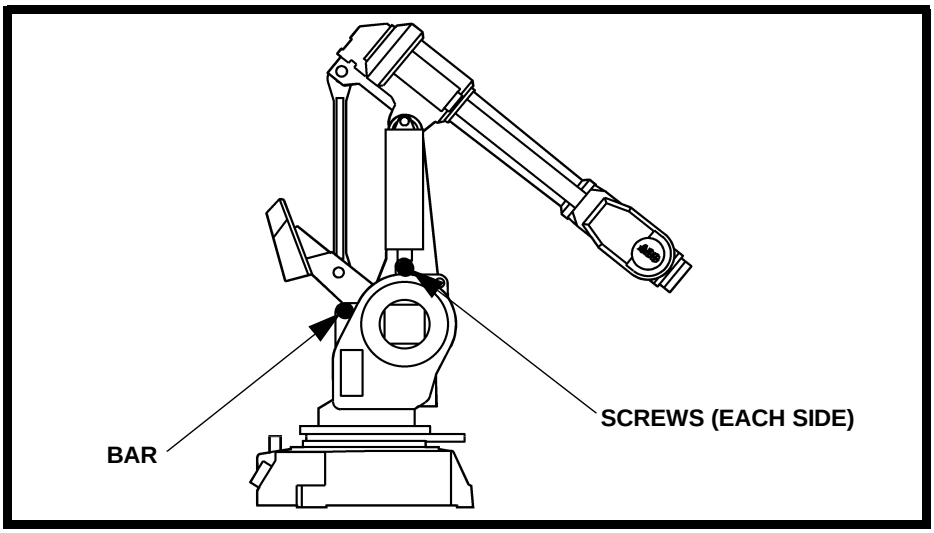
Hand Tools
Small 3-Jaw Puller
Strap Wrench
M10 x 150 Screw

NOTE: The following guideline is for axis 3 motor removal (right side motor). Axis 2 motor (left side motor) removal procedure is identical unless specifically noted.

1. Position the robot as shown below

2. Axis 2 motor (S71) removal (left side motor)

a. Position robot so lower arm (L17) can be locked from moving with support bars. See Figure below.



WARNING! BE SURE THAT THE AXIS YOU ARE REMOVING THE MOTOR FROM IS MECHANICALLY LOCKED FROM MOVING!

3. TURN ELECTRICAL DISCONNECT SWITCH OFF AND LOCK IT IN THE OFF POSITION.

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

4. DISCONNECT CABLES (S66) FROM AXIS MOTOR (S71).

a. Axis 3 connectors are R3.MP3 & R3.FB3.

b. Axis 2 connectors are R3.MP2 & R3.FB2.

MOTOR WEIGHS APPROX. 35 LB.

5. **ATTACH A HOIST TO MOTOR (S71) to help in lifting**
6. **REMOVE SCREWS (S73) AND WASHERS (S72).**
7. **PULL MOTOR (S71) STRAIGHT OUT AND OFF MOTOR SOCKET PLATE (S37).**
8. **REMOVE 0-RING (S38).**
9. **REMOVE PINION (S70) FROM MOTOR (S71).**

NOTE: Pinion is matched to the gear reduction unit. If a new motor is going to be installed, mount the old pinion on the new motor shaft. If a new gear reduction unit is going to be installed, mount the new pinion that comes with it on the motor shaft.

a. Remove screw (S68). Use a strap wrench to hold pinion from rotating while removing screw.

b. If pinion (S68) is tight on motor (S71) shaft, screw an M10x150 screw into threaded hole and pull pinion from motor shaft with the help of a small puller. Use the key slot hole in the side of the pinion to engage one jaw of the puller.

C

CAUTION: DO NOT HIT OR TAP MOTOR SHAFT.

c. Pinion (S70) is matched to gear reduction unit (S35), so keep it for re-assembly. If a new motor is to be installed, mount old pinion on new motor shaft.

MOTOR (S71) Installation

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

REFERENCE DRAWINGS

Exploded View:
"S" (pg 6-23, 12-2)

Assemblies:
3HAA 0001-EP (pg 13-10)
3HAA 0001-RB (pg 13-6)
3HAA 0001-RB (pg 13-7)
3HAA 0001-RB (pg 13-4)
3HAB 4162-2 (pg 189)
3HAB 4162-2 (pg 13-20)
3HAB 4163-2 (pg 13-23)
3HAB 4167-2 (pg 13-11)
3HAA 0001-AAS (pg 14-A)
3HAA 0001-AAO (pg 14-E)
3HAB 4252-2 (pg 14-I)

REQUIRED TOOLS

Hand Tools
Strap Wrench
M10 x 150 threaded Rod
M10 Hex Nut
M10 Washer
Lubricating Grease
Molycote 1000 Grease
Loctite 242
Torque Wrench (35-37 ft-lb)

NOTE: The following guideline is for axis 3 motor installation (right side motor). Axis 2 motor (left side motor) installation procedure is identical unless specifically noted.

NOTE: Pinion is matched to the gear reduction unit. If a new motor is going to be installed, mount the old pinion on the new motor shaft. If a new gear reduction unit is going to be installed, mount the new pinion that comes with it on the motor shaft

1. MOUNT PINION (S70) ONTO MOTOR (S71) SHAFT

a. Screw a fully threaded M10x150 rod into threaded end of motor (S71) shaft.

b. Slide pinion (S70) onto motor (S71) shaft as far as it will start with hand pressure.

c. Slide a washer over the threaded rod, thread on an M10 hex nut, and press the pinion (S70) onto the shaft by winding the nut down the rod. DO NOT TAP OR HIT THE MOTOR SHAFT IN ANY WAY!

CAUTION: DO NOT TAP OR HIT MOTOR SHAFT

d. Remove the threaded rod, nut, and washer.

e. Apply Loctite 242 (S69) to screw (S68) and insert in end of motor (S71) shaft. Torque to 35 ft-lb. Use strap wrench to keep pinion from turning.

2. CLEAN MOUNTING SURFACES

3. MOUNT MOTOR (S71) TO PLATE (S37)

a. Lightly grease (S74) O-Ring (S38) and position on motor socket plate (S37).

b. Apply Molycote 1000 to screws (S73) and washers (S72).

MOTOR WEIGHS APPROX. 50 LB.

c. Set motor (S71) in place on plate (S37) and insert screws (S73) with washers (S72). Torque to 37 ft-lb.

4. **CONNECT CABLES (S66) TO AXIS MOTOR (S71).**
   a. Axis 3 connectors are R3.MP3 & R3.FB3.
   b. Axis 2 connectors are R3.MP2 & R3.FB2.
5. **REMOVE LOWER ARM LOCKING SCREWS AND/OR PARALLEL ARM SUPPORT BAR.**
6. **CALIBRATE AXIS as outlined in Section 11**

GEAR REDUCTION UNIT (S35) Removal

REFEERENCE DRAWINGS

Exploded View:
"S" (pg 6-31,12-2)

Assemblies:
3HAA 0001-EP (pg 13-10)
3HAA 0001-RB (pg 13-6)
3HAA 0001-RB (pg 13-7)
3HAA 0001-RB (pg 13-4)
3HAB 4162-2 (pg 13-9)
3HAB 4162-2 (pg 13-8)
3HAB 4163-2 (pg 13-23)
3HAB 4167-2 (pg 13-11)
3HAA 0001-AAS (pg 14-A)
3HAA 0001-AAO (pg 14-E)
3HAB 4252-2 (pg 14-I)

REQUIRED TOOLS

Hand Tools
M12x200 Threaded Rods (2)
ABB 6896 0011-YL

NOTE: The following guideline is for axis 3 gear reduction unit (right side unit). Axis 2 gear reduction unit (left side unit) removal procedure is identical unless specifically noted.

1. **TURN MAIN ELECTRICAL SWITCH OFF AND LOCK IT IN THE LOCKED POSITION.**

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION.

2. **REMOVE MOTOR (S71) as outlined on page 6 - 1**

3. **REMOVE MOTOR SOCKET PLATE (S37).**
   a. Remove remaining six screws (S31) and six washers (S30).
   b. Remove motor socket plate (S37).
   c. Remove O-ring (S36).

4. **INSTALL GUIDE PINS:**
   a. Remove two screws (S31) and two washers (S30) that are horizontally opposite each other (at approximately 10 and 2 o'clock).
   b. Thread two M12 x 200 threaded rods into the threaded holes of the two removed screws (S31). These rods will serve as guide pins to aid in disassembly.

PLATE WEIGHS APPROX. 30 LB.

NOTE: If the optional gear reduction unit removal tool ABB 6896 0011-YL is used, guide pins are not required.

5. **REMOVE GEAR REDUCTIONS UNIT (S35).**
   a. Remove screws (S27) and washers (S26).
   b. Remove screws (S29) and washers (S28).
   c. Remove gear reduction unit (S35).
   d. Remove friction ring (S34), O-Ring (S33), and friction ring (S32).

6. **REMOVE M12x20 THREADED ROD GUIDE PINS (if they were used).**

GEAR REDUCTION UNIT (S35) Installation

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION.

REFERENCE DRAWINGS

Exploded View:
"S" (pg 6-23, 12-2)

Assemblies:
3HAA 0001-EP (pg 13-10)
3HAA 0001-RB (pg 13-6)
3HAA 0001-RB (pg 13-7)
3HAA 0001-RB (pg 13-4)
3HAB 4162-2 (pg 13-9)
3HAB 4162-2 (pg 13-8)
3HAB 4163-2 (pg 13-23)
3HAB 4167-2 (pg 13-11)
3HAA 0001-AAS (pg 14-A)
3HAA 0001-AAO (pg 14-E)
3HAB 4252-2 (pg 14-I)

REQUIRED TOOLS

Hand Tools
M12x200 Threaded Rods (2)
Lubricating Grease
Molycote 1000 Grease
Torque Wrench (90-221 ft-lb)
Loctite 242
6896 0011-YL

NOTE: The following guideline is for axis 3 gear reduction unit installation (right side of robot). Axis 2 gear reduction unit (left side of robot) installation procedure is identical unless specifically noted.

1. CLEAN ALL COMPONENTS.

2. INSTALL GUIDE PINS:

a. Thread two M12 x 200 threaded rods into two horizontally opposite threaded holes that are used for screws (S31). These rods will serve to hold friction ring (S32) in place and to guide RV into position. (Use holes located at approximately 10 and 2 o'clock.)

3. MOUNT GEAR REDUCTION UNIT (S35)

a. Lightly grease O-Ring (S33) with lubricating grease (S74). Position O-Ring in place.

b. Lightly grease friction ring (S32) and position in place on guide rods.

c. Position friction ring (S34) in place.

d. Slip gear reduction unit onto guide pins and into mounted position in frame housing (S21).

GEAR UNIT WEIGHS APPROX. 125 LB.

e. Use lifting tool (#6896 0011-YL) to lift RV into position.

f. Lubricate three screws (S29) and washers (S28) with Molycote 1000 and insert through center of gear reduction unit into M12 threaded holes. Start threads, but do not tighten.

g. Lubricate three screws (27) and washers (S26) with Molycote 1000 and insert through center of gear reduction unit into M16 threaded holes. Start threads, but do not tighten.

h. Check that all holes are aligned and components are correctly positioned.

i. Torque M16 screws (S27) to 224 ft-lb.

j. Torque M12 screws (S29) to 90 ft-lb.

4. MOUNT MOTOR MOUNTING PLATE (S37)

a. Lightly grease O-Ring (S36) with lubricating grease (S74). Position O-Ring in place.

b. Slip motor mounting plate onto guide pins and into mounted position. Orient so that the two magnetic plugs (S40) are in a horizontal position.

c. Lubricate all screws (S31) and washers (S30) with Molycote 1000 grease.

d. Insert screws (S31) with washers (S30) into motor mounting plate, removing the two guide pins for last two screws. Torque to 90 ft-lb.

NOTE: Pinion is matched to the gear reduction unit. If a new motor is going to be installed, mount the old pinion on the new motor shaft. If a new gear reduction unit is going to be installed, mount the new pinion that comes with it on the motor shaft

5. INSTALL MOTOR as outlined on page 6 - 3

6. GREASE GEAR REDUCTION UNIT (S35) as outlined in Section 4

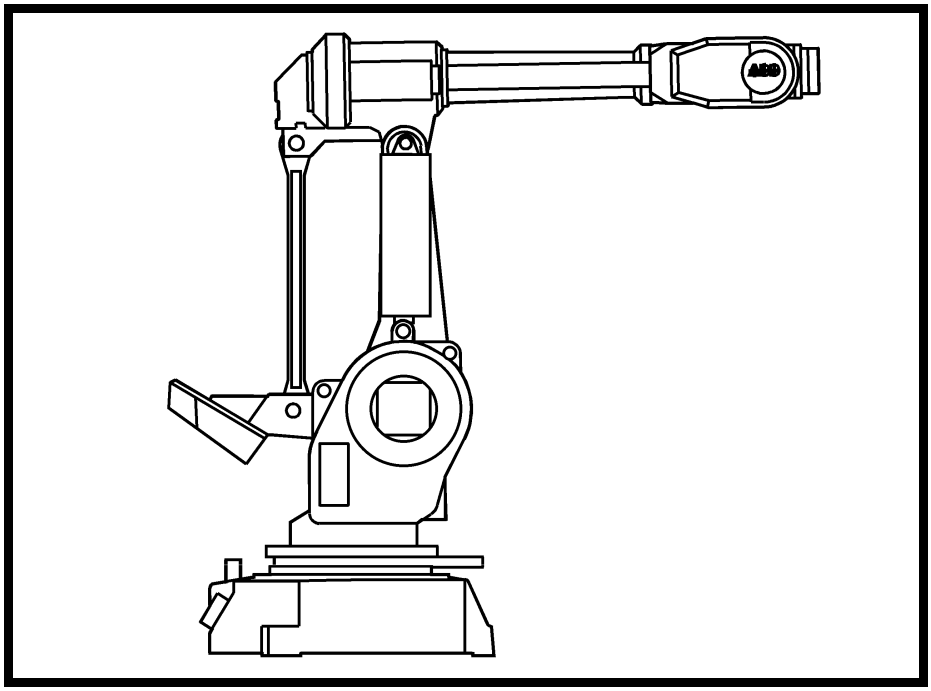
7. CALIBRATE AXIS as outlined in Section 11.

COUNTERBALANCE CYLINDER (L63) (L85) Removal

REFERENCE DRAWINGS
Exploded View:
"L" (pg 6-24, 12-3)
Assembly:
3HAA 0001-ZT (pg 13-5)

REQUIRED TOOLS
Hand Tools
M10x100 Screw (1)

1. **POSITION ROBOT SO LOWER ARM FRAME (L17) IS STRAIGHT UP**



2. **TURN MAIN ELECTRICAL DISCONNECT SWITCH OFF AND LOCK IT IN THE LOCKED POSITION.**

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

3. **LOCK CYLINDER LENGTH:**
   a. Remove M10 protective plug from top of cylinder.
   b. Insert M10 screw until it mechanically stops. Cylinder springs will now be locked and cylinder center distance held so cylinder can be easily remounted.

4. **ATTACH HOIST TO BALANCING CYLINDER (L63) (L85).**

5. **REMOVE NUTS (L66) (L90). (Nuts are Loctited).**

CYLINDER WEIGHS APPROX. 100 LB.

6. **REMOVE BALANCING CYLINDER. Carefully pry top off approximately half way. Then pry bottom all the way off. Make sure cylinder weight is supported by hoist, then pry top completely off.**

7. **LIFT CYLINDER AWAY AND SET IN A SAFE PLACE**

COUNTERBALANCE CYLINDER (L63) or (L85) Installation

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

REFERENCE DRAWINGS
Exploded View:
"L" (pg 6-24, 12-3)
Assembly:
3HAA 0001-ZT (pg 13-5)

REQUIRED TOOLS
Hand Tools
Lubricating Grease
Loctite 242

CYLINDER WEIGHS APPROX. 100 LB.

1. ***(MODELS 2.4-120 & 2.4-150 ONLY)*. . . INSERT WASHER SPACER (L62) ON CYLINDER MOUNTING SHAFTS**

   ***(S 2.9-120 ONLY)* . . . INSERT SLIDING RING (L84)**

   a. Apply lubricating grease to both sides of sliding ring (L84).

   b. Mount ring over shaft. Orient as shown in figure.

2. **MOUNT COUNTERBALANCE CYLINDER**

   a. Mount upper end of balancing cylinder first. Push onto shaft approximately half way.

   b. Mount lower end of balancing cylinder. Alternate pushing ends onto shafts so as not to bind.

3. **(TYPE A & B CYLINDERS ONLY) . . . INSERT CIRCLIP (L65)**

   (TYPE C CYLINDER ONLY):

   a. Apply lubricating grease to both sides of sliding ring (L88).

   b. Insert sliding ring (L88) in place. Orient as shown in figure.

   c. Insert washer (L89). Orient as shown in figure.

4. **INSTALL NUT (L66) (L90):**

   a. Apply Loctite 242 (L67) (L91) to lock nuts (L66) (L90).

   b. Install locknuts. Orient as shown in figure.

5. **REMOVE M10 SCREW AT TOP OF CYLINDER AND INSERT PROTECTIVE PLUG.**

6. **REMOVE HOIST.**

PARALLEL BAR (L42) Removal

1. **POSITION ROBOT SO PARALLEL ARM (L58) IS HORIZONTAL**

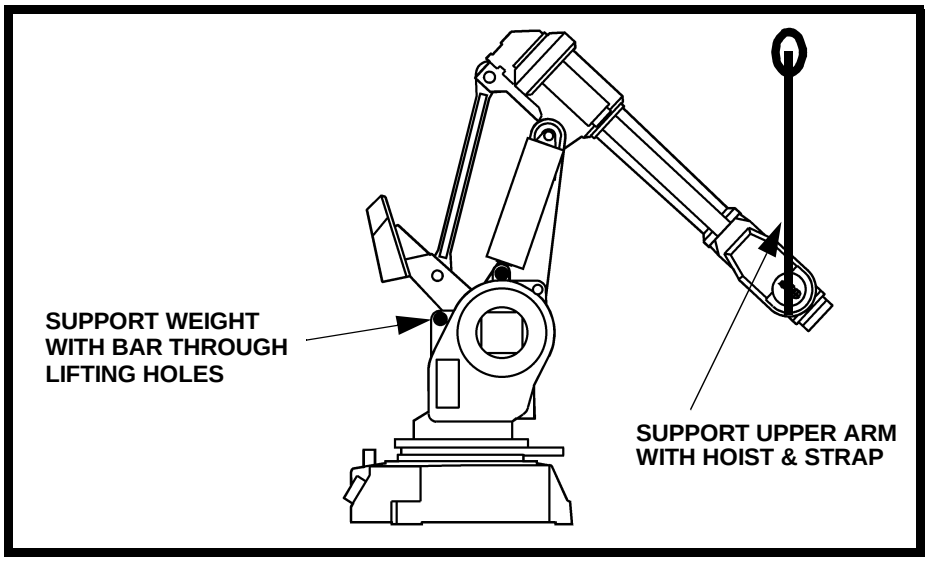
2. **TURN MAIN ELECTRICAL DISCONNECT OFF AND LOCK IT IN THE OFF POSITION.**

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

3. **ATTACH HOIST TO UPPER ARM & TAKE UP ALL SLACK TO SUPPORT WEIGHT. SEE FIGURE BELOW.**

REFERENCE DRAWINGS
Exploded View:
"L" (pg 6-24, 12-3)
Assembly:
3HAA 0001-ZT (pg 13-5)

REQUIRED TOOLS
Hand Tools



4. **REMOVE CLAMPS (L71):**
   a. Mark clamps so they can be reassembled in the same place.
   b. Remove screws (L69) and washers (L70).
   c. Remove clamps (L71).

5. **REMOVE CLAMPS (U58):**
   a. Mark clamps so they can be reassembled in the same place.
   b. Remove screws (U56) and washers (U57).
   c. Remove clamps (L58).

PARALLEL BAR WEIGHS APPROX. 65 LB.

6. **TAP PARALLEL BAR TO LOOSEN IT FROM MOUNTING AND LIFT (L42) AWAY. THE HOIST IS NOW HOLDING THE UPPER ARM IN POSITION.**

PARALLEL BAR BEARING Removal

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

REFERENCE DRAWINGS
Exploded View:
"L" (pg 6-24, 12-4)
Assembly:
3HAA 0001-ES (pg 13-12)

REQUIRED TOOLS
Hand Tools
Hand Press

1. Remove parallel bar (L42) pg. 6-10.
2. Remove retaining ring (L52).
3. Press (using a hand press) the shaft (L46) out towards snap ring slot.
4. Remove seal ring (L50) & (L43).
5. Remove nut (L49) & locking ring (L48).
6. Press (using a hand press) the spherical bearing off of the adapter sleeve.

PARALLEL BAR BEARING Installation

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

REFERENCE DRAWINGS
Exploded View:
"L" (pg 6-24, 12-4)
Assembly:
3HAA 0001-ES (pg 13-12)

REQUIRED TOOLS
Hand Tools
Hand Press

1. Ensure that adapter sleeve (L45) is centered on rod (L46).
2. Press spherical bearing (L47) onto adapter sleeve (L45).
3. Place lock washer (L48) and lock nut (L49) on adapter sleeve & tighten until no more play exists.
4. Press shaft and bearing assembly into parallel arm until bearing seats.
5. Place seals (L43) and (L50) over the ends of bearing assembly.
6. Install snap ring (L52).

PARALLEL BAR (L42) Installation

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

REFERENCE DRAWINGS

Exploded View:
"U" (pg 6-25, 12-4)
"L" (pg 6-24, 12-3)

Assembly:
3HAA 0001-ES (pg 13-12)

REQUIRED TOOLS

Hand Tools
Lubricating Grease
Molycote 1000 Grease
Torque Wrench (224 ft-lb)

BAR WEIGHS APPROX. 90 LB.

1. **SET PARALLEL BAR (L42) IN POSITION IN HOUSING (U61) AND PARALLEL ARM (L58).**

2. **INSTALL CLAMPS (U58):**
   a. Lubricate screws (U56) and washers (U57) with Molycote 1000 grease.
   b. Install clamps (U58) with screws (U56) and washers (U57). Torque 224 ft-lb. Tighten so clamps are balanced and neither clamp end bottoms out against housing (U61).

3. **INSTALL CLAMPS (L71):**
   a. Lubricate screws (L69) and washers (L70) with Molycote 1000 grease.
   b. Install clamps (L71) with screws (L69) and washers (L70). Torque 224 ft-lb. Tighten so clamps are balanced and neither clamp end bottoms out against parallel arm (L58).

4. **REMOVE ALL HOISTS AND EXTRA MECHANICAL STOPS**

5. **CALIBRATE AXIS 3 as outlined in Section 11**

BEARINGS (L40) & (L56) Removal

REFERENCE DRAWINGS

Exploded View:
"L" (pg 6-24, 12-3)

Assembly:
3HAB 4162-2 (pg 13-11)

REQUIRED TOOLS

Hand Tools
Bearing Puller

1. **REMOVE LOWER ARM (L17) & PARALLEL ARM (L58)** as outlined starting page 6 - 14.

2. **REMOVE BEARING (L40):**
   a. Remove spacer (L41).
   b. Remove bearing (L40) parallel arm (L58) using a bearing puller.

3. **REMOVE BEARING (L56):**
   a. Remove bearing (L56) from parallel arm (L58) using a bearing puller.
   b. Remove spacer (L57).

BEARINGS (L40) & (L56) Installation

REFERENCE DRAWINGS

Exploded View:
"L" (pg 6-24, 12-3)

Assembly:
3HAB 4162-2 (pg 13-11)

REQUIRED TOOLS

Hand Tools
Heating Oven

1. **INSTALL BEARING (L40):**
   a. Heat bearing (L40) to 250°F (120°C).
   b. Install bearing (L40) onto parallel arm (L58) shaft.
   c. Install spacer (L41).
2. **INSTALL BEARING L56):**
   a, Heat bearing (L56) to 250°F (120°C).
   b. Install spacer (L57).
   c. Install bearing (L56) on parallel arm (L58) shaft.
3. **IF READY, INSTALL LOWER ARM & PARALLEL ARM as outlined starting on page 6 - 18.**

LOWER ARM (L17) & PARALLEL ARM (L58) Removal

1. **TURN MAIN ELECTRICAL DISCONNECT SWITCH OFF AND LOCK IT IN THE OFF POSITION.**

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

REFERENCE DRAWINGS

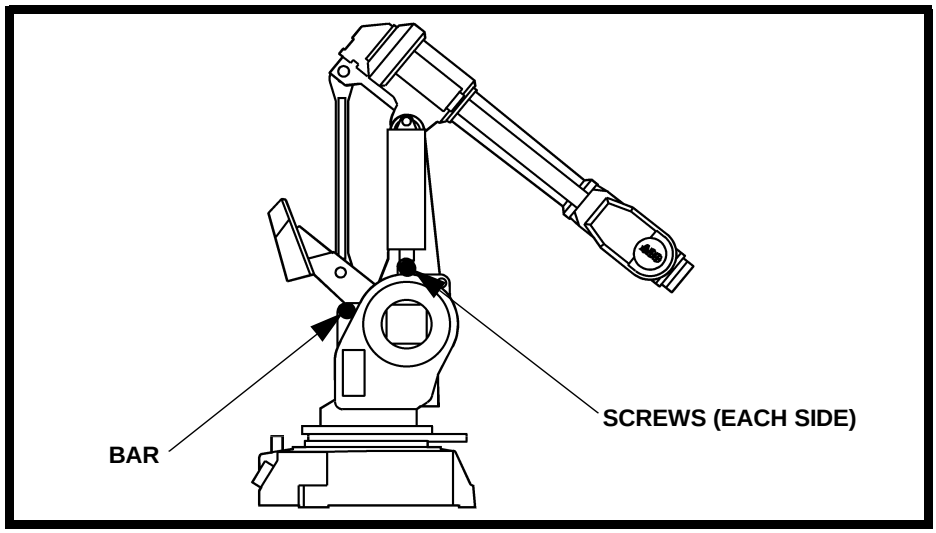
Exploded View:
- "S" (pg 6-23, 12-2)
- "L" (pg 6-24, 12-3)

Assemblies:
- 3HAA 0001-EP (pg 13-6)
- 3HAA 0001-RB (pg 13-13)
- 3HAA 0001-RB (pg 13-14)
- 3HAA 0001-RB (pg 13-15)
- 3HAB 4162-2 (pg 13-19)
- 3HAB 4162-2 (pg 13-20)
- 3HAB 4167-2 (pg 13-23)

REQUIRED TOOLS

Hand Tools
Shackles
Locking Screws

2. **SECURE AXIS 2 WITH LOCKING SCREW INTO LOWER ARM (L17). SECURE AXIS 3 WITH SUPPORT BAR**

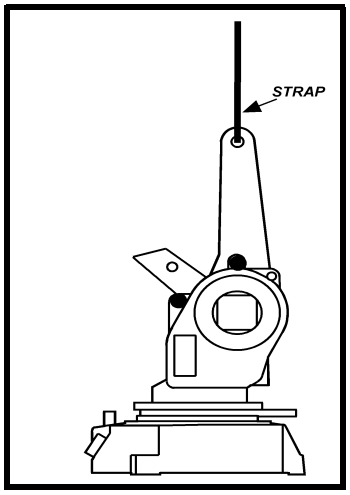


UPPER ARM ASSEM. ASSEMBLY WEIGHS APPROX. 800 LB.

3. **REMOVE UPPER ARM ASSEMBLY as outlined on page 6 - 17**

COUNTERBALANCE WEIGHT WEIGHS APPROX. 700 TO 900 LB.

4. **REMOVE COUNTERBALANCE WEIGHT (L68).**
   a. Insert shackles into threaded holes in counterbalance weight (L68) to attach hoist.
   b. Remove screws (L76) and washers (L75).
   c. Lift weight (L68) away and set in a safe place."



5. **ATTACH HOIST TO LOWER ARM FRAME (L17) AS SHOWN IN FIGURE AT LEFT.**

6. **REMOVE AXIS 2 & 3 GEAR REDUCTION UNITS as outlined on page 6 - 5.**

7. **REMOVE LOWER ARM (L17) AND PARALLEL ARM (L58).**
   a. Remove locking screws from step 2.
   b. Carefully lift lower arm (L17) and parallel arm (L58) assembly from frame housing (S21).

8. REMOVE LOWER ARM (L17) FROM PARALLEL ARM (L58)

LOWER ARM & PARALLEL ARM WEIGH APPROX. 300 LB.

a. Set lower arm (L17) and parallel arm (L58) on a working surface. Open arms out.

b. Use wood to block arms at joint to lay level on working surface, as necessary.

c. Force the parallel arm to the side to disengage the lower arm. Bearings may be tight. Use the threaded holes and a combination of threaded studs, washers, and nuts to help in forcing the arms apart.

d. Pull lower arm (L17) away from parallel arm (L58).

LOWER ARM (L17) & PARALLEL ARM (L58) Installatio n

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

REFERENCE DRAWINGS

Exploded Views:
"S" (pg 6-23, 12-2)
"L" (pg 6-24, 12-3)

Assemblies:
3HAA 0001-EP (pg 13-10)
3HAA 0001-RB (pg 13-6)
3HAA 0001-RB (pg 13-7)
3HAA 0001-RB (pg 13-4)
3HAB 4162-2 (pg 13-9)
3HAB 4162-2 (pg 13-8)
3HAB 4167-2 (pg 13-11)

REQUIRED TOOLS

Hand Tools
Torque Wrench (224 ft-lb)

LOWER ARM & PARALLEL ARM WEIGH APPROX. 300 LB.

COUNTERBALANCE WEIGHT WEIGHS APPROX. 700 TO 900 LB.

1. **MOUNT PARALLEL ARM (L58) TO LOWER ARM (L17).**
   a. Set lower arm (L58) and parallel arm (L17) on a working surface. Move arms to engage each other.
   b. Press parallel arm (L58) into lower arm (L17). Use the threaded holes in the arms and a combination of threaded rod, washers, and nuts to help in forcing the arms together.
2. **ATTACH HOIST TO LOWER ARM AND LIFT LOWER ARM (L17) AND PARALLEL ARM (L58) ASSEMBLY. Set in place in frame housing (S21). Leave hoist attached to support and position assembly during installation.**
3. **INSTALL AXIS 2 & 3 GEAR REDUCTION UNIT (S35) as outlined on page 6 - 6.**
4. **INSTALL UPPER ARM as outlined on page 7 - 1.**
5. **COMPLETE INSTALLATION OF PARALLEL BAR (L42) as outlined on page 6 - 13.**
6. **SECURE AXIS 2 WITH LOCKING SCREW INTO LOWER ARM (L17). SECURE AXIS 3 WITH EXTRA MECHANICAL STOPS**
7. **INSTALL COUNTERBALANCE WEIGHT (L68).**
   a. Lift weight (L68) into position for mounting.
   b. Insert screws (L76) and washers (L75). Torque to 224 ft-lb.
8. **CALIBRATE AXES 2 & 3 as outlined in Section 11.**

UPPER ARM ASSEMBLY Removal

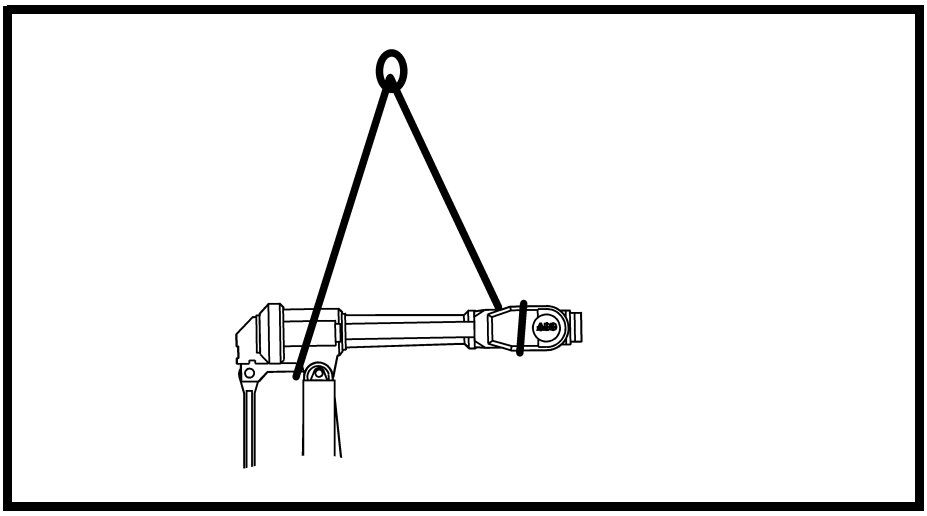
WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

REFERENCE DRAWINGS
Exploded View:
"L" (pg 6-24, 12-3)
"U" (pg 6-25, 12-4)
Assemblies:
3HAA 0001-ZT (pg 13-5)
3HAB 4163-2 (pg 13-23)
3HAA 0001-AAS (pg 14-A)
3HAB 4254-2 (pg 14-J)

REQUIRED TOOLS
Hand Tools

1. **TURN THE MAIN ELECTRICAL DISCONNECT SWITCH OFF AND LOCK IT IN THE OFF POSITION**
2. **REMOVE UPPER CABLE as outlined in Section 10**
3. **REMOVE COUNTERBALANCE CYLINDERS (L63)(L85) as outlined on page 6 - 8.**
4. **ATTACH HOIST TO UPPER ARM AS SHOWN IN FIGURE BELOW**

UPPER ARM WEIGHS APPROX. 500 LB.



5. **DETACH PARALLEL BAR (L42) AT TOP.**
   a. Mark clamps (U58) so they can be reassembled in same location.
   b. Remove screws (U56) and washers (U57).
   c. Remove clamps (U58).
   d. Let parallel bar (L42) swing back and rest on counterbalance weight (L68).

PARALLEL BAR WEIGHS APPROX. 80 LB.

6. **REMOVE NUTS (L8) AND (L24). An extended socket wrench is required for nuts used on S/2.9-120 robots**

7. REMOVE SHAFTS (L16) and (L18)

a. Remove two set screws (U64) which lock shafts (L16) & (L18) in place. These screws MUST be removed before trying to unscrew shafts (L16) and (L18).

WARNING! DO NOT ATTEMPT TO REMOVE SHAFTS (l16) OR (L18) WITHOUT FIRST REMOVING SET SCREWS (U64)!

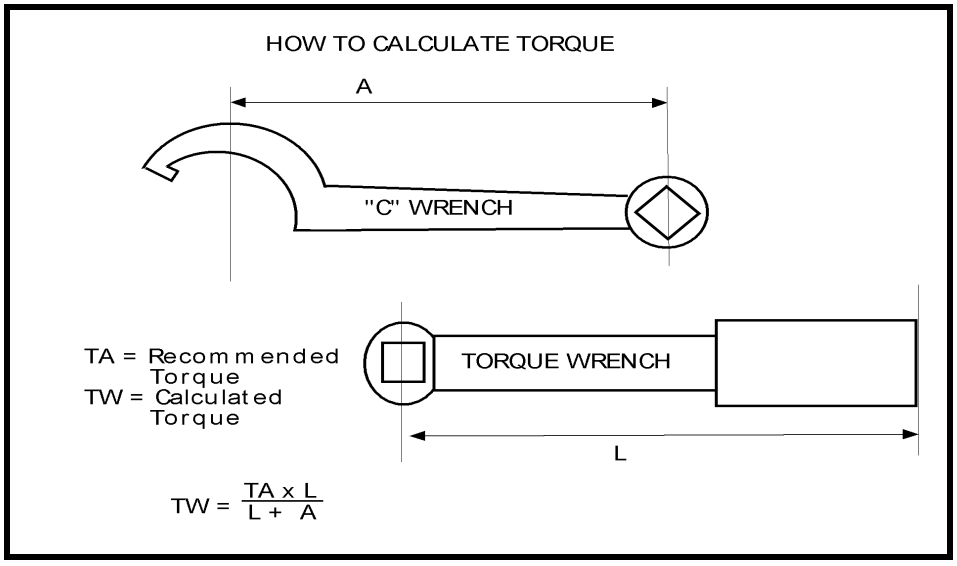
b. Carefully unscrew shafts (L16) and (L18) from lower arm frame (L17). Protect threads from damage.

NOTE: Both shaft assemblies (Ll16) & (L18) have nilos rings (L11) or (L22), spacers (L10) or (L23), bearing (L12) or (L21), sealing ring (L13) or (L20), and V-ring (L15) or (L19).

CAUTION: SHAFT (L16) HAS AN ADDITIONAL SPACER (L14). THIS ADDED SPACER IS IMPORTANT DURING REASSEMBLY.

UPPER ARM ASSEMBLY WEIGHS APPROX. 500 LB.

8. LIFT UPPER ARM ASSEMBLY AWAY AND SET IT IN A SAFE PLACE



UPPER ARM ASSEMBLY Installation

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

REFERENCE DRAWINGS

Exploded View:
- "L" (pg 6-24, 12-3)
- "U" (pg 6-25, 12-4)

Assemblies:
- 3HAA 0001-ZT (pg 13-5)
- 3HAB 4163-2 (pg 13-23)
- 3HAA 0001-AAS (pg 14-A)
- 3HAB 4254-2 (pg 14-J)

REQUIRED TOOLS

- Hand Tools
- Lubricating Grease
- Molycote 1000 Grease
- Loctite 242
- Torque Wrench (67-224 ft-lb)

1. POSITION UPPER ARM ASSEMBLY IN PLACE ON LOWER ARM FRAME (L17).

2. MOUNT SHAFTS (L16) AND (L18)

a. Lubricate shaft threads with Molycote 1000 grease.

b. Carefully insert shafts through lower arm frame (L17) bore and screw into upper arm housing (U61) threaded bore. Torque to 224 ft-lb.

c. Apply Loctite 242 to set screws (U64) and thread into housing (U61). Screw against shafts to lock then from turning.

NOTE: After screwing in both shafts (L16) and (L18) as outlined above, assemble components (L8,10,11,12,13,14,15) on (L16) shaft first (left side as viewed from robot rear). Note that spacer (L14) is assembled ONLY on shaft (L16), not on shaft (L18).

3. INSTALL BEARING COMPONENTS ONTO SHAFT (L16):

a. Install V-Ring (L15) on shaft, square side to shaft shoulder.

b. Install spacer (L14) onto shaft.

c. Insert sealing ring (L13) in lower arm frame (L17) bore, larger diameter of ring turned inward.

d. Insert outer race of bearing (L12) into lower arm frame (L17) bore, up against V-Ring (L15).

e. Pack inner race of bearing (L12) with grease (L87) and install on shaft (L16); position into bearing outer race.

f. Insert NILOS ring (L11) against bearing (L12).

g. Install spacer (L10) against bearing (L12).

4. INSTALL NUT (L8):

a. Apply Loctite 242 (L9) to nut (L8) and thread onto shaft (L16).

b. Tighten nut (L8), torque 67 ft-lb.Then loosen nut. (See figure on previous page.)

c. Re-tghten nut (L8), torque 67 ft-lb. This re-tightening the nut only applies to the left side shaft assembly

5. **INSTALL BEARING COMPONENTS ONTO SHAFT (L18):**
   a. Install V-Ring (L19) on shaft, square side to shaft shoulder.
   b. Insert sealing ring (L20) in lower arm frame (L17) bore, larger diameter of ring turned inward.
   c. Insert outer race of bearing (L21) into lower arm frame (L17) bore, up against V-Ring (L19).
   d. Pack inner race of bearing (L21) with grease (L87) and install on shaft (L18); position into bearing outer race.
   e. Insert NILOS ring (L22) against bearing (L21).
   f. Install spacer (L23) against bearing (L22).

6. **INSTALL NUT (L24):**
   a. Apply Loctite 242 (L25) to nut (L24) and thread onto shaft (L18).
   b. Tighten nut (L24). Torque to 67 ft-lb.

7. **ATTACH PARALLEL BAR (L42) AT TOP.**
   a. Lubricate screws (U56) and washers (U57) with Molycote 1000 .
   b. Install clamps (U58) with screws (U56) and washers (U57). Torque 224 ft-lb. Tighten so clamps are balanced and neither end bottoms out against housing (U61).

8. **INSTALL UPPER CABLE (U14) as outlined in Section 10**

9. **INSTALL COUNTERBALANCE CYLINDERS as outlined on page 6 - 9**

10. **REMOVE ALL HOISTS, LOCKING SCREWS, AND EXTRA MECHANICAL STOPS.**

11. **CALIBRATE AXIS 3 as outlined in Section 11**

ITEM	QTY.	DESCRIPTION	ABB PART NO .
1	2	Screw - M6x12	2321 2416-366
2	1	Bracket	3HAA 1001-104
3	1	Sync. Plate	3HAA 1001-79
4	2	Washer - Plain 4.3x19x0.8	2151 2062-136
5	2	Screw - M4x6	2121 2416-285
6	1	Cover	3HAA 0001-ZK
7	2	Screw - M6x16 2.8	2121 2411-368
8	1	Cable Guide	3HAA 1001-721
9	2	Screw - M6x30	2121 2411-374
10	1	Measure Card Unit	3HAB 4259-1
-	1	Serial Measurement Board	3HAB 2213-1
11	1	Battery Pack	4944 026-4
12	4	Screw - M6x16 8.8	2121 2411-368
13	4	Screw - M10x25	2121 2519-493
14	-	Loctite 242	1269 0014-410
15	4	Washer - Plain 10.5x22x2	2151 2062-173
16	1	Motor - Axis 1	3HAB 4039-1
-	1	Motor - Axis 1 PE/2.25-75	EHAB 4043-1
17	-	Permatex 3	1236 0012-202
18	1	Pinion	(Incl. in item 59)
19	1	Screw - M10x100 12.9	3HAB 3409-62
20	-	Loctite 242	1269 0014-410
21	1	Frame Housing	3HAB 4150-1
22	1	Cable - Axis 1 Signal	3HAB 4250-1
23	7	Strap	2166 2055-3
24	1	Screw M6x16	2121 2411-368
25	1	Holder	3HAA 1001-668
26	6*	Washer - Spring	3HAA 1001-181
27	6*	Screw- M16x140 12.9	3HAB 3409-95
28	6*	Washer - 12.5x24x5.9	3HAA 1001-200
29	6*	Screw - M12x140 12.9	3HAB 3409-200
30	16*	Washer - Plain 13x21x2	3HAA 1001-632
31	16*	Screw - M12x80 12.9	3HAB 3409-74
32	2*	Friction Ring	3HAA 1001-613
33	2*	O-Ring - 234.54x3.53	2152 0431-17
34	2*	Friction Ring	3HAA 1001-616
35	2*	Reduction Gear RV-250A	3HAB 4080-1
36	2*	O-Ring 269.3x5.7	2152 2012-550
37	2*	Plate - Motor Socket	3HAB 4056-1
38	2*	O-Ring 124.5x3	2152 2012-437
39	4*	Washer 13.5x18x1.5	2152 0441-1
40	4*	Magnetic Plug 1/4”	2522 122-1
41	3	Cap	3HAA 1001-199
42	3	Screw M6x20	2121 2411-370
43	1	Cover	3HAA 0001-SZ
44	15	Screw - M12x70 12.9	3HAB 3409-73
45	15	Washer - Plain 13x24x2.5	3HAA 1001-632
46	1	Bearing	3HAA 1001-1
47	15	Washer - Plain 13x24x2.5	2551 2062-177
48	15	Screw - M12x70 12.9	3HAB 3409-73
49	1	Plug - KR 1/2”	2522 2021-113
50	3	Screw - M16x140 12.9	3HAB 3409-95
51	-	Loctite 577	1269 1907-1
52	3	Washer - Spring	3HAA 1001-181
53	3	Screw - M12x140 12.9	3HAB 3409-200
54	-	Loctite 577	1269 1907-1
55	3	Washer - Support	3HAA 1001-200

ITEM	QTY.	DESCRIPTION	ABB PART NO .
56	Ref	Installation Aid Tool	3HAB 1067-6
57	1	Friction Ring	3HAA 1001-614
58	1	O-Ring 245.0x3.0	2152 0431-15
59	1	Gear Reduction Unit	3HAB 4079-1
60	8	Washer - Plain 13x24x2.5	2551 2062-177
61	8	Screw - M12x90 12.9	3HAB 3409-75
62	1	Friction Ring	3HAA 1001-613
63	1	O-Ring 234.54x3.53	2152 0431-17
64	1	Brake Release Unit	3HAA 0001-ADY
65	4	Screw M6x16 8.8	2121 2411-368
66	1	Cable - Axis 2	3HAB 4252-1
	1	Cable - Axis 3	3HAA 0001-YY
67	4	Screw - M6x16	2121 2411-368
68	2*	Screw - M10x100 12.9	3HAB 3409-62
69	-*	Loctite 242	1269 0014-410
70	2*	Pinion	(Incl. in Item 35)
71	2*	Motor - Axis 2 & 3	3HAB 4040-1
-	2*	Motor - Axis 2&3 PE/2.25-75	3HAB 4226-1
72	4	Washer - Plain 10.5x22.2	2151 2062-173
73	4	Screw - M10x25 8.8	2121 2419-493
74	-	Lubricating Grease	1171 4012-201

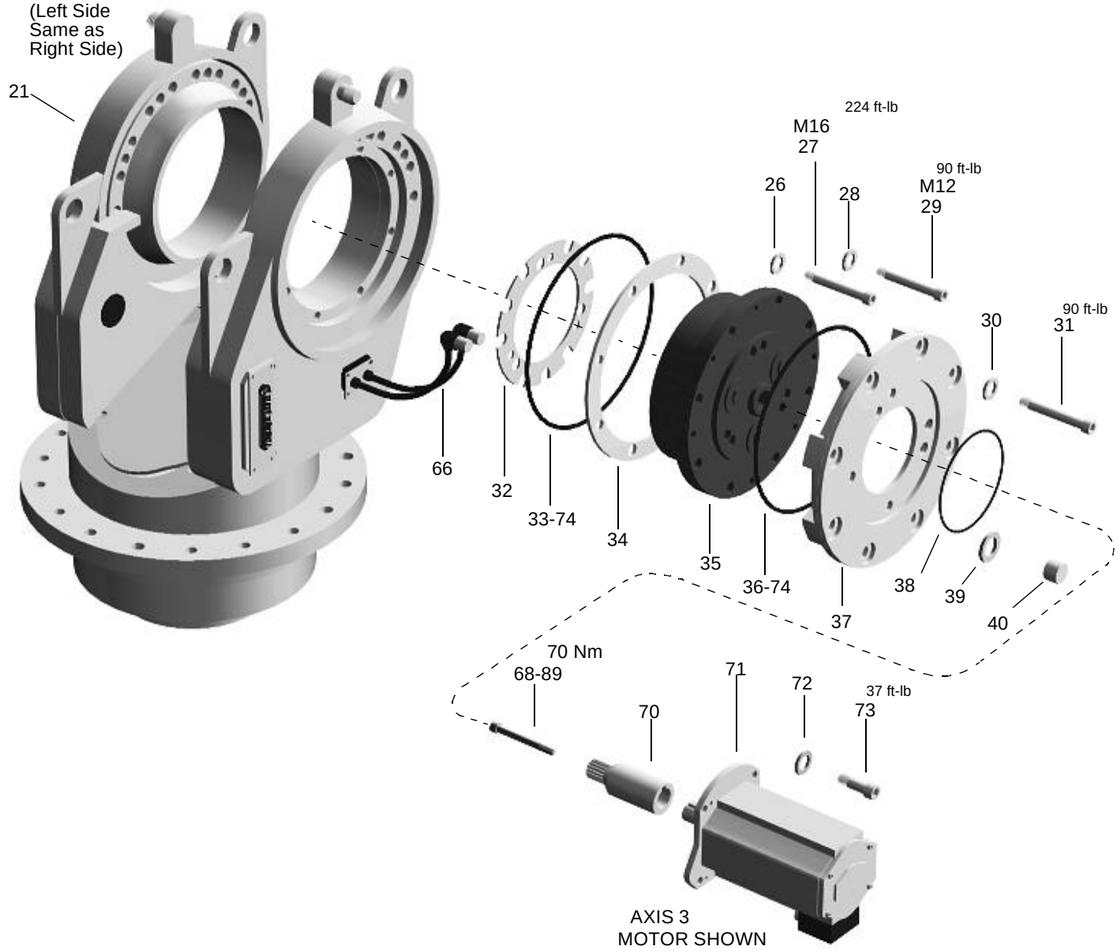
* The left side drive components for Axis 2 are the same as the same as the right side drive components for Axis 3. Quantities shown are for both sides combined, Axis 2 plus Axis 3.

FORK LIFT BRACKETS (not shown on drawing)			
		2.4-120, 2.4-150, 2.8-120,3.0-75: Lifting Device Set Compl.	3HAA 0001-SY
	8	Screw - M16x60 8.8	2121 2518-632
	8	Washer - 17x30x3	3HAA 1001-186
	2	Lifting Bracket	3HAA 1001-257
	2	Lifting Bracket	3HAA 1001-258

		Axis 1 Complete :	
		No Cust. Connections	3HAB 4161-1
		With Cust. Connections	3HAB4161-2

NOTE: See Section 12 for the illustration of all shoulder parts.

S

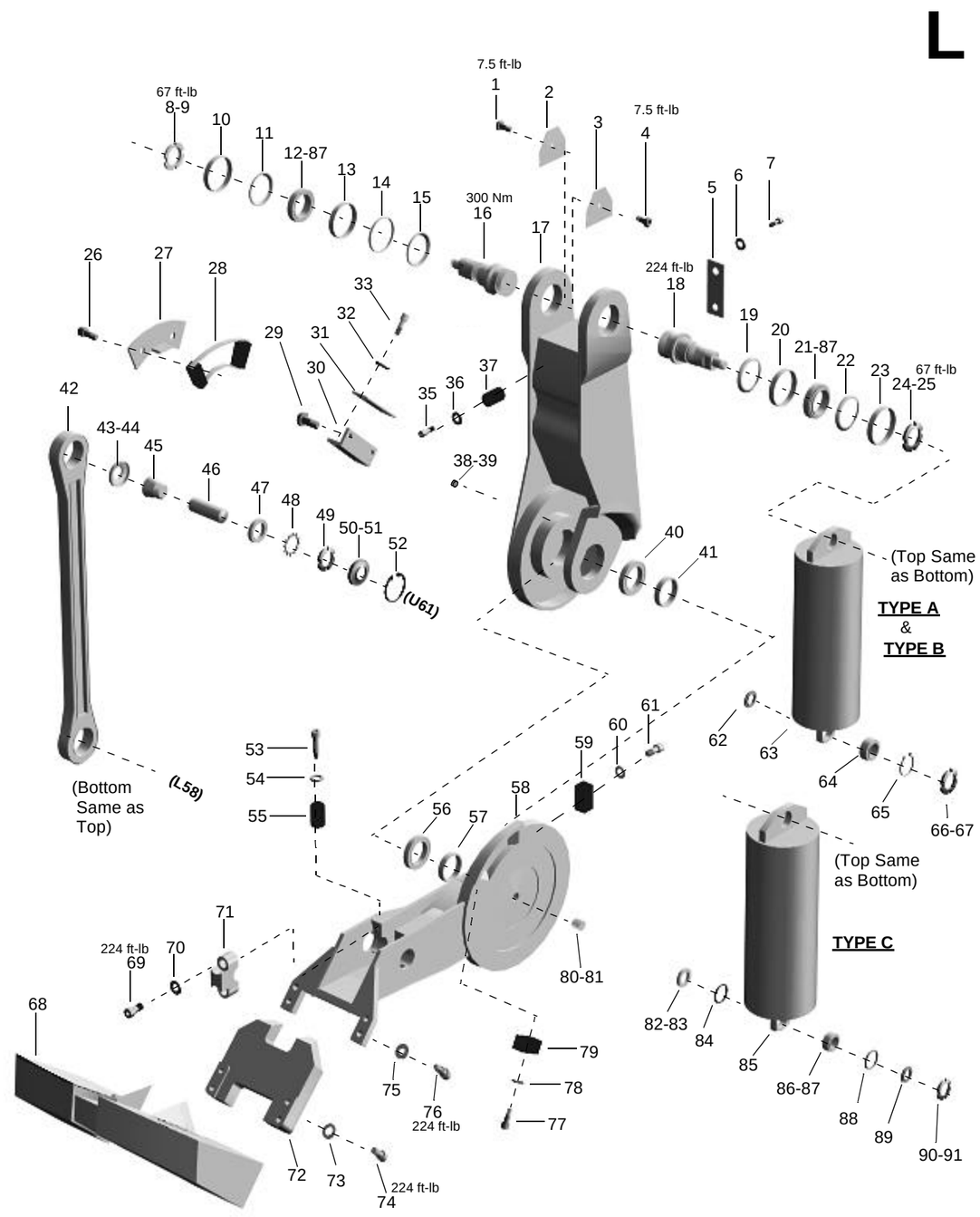


AXIS 3
MOTOR SHOWN

LOWER ARM . . .
including Parallel Arm & Balancing System

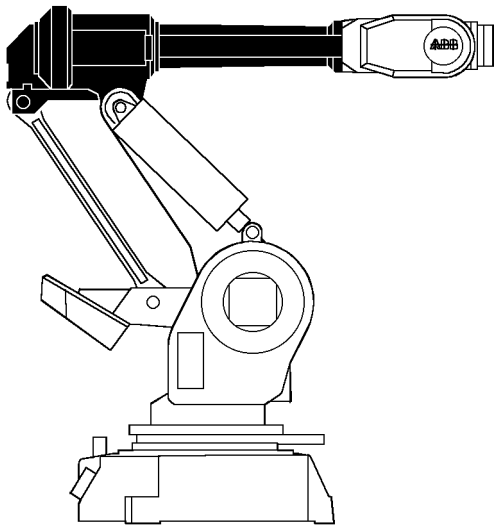
ITEM	QTY.	DESCRIPTION	ABB PART NO .
1	1	Screw - M6x10	2121 2763-364
2	1	Protective Plate	3HAA 1001-164
3	1	Protective Plate	3HAA 1001-164
4	1	Screw - M6x10	2121 2763-364
5	1	Sync. Plate	3HAA 1001-79
6	2	Washer - 4.3x9x0.8	2151 2062-136
7	2	Screw - M4x6	2121 2416-285
8	1	Lock Nut	2126 2851-112
9	-	Loctite 242	1269 0014-410
10	1	Spacer	3HAA 1001-126
11	1	NILOS Ring	2216 0085-5
12	1	Bearing - 32013X	2213 3802-8
13	1	Sealing Ring 6.4x15x3	3HAA 1001-173
14	1	Spacer (left side only)	3HAA 1001-125
15	1	V-Ring	2216 264-16
16	1	Shaft	3HAA 1001-127
		Shaft - S/2.9-120	3HAA 1001-317
17	1	Lower Arm Frame	3HAB 4168-1
18	1	Shaft	3HAA 1001-127
		Shaft - S/2.9-120	3HAA 1001-317
19	1	V-Ring	2216 264-16
20	1	Sealing Ring	3HAA 1001-173
21	1	Bearing - 32013X	2213 3802-8
22	1	NILOS Ring	2216 0085-5
23	1	Spacer	3HAA 1001-126
24	1	Lock Nut	2126 2851-112
25	-	Loctite 242	1269 0014-410
26	2	Screw - M6x10	2121 2763-364
27	1	Support Plate - Damper	3HAA 1001-282
28	1	Damper	3HAA 1001-90
29	2	Screw - M6x12	2121 2416-366
30	1	Bracker - Sync. Plate	3HAA 1001-104
31	1	Sync. Plate - Axis 2	3HAA 1001-74
32	2	Washer - Plain 6.4x12x0.8	2151 2062-153
33	2	Screw - M6x6	2121 2416-285
34		*(number not used)*	
35	2	Screw - M8x25	2121 2519-453
36	2	Washer - 8.4x16x1.5	
37	2	Damper	3HAA 1001-123
38	1	Set Screw - M20x20	2122 2765-99
39	-	Loctite 577	1269-1907-1
40	1	Spherical Roller Bearing	3HAB 4169-1
41	1	Spacer - Sleeve	3HAB 4387-1
42	1	Parallel Bar	3HAA 1001-71
43	2	Ring	3HAA 1001-86
44	-	Grease	1171 4012-201
45	2	Adapter Sleeve	2213 1905-21
46	2	Shaft	3HAA 1001-88
47	2	Spherical Bearing	3HAA 1001-189
48	2	Lock Washer	(Incl. in Item 45)
49	2	Lock Nut	(Incl. in Item 45)
50	2	Ring	3HAA 1001-86
51	-	Grease	1171 4012-201
52	2	Retaining Ring - Snap	2154 2527-160
53	2	Screw - M8x25	2121 2519-453
54	2	Washer - 8.4x16x1.5	2151 2062-165
55	2	Damper	3HAA 1001-81
56	1	Spherical Roller Bearing	3HAB 4169-1
57	1	Spacer - Sleeve	3HAB 4387-1
58	1	Parallel Arm Frame	3HAB 4170-1

ITEM	QTY.	DESCRIPTION	ABB PART NO .
59	1	Damper	3HAA 1001-622
60	2	Washer - Plain 6.4x12x1.6	2151 2062-153
61	2	Screw - M6x16	2121 2416-368
62	4	Spacer Washer	3HAB 4191-1
63	2	Type A - Standard Load	
		Balancing Unit Complete	3HAB 4216-1
		Balancing Unit	3HAB 4175-2
	2	Type B - Additional Load	
		Balancing Unit Complete	3HAB 4217-1
		Balancing Unit	3HAB 4175-3
64	4	Bearing	3HAA 1001-207
65	4	Circlip	3HAB 4190-1
66	4	Lock Nut (Mount in reverse)	2126 2851-106
67	-	Loctite 242	1269 0014-410
68	1	Weight - 314 kg - 2.4-120	3HAB 4022-1
	1	Weight - 400 kg - 2.4-150,	
		S/2.4-120,2.8-120, 3.0-75,	
		S/2.9-120	3HAB 4036-1
69	4	Screw - M16x70 12.9	3HAB 3409-88
70	4	Washer - 17x27x3	3HAA 1001-186
71	2	Clamp	3HAA 1001-13
72	1	Weight Adapter - S/2.9-120	3HAA 1001-334
			3HAA 0001-ST
-	4	Screws M16x60	2121 2518-632
-	4	Washers 17x30x3	2151 2062-185
-	1	Protect. Plate - PE/2.25-75	3HAA 1001-609
73	4	Washer - 17x27x3	3HAA 1001-186
74	4	Screw - M16x60 12.9	3HAB 3409-86
75	4	Washer - 17x27x3	3HAA 1001-186
76	4	Screw - M16x60	2121 2518-632
77	2	Screw - M6x16	2121 2416-368
78	2	Washer - Plain 6.4x12x1.6	2151 2062-153
79	1	Damper	3HAA 1001-622
80	1	Set Screw - M20x20	2122 2765-99
81	-	Loctite 577	1269 1907-1
82	4	Sliding Ring	3HAB 4545-1
83	-	Grease - ESSO Beacon EP2	1171 4013-301
84	4	Washer	3HAB 4546-1
85	2	Type C - S/2.9-120	
		Balancing Unit Complete	3HAB 4218-1
		Balancing Unit	3HAA 0001-US
86	4	Radial Bearing	3HAA 1001-207
87	-	Grease - ESSO Beacon EP2	1171 4013-301
88	4	Sliding Ring	3HAB 4545-1
89	4	Ring	3HAB 4544-1
90	4	Lock Nut (Mount in reverse)	2126 2851-106
91	-	Loctite 242	1269 0014-410



SECTION 7

Axis 4
Disassembly/Assembly



Disassembly/Assembly
Guidelines
IRB 6400

AXIS 4

Table of Contents

MOTOR (U83) Removal

REFERENCE DRAWINGS

Exploded Views:
- "S" (pg 7-20, 12-2)
- "L" (pg 7-21, 12-3)
- "U" (pg 7-22, 12-4)

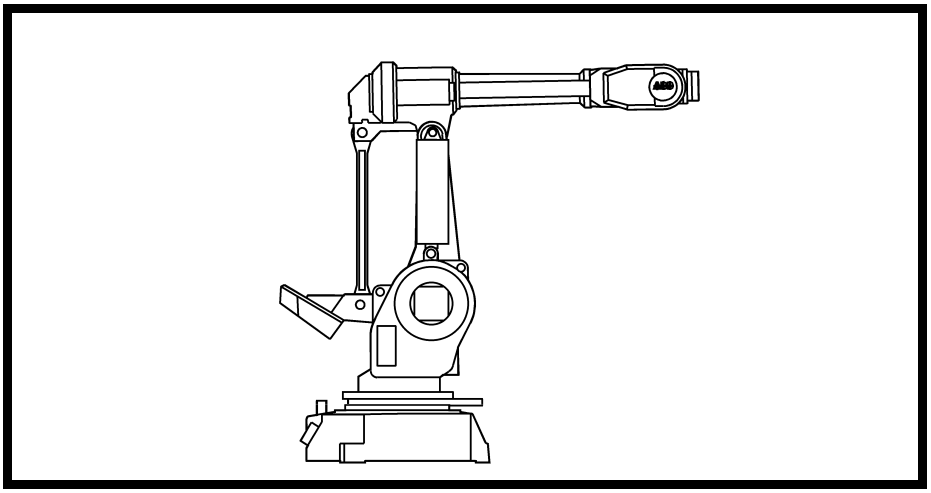
Assemblies:
- 3HAA 0001-AAH (pg 13-13)
- 3HAB 4163-2 (pg 13-23)
- 3HAA 0001-AAS (pg 14-A)
- 3HAB 4252-2 (pg 14-J)

REQUIRED TOOLS

- Hand Tools
- SKF Oil Injector #226 270
- SKF Nipple 725 870
- SKF Nipple 234 063
- ABB #6896 134-AC
- ABB #6896 134-EA

NOTE: Axes 4, 5, & 6 are either all ELMO motors or all Siemens motors. If replacing motor, do not mix manufacturers.

1. POSITION ROBOT WITH UPPER ARM HORIZONTAL.



2. RELEASE AXIS 4 BRAKE TO ALLOW AXIS 4 TO MOVE TO THE NEUTRAL POSITION IT WILL BE IN AFTER MOTOR IS REMOVED

3. TURN ELECTRICAL DISCONNECT SWITCH OFF AND LOCK IT IN THE OFF POSITION.

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

4. DRAIN OIL FROM HOUSING (U61)

a. Remove plug (U59) and washer (U60).

b. Remove plug (U38) and washer (U39).

c. Drain oil.

d. Clean and re-insert plug (U59) with washer (U60) and plug (U38) with washer (U39).

In rush situations you may skip to step 12 and skip backlash adjustments until a later time.

5. DISCONNECT LOWER HALF OF UPPER CABLE (U14)

NOTE: In extreme conditions when downtime is critical, steps 5, 6, 7, 8, 10, & 11 may be skipped. However, substantial backlash may result due to the elimination of the backlash adjustment.

a. Remove screws (S42) and cover (S43).

b. Disconnect connectors R2.MP4, R2.MP5-6, R2.CP, and R2.CS.

c. Remove screws (S12).

d. Pull measuring card unit (S10) out.

e. Disconnect R2.SMB3-6(X5) from signal measuring board.

f. Uncouple customer air hose by accessing clamp through measuring card unit (S10) opening.

6. LOOSEN SMALL COVERS HOLDING CABLES TO COVER (S6). Carefully feed cables up and out through the three holes in cover (S6)

7. REMOVE CABLE TUBE HOLDER (U53)

a. Remove screws (U49) and washers (U50).

b. Remove cover (U51).

c. Remove screws (U52).

d. Remove cable tube holder (U53).

8. DETACH UPPER CABLE (U14) CLAMPS

a. Detach upper cable (U14) clamp at inside front of lower arm (L17). Leave clamp clamped to cable to maintain location.

b. Detach upper cable (U14) clamp from under housing (U61). Leave clamp clamped to cable to maintain location.

9. DISCONNECT CABLES AT MOTOR (U83)

a. Disconnect connector R3.MP4.

b. Disconnect connector R3.FB4.

10. FEED LOWER PART OF CABLE (U14) UP AND OUT TO THE BACK OF ROBOT. Cable should be free enough for cover (U54) and gasket (U55) to be removed over it. If not, disconnect cable hangers and anything else holding it

COVER WEIGHS APPROX. 20 LB.

11. REMOVE COVER (U54) AND GASKET (U55)

a. Remove screws (U36) with washers (U37).

b. Remove cover (U54) including seal ring (U40)and cork gasket (U55).

MOTOR WEIGHS APPROX. 35 LB.

12. REMOVE MOTOR (U83):

a. Remove screws (U85) with washers (U84).

b. Carefully pull motor (U83) off housing (U61).

c. Remove O-Ring (U81).

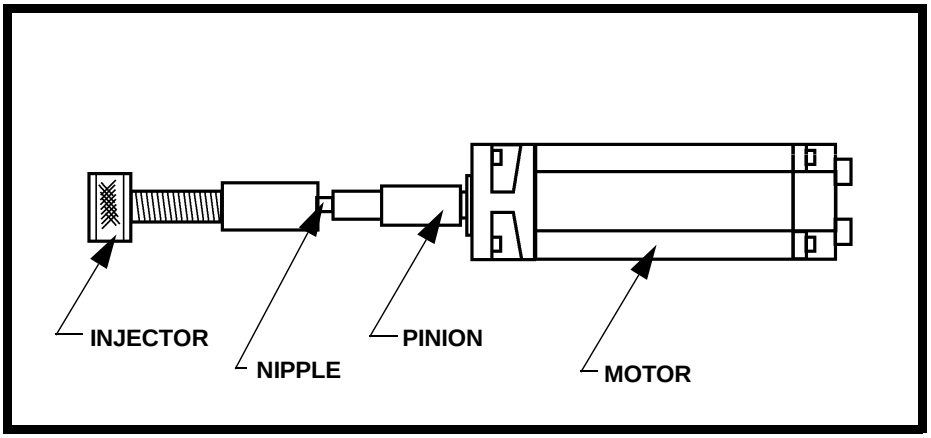
13. REMOVE PINION (U82) FROM MOTOR (U83) SHAFT

C

CAUTION: DO NOT HIT OR TAP MOTOR SHAFT.

a. Mount SKF Oil Injector #226 270 and SKF Nipples #725 870 & #234 063 into the center of pinion (U82).

b. Press pinion off motor shaft.



MOTOR (U83) Installation

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

REFERENCE DRAWINGS

Exploded Views:
"L" (pg 7-21, 12-3)
"U" (pg 7-22, 12-4)

Assemblies:
3HAA 0001-AAH (pg 13-13)
3HAB 4163-2 (pg 13-23)
3HAA 0001-AAS (pg 14-A)
3HAB 4252-2 (pg 14-J)

REQUIRED TOOLS

Hand Tools
ABB #6896 134-EA
ABB #6896 134-AC
Lubricating Grease

NOTE: Axes 4, 5, & 6 are either all ELMO motors or all Siemens motors. If replacing motor, do not mix manufacturers.

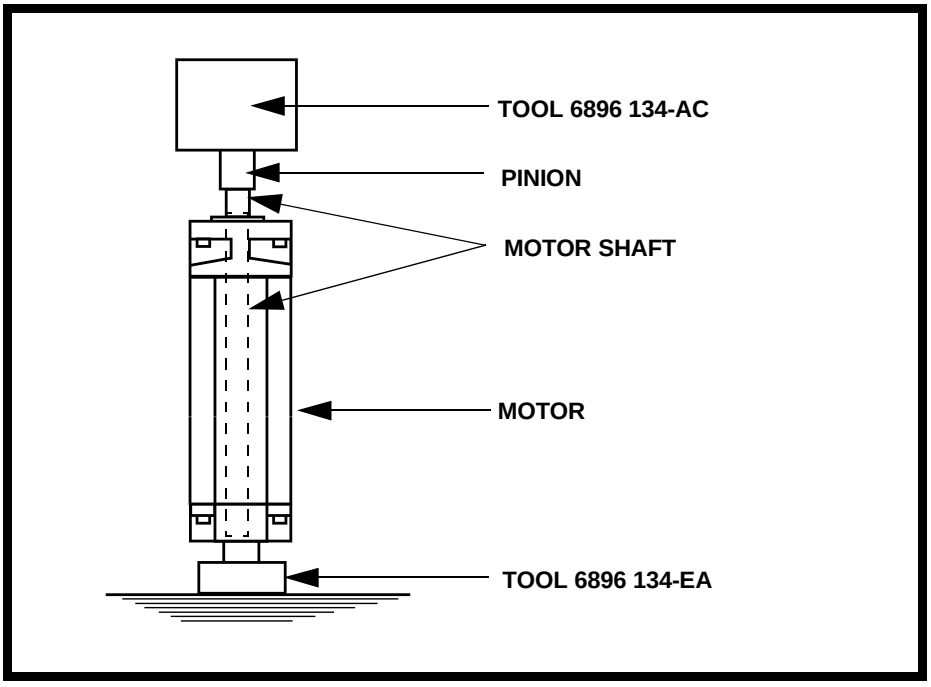
1. PRESS PINION (U83) ONTO MOTOR (U83) SHAFT

CAUTION: DO NOT HIT OR TAP MOTOR SHAFT.

a. Remove plug at rear of motor and place support tool ABB #6896 134-EA under motor shaft to avoid axial loading of bearings.

b. Use tool ABB #6896 134-AC to press pinion (U82) onto motor (U83).

c. Re-install plug at rear of motor.



2. INSTALL MOTOR (U83):

MOTOR WEIGHS APPROX. 35 LB.

a. Lightly grease O-Ring (U81) and set in place.

b. Place motor in mounting position. It may be necessary for you to manually turn axis 4 a little to engage pinion (U82).

c. Insert screws (U85) with washers (U84). do not use Loctite at this time. Tighten.

3. ADJUST PLAY BETWEEN INTERMEDIATE GEAR (U74) & PINION (U82) as outlined in Section 4, Page 17.

NOTE: In extreme conditions when downtime is critical, steps 3, 4, 5, 6, 7, 8, 9, & 10 may be skipped. However, substantial backlash may result due to the elimination of the backlash adjustment.

COVER WEIGHS APPROX. 20 LB.

4. INSTALL COVER (U54):

b. Lightly grease lip of seal (U40), which is already installed in cover (U54).

c. Set cover (U54) and gasket (U55) in place on housing (U61). Use new gasket (U55), if necessary.

d. Insert screws (U36) with washers (U37) and tighten to secure cover to housing. Cover must be oil tight.

5. INSTALL TUBE BRACKET (U53)

a. Set tube bracket (U53) in place supporting cable (U14) tube.

b. Insert screws (U52) and tighten.

6. INSERT BOTTOM HALF OF UPPER CABLE (U14)

a. Feed lower part of upper cable (U14) under housing (U61) and down through lower arm (L17).

b. Adjust cable clamps to mount under housing (U61) and inside front lower arm frame (L17). Secure both clamps to housings.

7. CONNECT CABLES AT MOTOR (U83)

a. Connect connector R3.FB4 to motor (U83).

b. Connect connector R3.MP4 to motor (U83).

c. Secure cables to housing (U61) with tie wraps.

8. **CONNECT CUSTOMER AIR HOSE by accessing clamp through measuring card unit (S10) opening.**

9. **CONNECT CONNECTOR R2.SMB3-6 (X5)**

    a. Connect connector R2.SMSB3-6(X5) to serial measurement board on measure card unit (S10).

    b. Mount measuring card unit (S10) in place.

    c. Insert screws (S12) and tighten.

10. **CONNECT CABLE (U14) CONNECTORS IN FRAME HOUSING (S21)**

    a. Connect connectors R2.MP4, R2.MP5-6, R2.CP, & R2.CS inside frame housing (S21).

    b. Set cover (S43) in place and secure with screws (S42).

11. **FILL HOUSING (U61) WITH OIL as outlined in Section 4**

12. **CALIBRATE AXIS 4 as outlined in Section 11**

INTERMEDIATE GEAR UNIT (U75) Removal

REFERENCE DRAWINGS

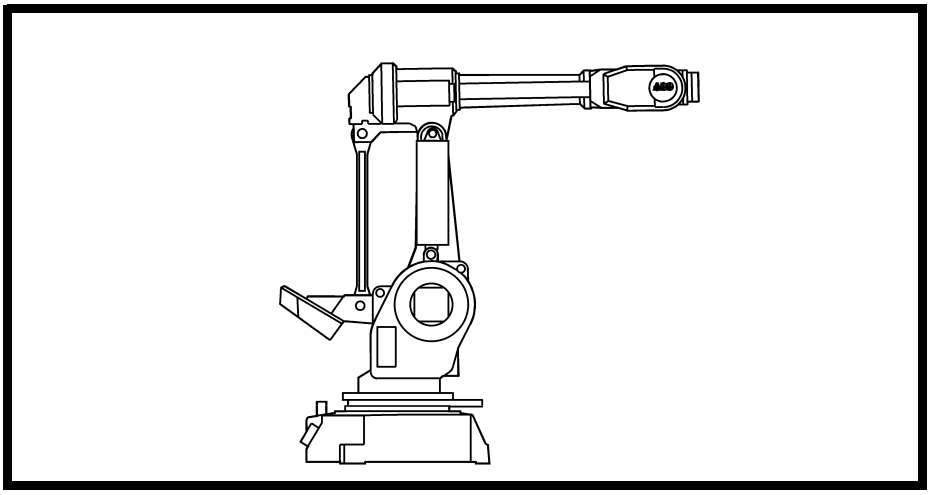
Exploded View:
"S" (pg 7-20, 12-2)
"U" (pg 7-22, 12-4)

Assemblies:
3HAA 0001-AAH (pg 13-13)
3HAB 4163-2 (pg 13-23)
3HAA 0001-AAS (pg 14-A)
3HAB 4252-2 (pg 14-J)

REQUIRED TOOLS

Hand Tools

1. POSITION ROBOT WITH UPPER ARM HORIZONTAL.



2. RELEASE AXIS 4 BRAKE TO ALLOW AXIS 4 TO MOVE TO THE NEUTRAL POSITION IT WILL BE IN AFTER MOTOR IS REMOVED

3. TURN ELECTRICAL DISCONNECT SWITCH OFF AND LOCK IT IN THE OFF POSITION.

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

4. DRAIN OIL FROM HOUSING (U61)

a. Remove plug (U59) and washer (U60).

b. Remove plug (U38) and washer (U39).

c. Drain oil.

d. Clean and re-insert plug (U59) with washer (U60) and plug (U38) with washer (U39).

5. DISCONNECT CABLE (U14) CONNECTORS IN FRAME HOUSING (S21):

a. Remove screws (S43) and cover (S42).

b. Disconnect connectors (R2.MP4), (R2.MP5-6), (R2.CP), & (R2.CS).

6. **DISCONNECT CONNECTOR (R2.SMB3-6 X5) ON MEASURE CARD UNIT (S10):**
   a. Remove screws (S12).
   b. Pull measuring card unit (S10) out.
   c. Disconnect R2.SMB3-6 (X5) from serial measurement board.

7. **UNCOUPLE CUSTOMER AIR HOSE by accessing clamp through measuring card unit (S10) opening**

8. **REMOVE SMALL COVERS HOLDING CABLES TO COVER (S6). CAREFULLY FEED CABLES UP AND OUT THROUGH THE THREE HOLES IN COVER (S6).**

9. **REMOVE CABLE TUBE BRACKET (U53)**
   a. Remove screws (U49) and washers (U50).
   b. Remove cover (U51).
   c. Remove screws (U52).
   d. Remove cable tube holder (U53).

10. **DETACH UPPER CABLE (U14) CLAMPS**
    a. Detach upper cable (U14) clamps at lower arm (L17). Leave clamp clamped to cable to maintain location.
    b. Detach upper cable (U14) clamp at housing (U61). Leave clamp clamped to cable to maintain location.

11. **DISCONNECT CABLES AT MOTOR (U83)**
    a. Disconnect connector R3.MP4.
    b. Disconnect connector R3.FB4.

12. **FEED LOWER PART OF CABLE (U14) UP AND OUT TO THE BACK OF ROBOT. Cable should be free enough for cover (U54) and gasket (U55) to be removed over it**

COVER WEIGHS APPROX. 20 LB.

13. **REMOVE COVER (U54) AND GASKET (U55)**
    a. Remove screws (U36) with washers (U37).
    b. Remove cover (U54) including seal ring (U40) and cork gasket (U55).

14. **LOOSEN MOTOR (U83) MOUNTING**
    a. Loosen screws (U85):
    b. Loosen motor in mounting.

INTERMEDIATE GEAR WEIGHS APPROX. 15 LB.

15. REMOVE INTERMEDIATE GEAR UNIT (U75)

a. Remove nuts (U76).

b. Remove washers (U77).

c. Remove wedges (U78).

d. Remove screws (U67) with washers (U68).

e. Remove intermediate gear unit assembly (U75).

INTERMEDIATE GEAR UNIT (U75) Installation

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

REFERENCE DRAWINGS

Exploded View:
- "S" (pg 7-20, 12-2)
- "U" (pg 7-22, 12-4)

Assemblies:
- 3HAA 0001-AAH (pg 13-13)
- 3HAB 4163-2 (pg 13-23)
- 3HAA 0001-AAS (pg 14-A)
- 3HAB 4252-2 (pg 14-J)

REQUIRED TOOLS

Hand Tools
Luabricating Grease

INTERMEDIATE GEAR WEIGHS APPROX. 15 LB.

COVER WEIGHS APPROX. 20 LB.

1. **SET INTERMEDIATE GEAR ASSEMBLY (U75) UNIT IN PLACE**
   a. Set intermediate gear unit (U75) in place with intermediate gear (U74) in mesh with final gear (U41).
   b. Insert screws (U67) with washers (U68). Just lightly touch tighten.
2. **ADJUST PLAY BETWEEN INTERMEDIATE GEAR (U76) AND FINAL GEAR (U41) as outlined in Section 4**
3. **ADJUST BACKLASH BETWEEN MOTOR PINION (U83) AND INTERMEDIATE GEAR (U76) as outlined in Section 4**
4. **INSTALL COVER (U54):**
   a. Lightly grease lip of seal (U40), which is already installed in cover (U54).
   b. Set cover (U54) and gasket (U55) in place on housing (U61). Use new gasket (U55), if necessary.
   c. Insert screws (U36) with washers (U37) and tighten to secure cover to housing. Cover must be oil tight.
5. **INSTALL TUBE BRACKET (U53)**
   a. Set tube bracket (U53) in place supporting cable (U14) tube.
   b. Insert screws (U52) and tighten.
6. **INSERT BOTTOM HALF OF UPPER CABLE (U14)**
   a. Feed lower part of upper cable (U14) under housing (U61) and down through lower arm (L17).
   b. Adjust cable clamps to mount under housing (U61) and inside front lower arm frame (L17). Secure both clamps to housings.
7. **CONNECT CABLES AT MOTOR (U83)**
   a. Connect connector R3.FB4 to motor (U83).
   b. Connect connector R3.MP4 to motor (U83).
8. **CONNECT CUSTOMER AIR HOSE by accessing clamp through measuring card unit (S10) opening**

9. CONNECT CONNECTOR R2.SMB3-6 (X5)

a. Connect connector R2.SMB3-6(X5) to serial measurement board on measure card unit (S10).

b. Mount measuring card unit (S10) in place.

c. Insert screws (S12) and tighten.

10. CONNECT CABLE (U14) CONNECTORS IN FRAME HOUSING (S21)

a. Connect connectors R2.MP4, R2.MP5-6, R2.CP, & R2.CS inside frame housing (S21).

b. Set cover (S43) in place and secure with screws (S42).

11. FILL HOUSING WITH OIL as outlined in Section 4

12. CALIBRATE AXIS 4 as outlined in Section 11

FINAL GEAR (U41) Removal

REFERENCE DRAWINGS

Exploded View:

"U" (page 7-22, 12-4)

Assemblies:

3HAA 0001-AP (pg 13-15)
3HAA 0001-CS (pg 13-14)
3HAB 4163-2 (pg 13-23)
3HAA 0001-AAS (pg 14-A)
3HAB 4254-2 (pg 14-J)

REQUIRED TOOLS

Hand Tools
ABB #6896 134-AN
ABB #6896 134-AT
ABB #6896 134-EA

SKF #234 063
NIKE #1-AQU 8
NIKE #1-CH 612
NIKE #1-PP6
NIKE #1-HP 416
NIKE #1-VAD 2
NIKE #LS 150
NIKE #LS 51

NOTE: Removal of final gear (U41) requires several tools and careful disassembly procedures:

1. **POSITION ROBOT WITH UPPER ARM HORIZONTAL.**
2. **RELEASE AXIS 4 BRAKE TO ALLOW AXIS 4 TO MOVE TO THE NEUTRAL POSITION IT WILL BE IN AFTER MOTOR IS REMOVED**
3. **TURN ELECTRICAL DISCONNECT SWITCH OFF AND LOCK IT IN THE OFF POSITION.**

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

4. **REMOVE UPPER CABLE (U14) as outlined In Section 10.**
5. **REMOVE COVER (U54) AND GASKET (U55)**
   a. Remove screws (U36) with washers (U37).
   b. Remove cover (U54) including seal ring (U40) and cork gasket (U55).
6. **DRAIN OIL FROM HOUSING (U61)**
   a. Remove plug (U59) and washer (U60).
   b. Remove plug (U38) and washer (U39).
   c. Drain oil.
   d. Clean and re-insert plug (U59) with washer (U60) and plug (U38) with washer (U39).
7. **LOOSEN AXIS 4 MOTOR (U83) MOUNTING**
   a. Loosen screws (U85).
   b. Loosen motor in mounting.

8. REMOVE INTERMEDIATE GEAR UNIT (U75)

a. Remove nuts (U76).

b. Remove washers (U77).

c. Remove wedges (U78).

d. Remove screws (U67) with washers (U68).

INTERMEDIATE GEAR WEIGHS APPROX. 15 LB.

e. Remove intermediate gear unit assembly (U75).

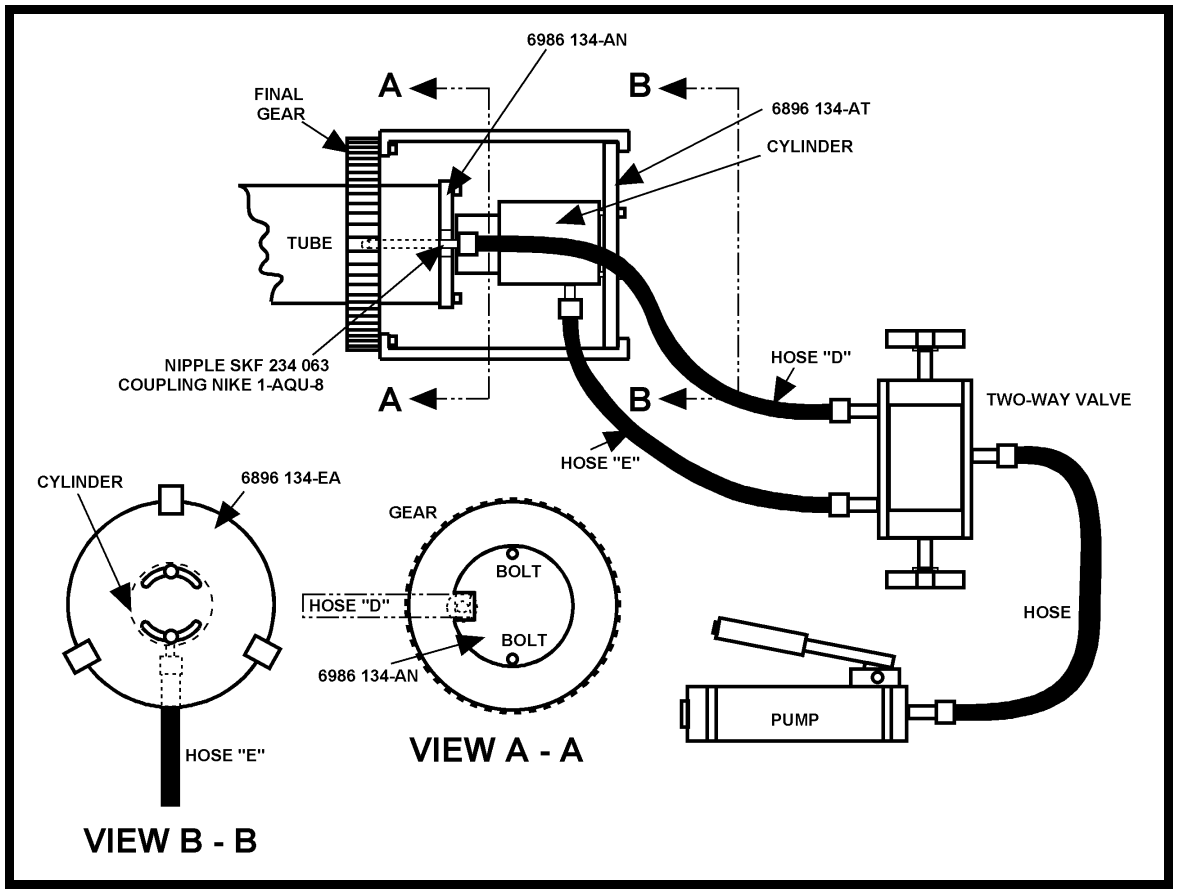
9. MOUNT GEAR REMOVAL TOOLING

a. Mount tool ABB# 6896 134-AN to end of tube shaft (U19).

b. Remove plastic cover in tube (U19) and screw in nipple SKF #234 063 with quick coupling NIK E# I-AQU 8. (Removing cover will destroy it, so you will need a new cover.)

c. Mount tool ABB # 6396 134-AT with hydraulic cylinder NIKE # 1-CH 612 on final gear (U41) with three hex screws M12x70 10.9.

d. Connect either pump NIKE # I-PP6 or hand pump NIKE# I-HP 416 through two way valve NIKE # I-VAD 2 to cylinder and nipple in gear using one hose NIKE# LS 150 and two hoses NIKE # LS 51.



10. REMOVE FINAL GEAR (U41)

a. Pump up the pressure with both taps on the 2-way valve open.

b. When gear moves enough to cause pressure to disappear between gear and tube shaft, close the 2-way valve tap that directs pressure to the final gear.

c. Remove nipple SKF # 234 063 with coupling NIKE # I-AQU 8. Insert new cover.

CAUTION: BE PREPARED TO CATCH GEAR WHEN IT COMES OFF TUBE SHAFT.

d. Continue to pump in pressure to the hydraulic cylinder until final gear has been pulled from tube shaft. Be prepared to catch gear as it comes off tube shaft.

e. If cylinder stroke runs out, use a spacer as required.

f. Protect the surface at end of tube shaft from scratches.

FINAL GEAR (U41) Installation

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

REFERENCE DRAWINGS

Exploded View:
"U" (pg 7-22, 12-4)

Assemblies:
3HAA 0001-AP (pg 13-15)
3HAA 0001-CS (pg 13-14)
3HAB 4163-2 (pg 13-23)
3HAA 0001-AAS (pg 14-A)
3HAB 4254-2 (pg 14-J)

REQUIRED TOOLS

Hand Tools
ABB #6896 134-BU
ABB #6396 134-FK
SKF #234 063
NIKE #1-CH 612
NIKE #1-VRF 31
NIKE #AMT 150
Heating Oven

NOTE: Installation of final gear (U41) requires several tools and careful assembly procedures.

1. **HEAT FINAL GEAR (U41) TO 350°F (160°C) USING AN INDUCTION HEATER OR OVEN.**

2. **MOUNT TOOL ABB # 6896 134-BU ONTO END OF TUBE SHAFT (U19).**

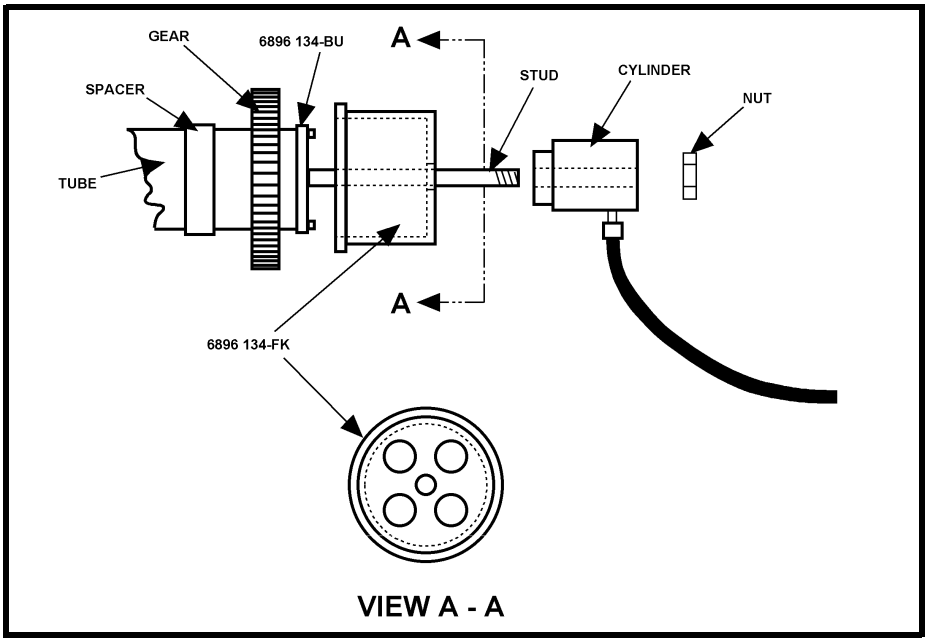
3. **BE SURE THAT SPACER (U42) IS POSITIONED IN PLACE BEHIND FINAL GEAR (U41).**

4. **FOLLOWING STEPS MUST BE COMPLETED WHILE FINAL GEAR IS STILL HOT:**

   a. Mount final gear (U41) onto tube shaft (U19) and quickly place against spacer.

   b. Mount tool ABB # 6896 134-FK over stud and against gear.

   c. Mount hydraulic cylinder NIKE # I-CH 612 with regulator valve NIKE # I-VRF31 over stud and screw on nut.



VIEW A - A

d. Pump up pressure and press final gear (U41) onto tube shaft.

e. Check again that spacer (U42) is pressed tight into position behind final gear (U41).

f. Hold 16,000 N pressure in cylinder until final gear (U41) has cooled and shrunk onto the tube shaft (U19).

g. Check that tube turns before continuing.

5. SET INTERMEDIATE GEAR ASSEMBLY (U75) UNIT IN PLACE

a. Set intermediate gear unit (U75) in place with intermediate gear (U74) in mesh with final gear (U41).

b. Insert screws (U67) with washers (U68) Lightly tighten.

6. ADJUST PLAY BETWEEN INTERMEDIATE GEAR (U76) AND FINAL GEAR (U41) as outlined in Section 4

7. ADJUST PLAY BETWEEN MOTOR PINION (U83) AND INTERMEDIATE GEAR (U76) as outlined in Section 4

8. INSTALL UPPER CABLE (U14) as outlined in Section 10

9. CALIBRATE AXIS 4 as outlined in Section 11

TUBE SHAFT (U19) Removal

REFERENCE DRAWINGS
Exploded View:
"U" (pg 7-22, 12-4)
Assembly:
3HAA 0001-CS (pg 13-16)

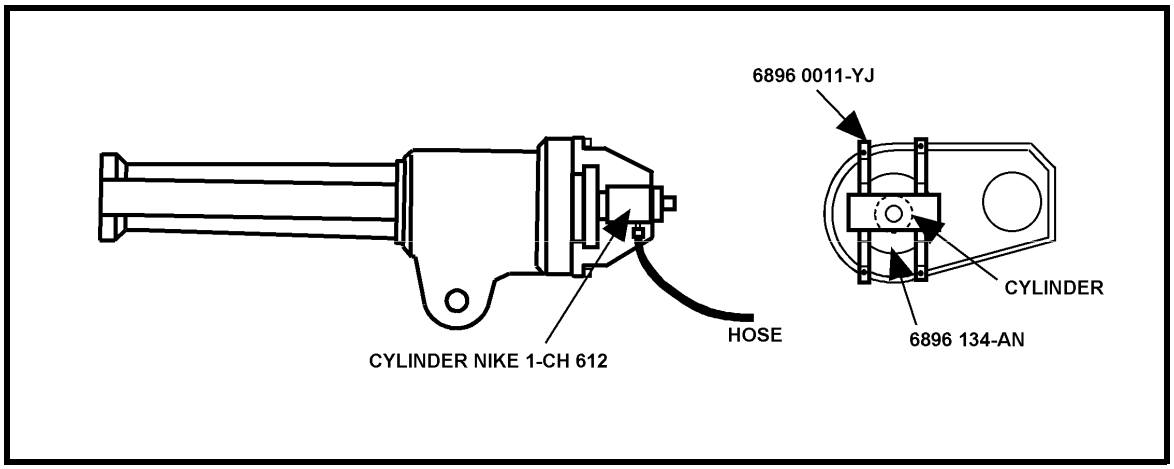
REQUIRED TOOLS
Hand Tools
ABB #6896 0011-YJ
NIKE #I-CH 612
ABB #6896 134-AN

NOTE: Removal of tube shaft (U19) requires several tools and careful disassembly procedures.

1. **TURN MAIN ELECTRICAL DISCONNECT SWITCH OFF AND LOCK IT IN THE OFF POSITION.**

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

2. **REMOVE UPPER CABLE (U14) as outlined in Section 10**
3. **REMOVE WRIST ASSEMBLY (U10) as outlined in Section 9**
4. **REMOVE FINAL GEAR (U41) as outlined on page 7 - 12**
5. **REMOVE MECHANICAL STOP (U25)**
   a. Remove screws (U22) with washers (U24).
   b. Remove axis 4 stop (U25), gasket (U27), and rubber cushion (U26). Axis 4 may have to be turned to gain access to cushion.
   c. Rotate axis 4 until stop (U13) is visible. Remove screws (U11) and stop (U13).
6. **REMOVE TUBE SHAFT (U19)**
   a. Press tube shaft (U19) out with tool ABB # 6896 0011-YJ and tool NIKE # 1-CH 612. Protect the surface at end of tube shaft. Scratches will result in oil leakage through seal ring (U40) in cover (U54).
   b. Remove seal (U48), bearing (U46), and seal (U45).



TUBE SHAFT (U19) Installation

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

REFERENCE DRAWINGS

Exploded View:
"U" (pg 7-22, 12-4)
Assemblies:
3HAA 0001-CS (pg 13-16)

REQUIRED TOOLS

Hand Tools

ABB #6896 134-FL
ABB #6896 134-FA
ABB #6896 134-S
NIKE #I-CH 612
ABB #6896 134-AN
ABB #6896 134-FH

NOTE: Installation of tube shaft (U19) requires several tools and careful assembly procedures.

1. **PROTECT ALL SLIDING SURFACES FOR THE SEAL RINGS BY COVERING THEM WITH TAPE**

2. **APPLY GREASE ON ALL DIAMETERS OF TUBE SHAFT WHERE SEALS MUST PASS OVER**

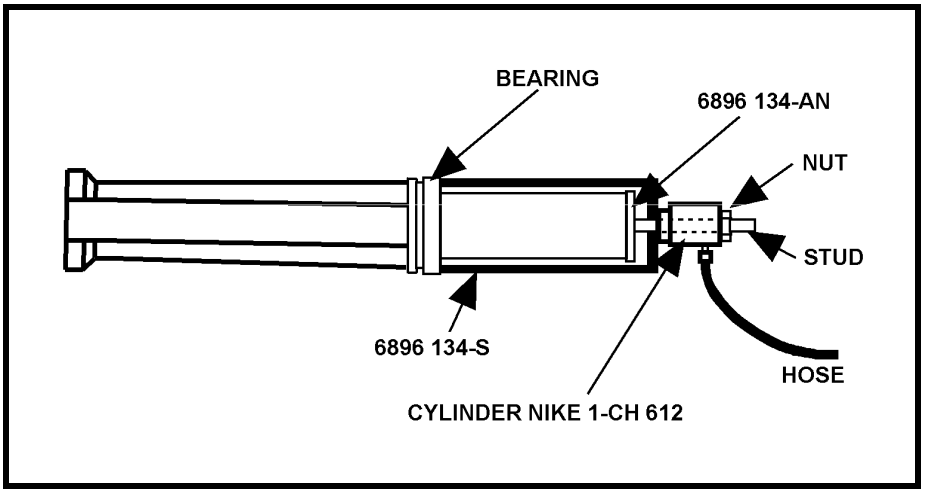
3. **ASSEMBLE COMPONENTS ON TUBE SHAFT (U19)**

   a. Install seal (U48) to shaft. Orient as shown on page 13-3 (8).

   b. Grease bearing (U46) with grease (U47).

   c. Install bearing (U46) to shaft. Use tool ABB # 6896 134-S and NIKE # I-CH 612. Orient as shown on page 13-3 (7).

   d. Grease seal (U45) and set in place against bearing (U46).



4. **INSTALL COMPONENTS IN HOUSING (U61)**

   a. Lightly grease seal ring (U44) and insert into its bore in housing (U61). Use tool ABB # 6896 134-FA. Orient as shown on page 13-3 (10).

   b. Grease bearing (U43) with grease (U47) and insert into its bore in housing (U61).

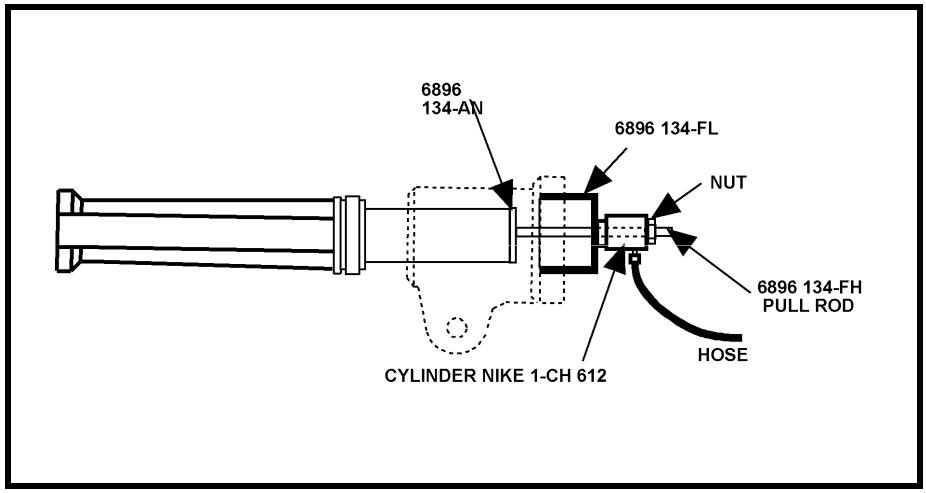
5. INSTALL TUBE SHAFT (U19) INTO HOUSING (U61)

a. Insert tube shaft into front of housing (U61).

b. Be sure that bearing (U46) and bearing (U43) are fully seated in their housing (U61) bores.

c. Pull tube shaft into place as shown in below figure.

c. Mount spacer (U42) on end of tube shaft and up against bearing (U43).



6. MOUNT MECHANICAL STOP (U25)

a. Rotate Axis 4 until stop mounting holes are visible.

b. Apply Loctite 242 (U12) to screws (U11).

c. Mount stop (U13) with screws (U11).

d. Rotate Axis 4 and insert rubber stopper (U26).

e. Attach Axis 4 stop.

7. MOUNT FINAL GEAR (U41) as outlined on page 7 - 15

8. INSTALL UPPER CABLE (U14) as outlined in Section 10

9. INSTALL WRIST ASSEMBLY (U10) as outlinedin Section 9

10. REMOVE ALL HOISTS, MECHANICAL HARD STOPS, AND MISCELLANEOUS BLOCKING.

11. CALIBRATE AXIS 4 as outlined in Section 11

SHOULDER . . .
including Axes 1, 2, & 3 Drives

S

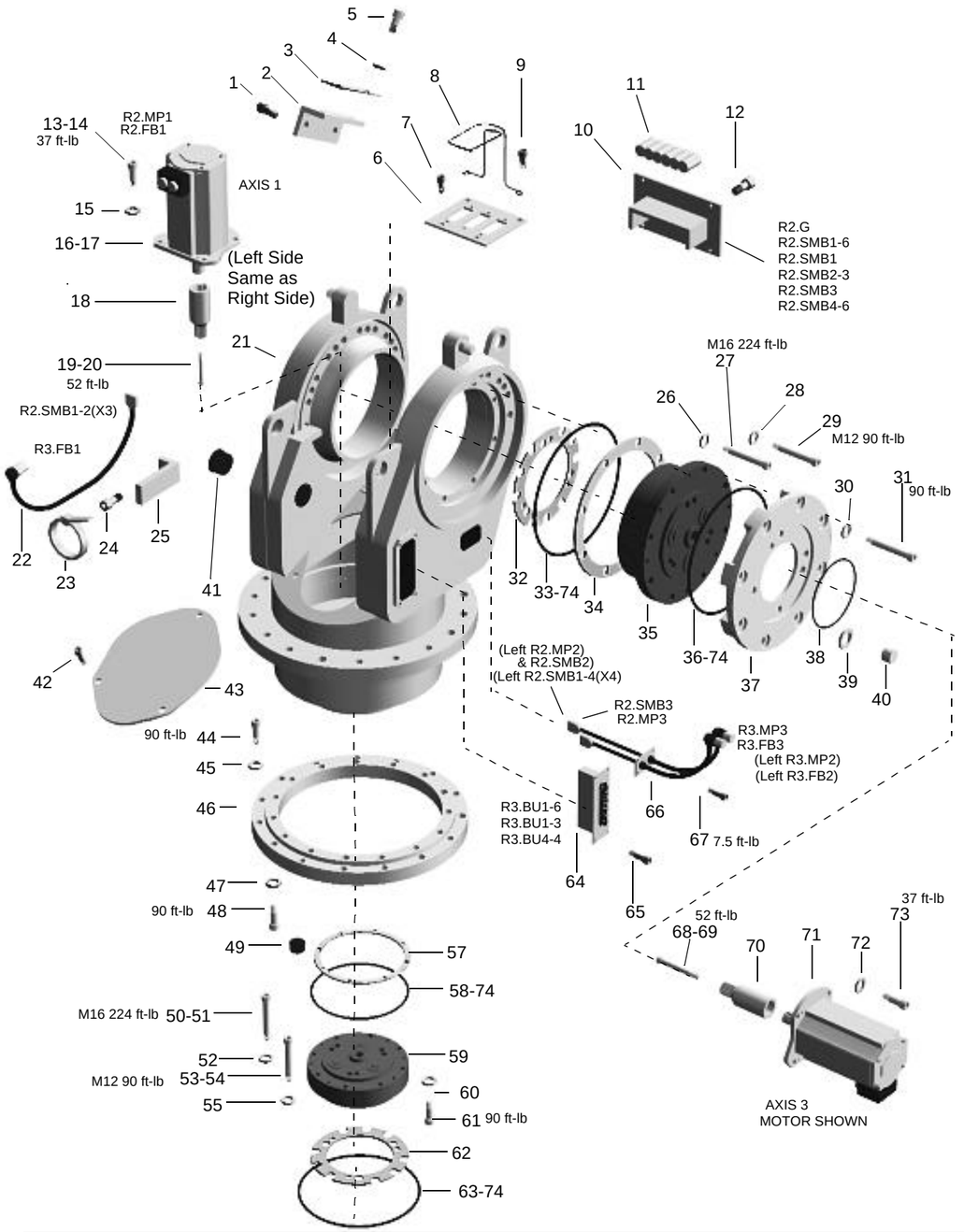
ITEM	QTY.	DESCRIPTION	ABB PART NO .
1	2	Screw - M6x12	2321 2416-366
2	1	Bracket	3HAA 1001-104
3	1	Sync. Plate	3HAA 1001-79
4	2	Washer - Plain 4.3x19x0.8	2151 2062-136
5	2	Screw - M4x6	2121 2416-285
6	1	Cover	3HAA 0001-ZK
7	2	Screw - M6x16 2.8	2121 2411-368
8	1	Cable Guide	3HAA 1001-721
9	2	Screw - M6x30	2121 2411-374
10	1	Measure Card Unit	3HAB 4259-1
-	1	Serial Measurement Board	3HAB 2213-1
11	1	Battery Pack	4944 026-4
12	4	Screw - M6x16 8.8	2121 2411-368
13	4	Screw - M10x25	2121 2519-493
14	-	Loctite 242	1269 0014-410
15	4	Washer - Plain 10.5x22x2	2151 2062-173
16	1	Motor - Axis 1	3HAB 4039-1
-	1	Motor - Axis 1 PE/2.25-75	EHAB 4043-1
17	-	Permatex 3	1236 0012-202
18	1	Pinion	(Incl. in item 59)
19	1	Screw - M10x100 12.9	3HAB 3409-62
20	-	Loctite 242	1269 0014-410
21	1	Frame Housing	3HAB 4150-1
22	1	Cable - Axis 1 Signal	3HAB 4250-1
23	7	Strap	2166 2055-3
24	1	Screw M6x16	2121 2411-368
25	1	Holder	3HAA 1001-668
26	6*	Washer - Spring	3HAA 1001-181
27	6*	Screw- M16x140 12.9	3HAB 3409-95
28	6*	Washer - 12.5x24x5.9	3HAA 1001-200
29	6*	Screw - M12x140 12.9	3HAB 3409-200
30	16*	Washer - Plain 13x21x2	3HAA 1001-632
31	16*	Screw - M12x80 12.9	3HAB 3409-74
32	2*	Friction Ring	3HAA 1001-613
33	2*	O-Ring - 234.54x3.53	2152 0431-17
34	2*	Friction Ring	3HAA 1001-616
35	2*	Reduction Gear RV-250A	3HAB 4080-1
36	2*	O-Ring 269.3x5.7	2152 2012-550
37	2*	Plate - Motor Socket	3HAB 4056-1
38	2*	O-Ring 124.5x3	2152 2012-437
39	4*	Washer 13.5x18x1.5	2152 0441-1
40	4*	Magnetic Plug 1/4”	2522 122-1
41	3	Cap	3HAA 1001-199
42	3	Screw M6x20	2121 2411-370
43	1	Cover	3HAA 0001-SZ
44	15	Screw - M12x70 12.9	3HAB 3409-73
45	15	Washer - Plain 13x24x2.5	3HAA 1001-632
46	1	Bearing	3HAA 1001-1
47	15	Washer - Plain 13x24x2.5	2551 2062-177
48	15	Screw - M12x70 12.9	3HAB 3409-73
49	1	Plug - KR 1/2”	2522 2021-113
50	3	Screw - M16x140 12.9	3HAB 3409-95
51	-	Loctite 577	1269 1907-1
52	3	Washer - Spring	3HAA 1001-181
53	3	Screw - M12x140 12.9	3HAB 3409-200
54	-	Loctite 577	1269 1907-1
55	3	Washer - Support	3HAA 1001-200

ITEM	QTY.	DESCRIPTION	ABB PART NO .
56	Ref	Installation Aid Tool	3HAB 1067-6
57	1	Friction Ring	3HAA 1001-614
58	1	O-Ring 245.0x3.0	2152 0431-15
59	1	Gear Reduction Unit	3HAB 4079-1
60	8	Washer - Plain 13x24x2.5	2551 2062-177
61	8	Screw - M12x90 12.9	3HAB 3409-75
62	1	Friction Ring	3HAA 1001-613
63	1	O-Ring 234.54x3.53	2152 0431-17
64	1	Brake Release Unit	3HAA 0001-ADY
65	4	Screw M6x16 8.8	2121 2411-368
66	1	Cable - Axis 2	3HAB 4252-1
	1	Cable - Axis 3	3HAA 0001-YY
67	4	Screw - M6x16	2121 2411-368
68	2*	Screw - M10x100 12.9	3HAB 3409-62
69	-*	Loctite 242	1269 0014-410
70	2*	Pinion	(Incl. in Item 35)
71	2*	Motor - Axis 2 & 3	3HAB 4040-1
-	2*	Motor - Axis 2&3 PE/2.25-75	3HAB 4226-1
72	4	Washer - Plain 10.5x22.2	2151 2062-173
73	4	Screw - M10x25 8.8	2121 2419-493
74	-	Lubricating Grease	1171 4012-201

* The left side drive components for Axis 2 are the same as the same as the right side drive components for Axis 3. Quantities shown are for both sides combined, Axis 2 plus Axis 3.

FORK LIFT BRACKETS (not shown on drawing)			
		2.4-120, 2.4-150, 2.8-120,3.0-75: Lifting Device Set Compl.	3HAA 0001-SY
	8	Screw - M16x60 8.8	2121 2518-632
	8	Washer - 17x30x3	3HAA 1001-186
	2	Lifting Bracket	3HAA 1001-257
	2	Lifting Bracket	3HAA 1001-258

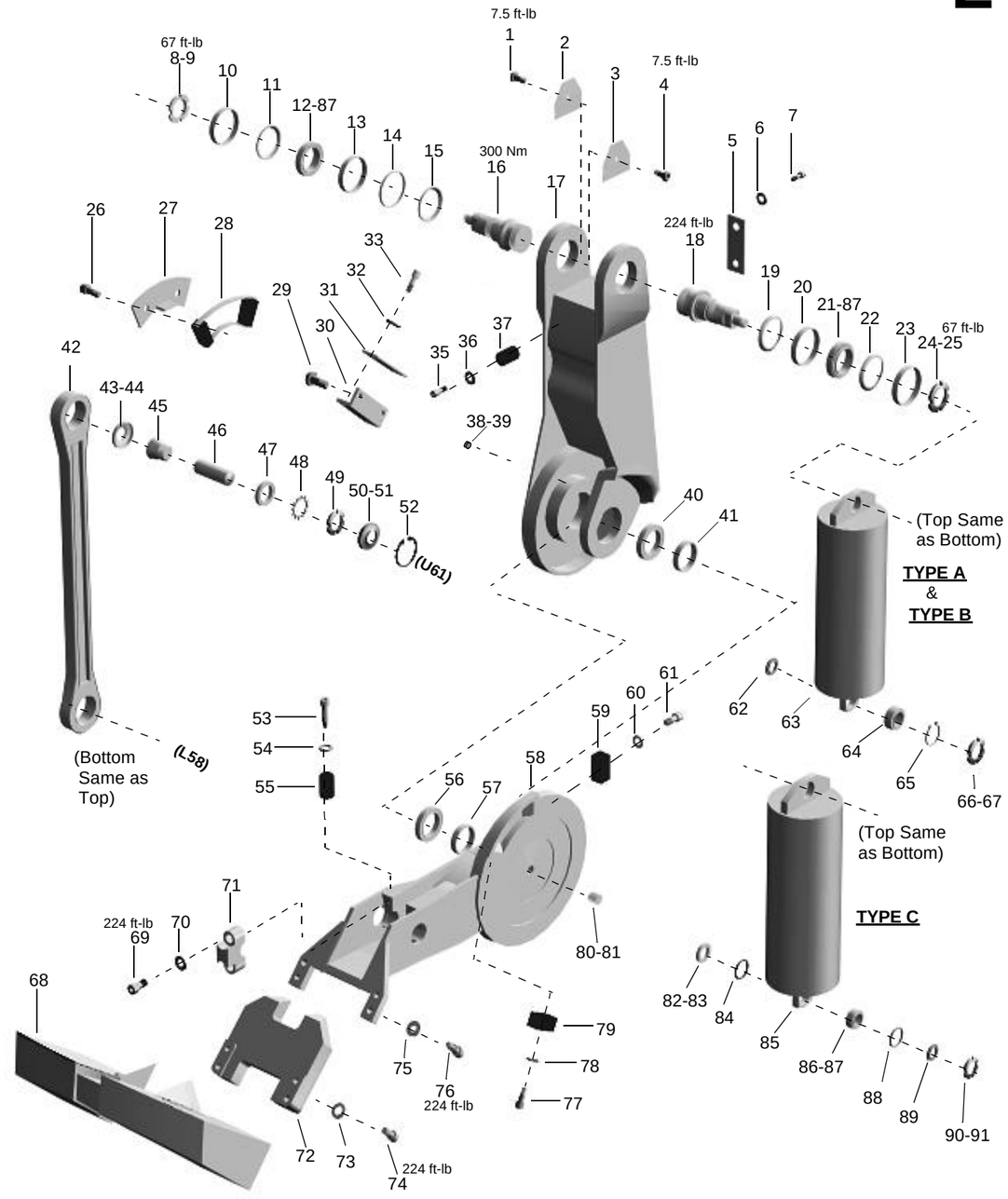
		Axis 1 Complete :	
		No Cust. Connections	3HAB 4161-1
		With Cust. Connections	3HAB4161-2



LOWER ARM . . .
including Parallel Arm & Balancing System

ITEM	QTY.	DESCRIPTION	ABB PART NO .
1	1	Screw - M6x10	2121 2763-364
2	1	Protective Plate	3HAA 1001-164
3	1	Protective Plate	3HAA 1001-164
4	1	Screw - M6x10	2121 2763-364
5	1	Sync. Plate	3HAA 1001-79
6	2	Washer - 4.3x9x0.8	2151 2062-136
7	2	Screw - M4x6	2121 2416-285
8	1	Lock Nut	2126 2851-112
9	-	Loctite 242	1269 0014-410
10	1	Spacer	3HAA 1001-126
11	1	NILOS Ring	2216 0085-5
12	1	Bearing - 32013X	2213 3802-8
13	1	Sealing Ring 6.4x15x3	3HAA 1001-173
14	1	Spacer (left side only)	3HAA 1001-125
15	1	V-Ring	2216 264-16
16	1	Shaft	3HAA 1001-127
		Shaft - S/2.9-120	3HAA 1001-317
17	1	Lower Arm Frame	3HAB 4168-1
18	1	Shaft	3HAA 1001-127
		Shaft - S/2.9-120	3HAA 1001-317
19	1	V-Ring	2216 264-16
20	1	Sealing Ring	3HAA 1001-173
21	1	Bearing - 32013X	2213 3802-8
22	1	NILOS Ring	2216 0085-5
23	1	Spacer	3HAA 1001-126
24	1	Lock Nut	2126 2851-112
25	-	Loctite 242	1269 0014-410
26	2	Screw - M6x10	2121 2763-364
27	1	Support Plate - Damper	3HAA 1001-282
28	1	Damper	3HAA 1001-90
29	2	Screw - M6x12	2121 2416-366
30	1	Bracker - Sync. Plate	3HAA 1001-104
31	1	Sync. Plate - Axis 2	3HAA 1001-74
32	2	Washer - Plain 6.4x12x0.8	2151 2062-153
33	2	Screw - M6x6	2121 2416-285
34		*(number not used)*	
35	2	Screw - M8x25	2121 2519-453
36	2	Washer - 8.4x16x1.5	
37	2	Damper	3HAA 1001-123
38	1	Set Screw - M20x20	2122 2765-99
39	-	Loctite 577	1269-1907-1
40	1	Spherical Roller Bearing	3HAB 4169-1
41	1	Spacer - Sleeve	3HAB 4387-1
42	1	Parallel Bar	3HAA 1001-71
43	2	Ring	3HAA 1001-86
44	-	Grease	1171 4012-201
45	2	Adapter Sleeve	2213 1905-21
46	2	Shaft	3HAA 1001-88
47	2	Spherical Bearing	3HAA 1001-189
48	2	Lock Washer	(Incl. in Item 45)
49	2	Lock Nut	(Incl. in Item 45)
50	2	Ring	3HAA 1001-86
51	-	Grease	1171 4012-201
52	2	Retaining Ring - Snap	2154 2527-160
53	2	Screw - M8x25	2121 2519-453
54	2	Washer - 8.4x16x1.5	2151 2062-165
55	2	Damper	3HAA 1001-81
56	1	Spherical Roller Bearing	3HAB 4169-1
57	1	Spacer - Sleeve	3HAB 4387-1
58	1	Parallel Arm Frame	3HAB 4170-1

ITEM	QTY.	DESCRIPTION	ABB PART NO .
59	1	Damper	3HAA 1001-622
60	2	Washer - Plain 6.4x12x1.6	2151 2062-153
61	2	Screw - M6x16	2121 2416-368
62	4	Spacer Washer	3HAB 4191-1
63	2	Type A - Standard Load	
		Balancing Unit Complete	3HAB 4216-1
		Balancing Unit	3HAB 4175-2
	2	Type B - Additional Load	
		Balancing Unit Complete	3HAB 4217-1
		Balancing Unit	3HAB 4175-3
64	4	Bearing	3HAA 1001-207
65	4	Circlip	3HAB 4190-1
66	4	Lock Nut (Mount in reverse)	2126 2851-106
67	-	Loctite 242	1269 0014-410
68	1	Weight - 314 kg - 2.4-120	3HAB 4022-1
	1	Weight - 400 kg - 2.4-150,	
		S/2.4-120,2.8-120, 3.0-75,	
		S/2.9-120	3HAB 4036-1
69	4	Screw - M16x70 12.9	3HAB 3409-88
70	4	Washer - 17x27x3	3HAA 1001-186
71	2	Clamp	3HAA 1001-13
72	1	Weight Adapter - S/2.9-120	3HAA 1001-334
			3HAA 0001-ST
-	4	Screws M16x60	2121 2518-632
-	4	Washers 17x30x3	2151 2062-185
-	1	Protect. Plate - PE/2.25-75	3HAA 1001-609
73	4	Washer - 17x27x3	3HAA 1001-186
74	4	Screw - M16x60 12.9	3HAB 3409-86
75	4	Washer - 17x27x3	3HAA 1001-186
76	4	Screw - M16x60	2121 2518-632
77	2	Screw - M6x16	2121 2416-368
78	2	Washer - Plain 6.4x12x1.6	2151 2062-153
79	1	Damper	3HAA 1001-622
80	1	Set Screw - M20x20	2122 2765-99
81	-	Loctite 577	1269 1907-1
82	4	Sliding Ring	3HAB 4545-1
83	-	Grease - ESSO Beacon EP2	1171 4013-301
84	4	Washer	3HAB 4546-1
85	2	Type C - S/2.9-120	
		Balancing Unit Complete	3HAB 4218-1
		Balancing Unit	3HAA 0001-US
86	4	Radial Bearing	3HAA 1001-207
87	-	Grease - ESSO Beacon EP2	1171 4013-301
88	4	Sliding Ring	3HAB 4545-1
89	4	Ring	3HAB 4544-1
90	4	Lock Nut (Mount in reverse)	2126 2851-106
91	-	Loctite 242	1269 0014-410



UPPER ARM . . .
including Axis 4 Drive

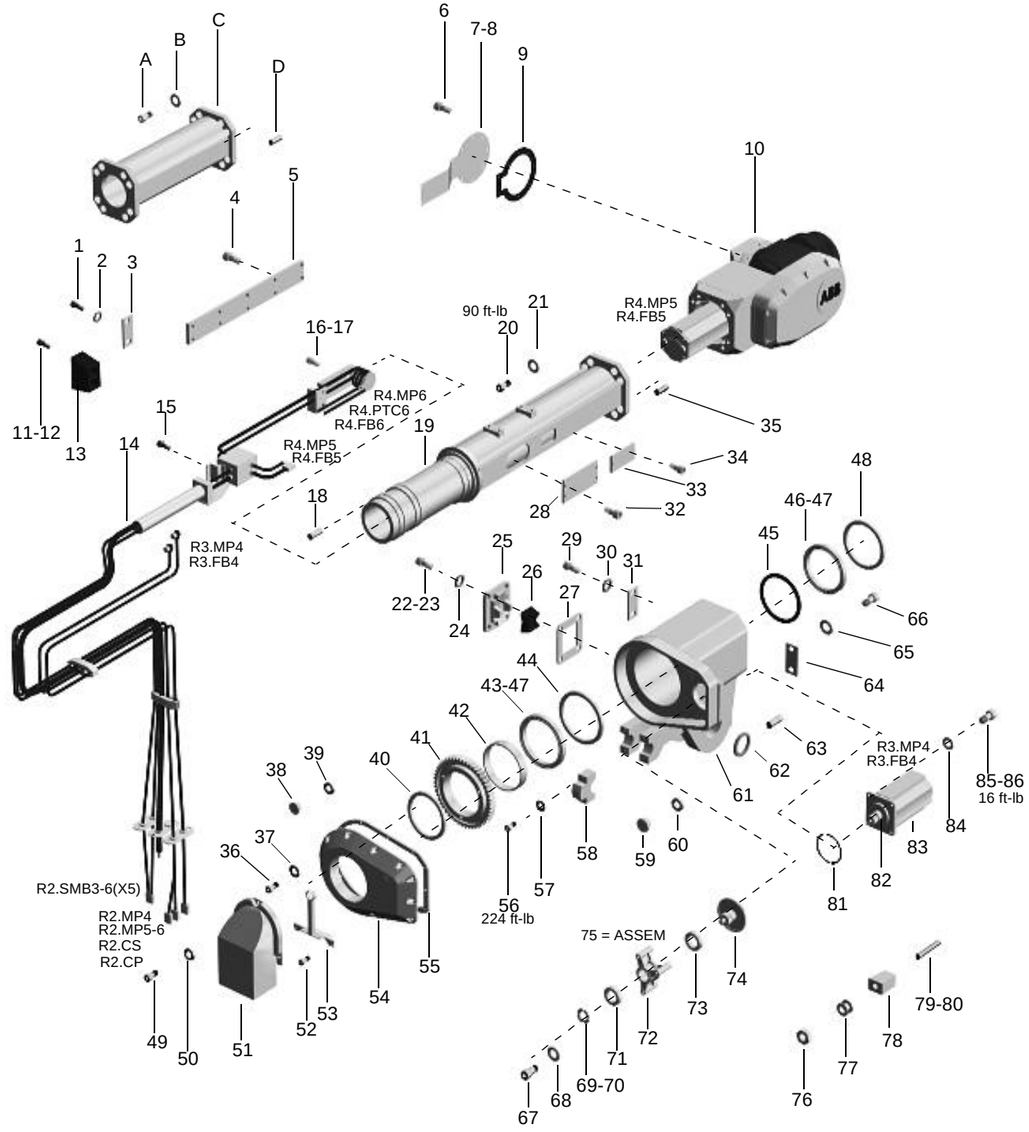
U

ITEM	QTY.	DESCRIPTION	ABB PART NO .
1	2	Screw	2121 2411-287
2	2	Washer	2151 2062-136
3	3	Sync. Plate - Axis 4	3HAA 1001-76
4	4	Screw	2121 2411-368
5	1	Cover - 2.8-120, S/2.9-20	3HAA 1001-302
	1	Cover - 3.0-75	3HAA 1001-305
6	7	Screw	2121 2411-368
7	1	Cover	3HAA 1001-500
8	-	Sealant	1236 0012-227
9	1	Gasket	3HAA 1001-166
10	1	Wrist Assy.- 120 kg. Elmo	3HAB 4196-1
	1	Wrist Assy.- 120 kg. Siemens	3HAB 4590-1
	1	Wrist Assy.- 150 kg. Elmo	3HAB 4196-2
	1	Wrist Assy.- 150 kg. Siemens	3HAA 0001-ABR
11	2	Screw	2121 1519-536
12	-	Loctite 242	1269 0014-410
13	1	Stop - Axis 4	3HAA 1001-102
14	1	Upper Cable Complete:	3HAB 4165-3
		With Cust. Connections	3HAB4165-3
		S/2.9-120	3HAB 4183-2
		PE /2.25-75	3HAB 4483-2
15	2	Screw - M6x30	2121 2411-374
16	2	Screw - M6x16	2121 2411-368
17	2	Screw - M4x12	2121 2411-291
18	1	Protecting Plug	2522 726-4
19	1	Upper Arm Tube Shaft	3HAB 4452-1
		Upper Arm - PE/2.25-75	3HAB 4453-1
20	8	Screw	3HAB 3409-69
21	8	Washer	3HAB 1001-134
22	4	Screw	2121 2519-453
23	-	Loctite 242	1269 0014-410
24	4	Washer	2151 2062-165
25	1	Stop - Axis 4	3HAA 1001-17
26	1	Damper	3HAA 1001-100
27	1	Gasket	3HAA 1001-98
28	1	Cover	3HAA 1001-719
29	2	Screw	2121 2411-287
30	2	Washer	2151 2062-136
31	1	Sync. Plate	3HAA 1001-79
32	4	Screw	2121 2411-366
33	1	Cover	3HAA 1001-161
34	2	Screw	2121 2411-372
35	1	Roll Pin	2111 2835-416
36	12	Screw	2121 2411-370
37	12	Washer	2154 2022-4
38	1	Magnetic Plug	2522 0122-1
39	1	Washer	2152 0441-1
40	1	Seal Ring	3HAA 1001-628
41	1	Gear	3HAA 1001-24
42	1	Spacer	3HAA 1001-103
43	1	Bearing	2213 0253-5
44	1	Seal Ring	2216 0261-18
45	1	Seal	2216 0086-4
46	1	Bearing	2213 0253-5
47	-	Grease	1171 4013-301
48	1	Seal	3HAB 4217-1
49	3	Screw	2121 2411-368
50	3	Washer	2151 2062-153
51	1	Cover	3HAA 1001-176
52	2	Screw	2121 2411-368

ITEM	QTY.	DESCRIPTION	ABB PART NO .
53	1	Cable Holder	3HAA 1001-201
54	1	Cover	3HAA 1001-33
55	1	Gasket	3HAA 1001-97
56	4	Screw	2121 2518-634
57	4	Washer	2151 2062-185
58	2	Clamp	3HAA 1001-13
59	1	Magnetic Plug	2522 0122-1
60	1	Washer	2152 0441-1
61	1	Housing	3HAA 0001-AA
62	2	Support Ring	3HAA 1001-124
63	2	Set Screw - M10	2122 2719-401
64	1	Sync.Plate Axis 3	3HAA 1001-75
65	2	Washer	2151 2062-136
66	2	Screw	2121 2411-287
67	3	Screw	3HAB 3409-62
68	3	Washer	2151 2062-173
69	1	Nut (in Item 73)	2126 2851-104
70	-	Loctite 242 (in Item 73)	1269 0014-410
71	1	Bearing (in Item 73)	3HAA 1001-129
72	1	Hub Axis 4 (in Item 73)	3HAA 1001-16
73	-	Bearing	2213 3802-11
74	1	Gear Unit	3HAA 0001-M
75	1	Intermediate Wheel Assem.	3HAA 0001-AN
76	13	Nut	2126 2011-117
77	6	Spring Washers	2154 2033-9
78	3	Wedge	3HAA 1001-99
79	3	Stud	2122 2011-465
80	-	Loctite 601	1269 0014-407
81	1	O-Ring	2152 2012-430
82	1	Pinion	3HAA 1001-21
83	1	Motor - 120 kg. Elmo	3HAB 4041-1
	1	Motor - 120 kg. Siemens	3HAB 4584-1
	1	Motor - 150 kg. Elmo	3HAB 4044-1
	1	Motor - 150 kg. Siemens	3HAA 1001-ZH
84	4	Washer	2151 2062-165
85	4	Screw	2121 2519-453
86	-	Loctite 242	1269 0014-410

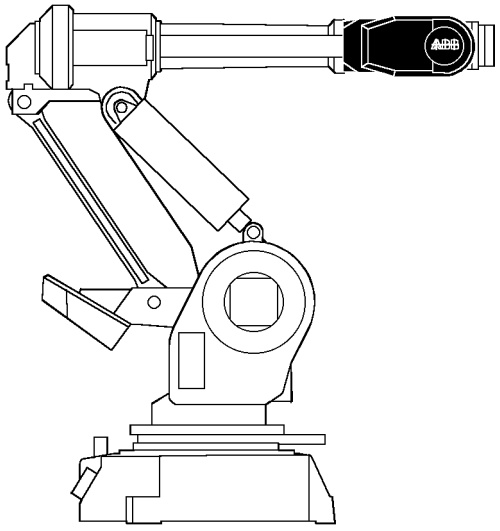
A	8	Screw	3HAB 3409-69
B	8	Washer	3HAA 1001-134
C	1	Extension:	
		2.8-120, S/2.9-120	3HAA 1001-301
		3.0-75	3HAA 1001-304
D	1	Roll Pin	2111 2835-416

120 kg:	Upper Arm Assy.	
	2.4 - Elmo	3HAB 4194-1
	2.4 - Siemens	3HAB 4591-1
	2.8 - Elmo	3HAB 4194-3
	2.8 - Siemens	3HAB 4592-1
	S/2.9	3HAB 4194-3
	Drive Unit Assy. - Elmo	3HAB 4195-1
	Drive Unit Assy. - Siemens	3HAB 4585-1
150 kg:	Upper Arm Assy. - Elmo	3HAB 4194-2
	Upper Arm Assy. - Siemens	3HAA 0001-AAE
	Drive Unit Assy. - Elmo	3HAB 4195-2
	Drive Unit Assy. - Siemens	3HAA 0001-ABN
3.0-75	Upper Arm Assy. - Elmo	3HAB 4194-4
	Upper Arm Assy. - Siemens	3HAB 4593-1



SECTION 8

Axis 5
Disassembly/Assembly



Disassembly/Assembly
Guidelines
IRB 6400

AXIS 5

Table of Contents

MOTOR (W52) Removal

REFERENCE DRAWINGS

Exploded View:
- "U" (pg 8-9, 12-4)
- "W" (pg 8-10, 12-5)

Assembly:
- 3HAA 0001-GX (pg 13-18)
- 3HAA 0001-AAH (pg 13-13)
- 3HAA 0001-GX (pg 13-21)
- 3HAA 0001-AAS (pg 14-A)
- 3HAB 4254-2 (pg 14-J)

REQUIRED TOOLS

Hand Tools
ABB #6896134-AA
ABB #6896 134-GN
SKF #725870
SKF #226270

NOTE: Axes 4, 5, & 6 are either all ELMO motors or all Siemens motors. If replacing motor, do not mix manufacturers.

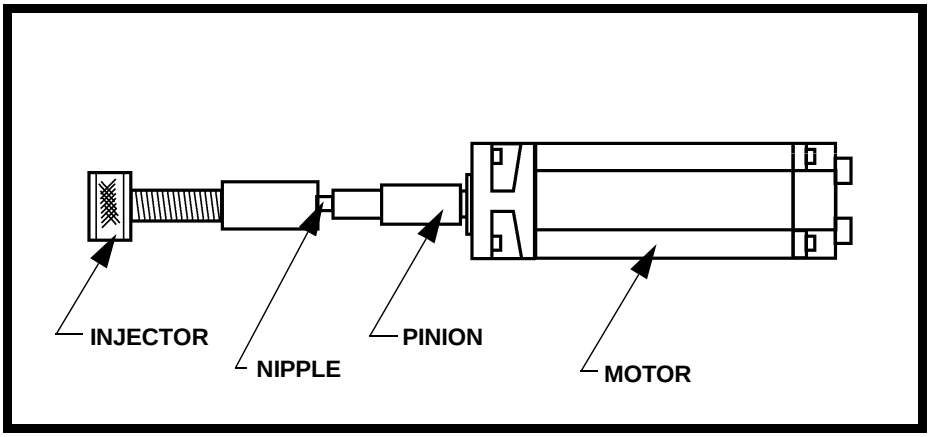
1. **TURN MAIN ELECTRICAL DISCONNECT SWITCH OFF AND LOCK IT IN THE OFF POSITION.**

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

1. **DRAIN OIL FROM WRIST ASSEMBLY (U10) as outlined in Section 4**
2. **REMOVE WRIST ASSEMBLY (U10) as outlined on page 8 - 5. Place wrist assembly on a solid work bench**

MOTOR WEIGHS APPROX. 35 LB.

3. **REMOVE MOTOR (W52):**
   a. Remove screws (W49) with washers (W51).
   b. Pull motor out. Use M8x65 screws in extractor holes to aid in pulling motor, if necessary.
   c. Keep track of shims (W55) so the same shims can be re-installed in the same orientaion.
   d. Remove O-Ring (W53).
4. **REMOVE PINION (W54):**
   a. Measure distance between motor flange and outer surface of pinion. Use tool ABB# 6896 134-GN. Make a written record of measurement.
   b. Press pinion off motor shaft. Use tools: nipple ABB# 6896 134-AA, TREDO washer as a seal, nipple SKF# 725870, and oil injector SKF# 22670.



NOTE:The pinion is a matched set with bevel gear (W27) assembly. If motor is changed, this pinion must be installed on the new motor's shaft. If pinion is damaged, complete bevel gear assembly (W26) with new pinion must be replaced. Contact ABB service to replace complete bevel gear assembly.

MOTOR (W52) Installation

REFERENCE DRAWINGS
Exploded View:
"U" (pg 8-9, 12-4)
Assembly:
3HAA 0001-CS (pg 13-16)

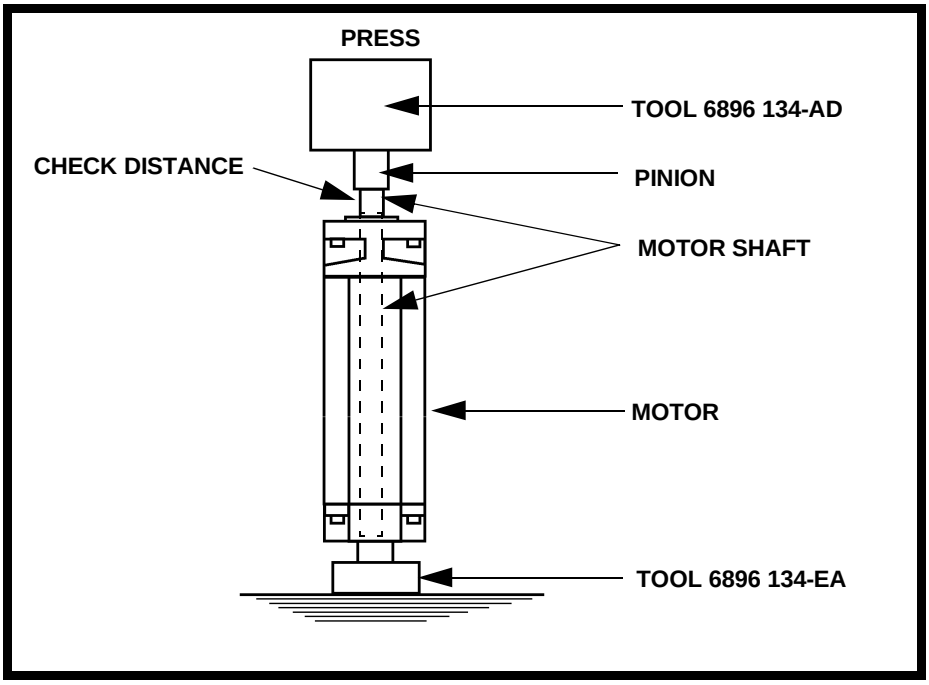
REQUIRED TOOLS
Hand Tools
ABB #6896 134-EA
ABB #6896 134-GN
ABB #6896 134-AD
Torque Wrench (18 ft-lb)

NOTE:The pinion is a matched set with the other parts of the bevel gear (W27) assembly. If motor is changed, this pinion must be installed on the new motor's axis. If pinion is damaged, complete bevel gear assembly must be replaced. Contact ABB service to replace complete bevel gear assembly.

NOTE:Axes 4, 5, & 6 are either all ELMO motors or all Siemens motors. If replacing motor, do not mix manufacturers.

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

1. **PRESS PINION (W54) ONTO MOTOR SHAFT. Use tools ABB# 6896 134-EA & ABB# 6896 134-AD. NOTE: Remove plug at rear of motor and place support ABB# 6896 134-EA under motor shaft to avoid axial loading of the bearings in the motor**



2. **CHECK DISTANCE BETWEEN MOTOR FLANGE AND END OF PINION WITH TOOL ABB# 6896 134-GN. If distance is different than noted when pinion was removed, shims (W55) must be added or removed to compensate for the difference**

3. **MOUNT MOTOR (W52):**

   a. Use a new O-Ring (W53). Lightly grease O-Ring and set in place.

   b. Set shims (W55) in place.

MOTOR WEIGHS APPROX. 35 LB.

   c. Position motor in place ready to insert screws (W49).

   d. Apply Loctite 242 (W50) to screws (W49). Insert screws with washers (W51) and torque 18 ft-lb.

4. **FILL GEARBOX WITH OIL as outlined in Section 4**

5. **CALIBRATE AXIS 5 as outlined in Section 11**

WRIST ASSEMBLY (U10) Removal

REFERENCE DRAWINGS
Exploded Views:
"U" (pg 8-9, 12-4)
"W" (pg 8-10, 12-5)

Assemblies:
3HAA 0001-GX (pg 13-18)
3HAA 0001-AAH (pg 13-13)
3HAA 0001-GX (pg 13-21)
3HAA 0001-AAS (pg 14-A)
3HAB 4254-2 (pg 14-J)

REQUIRED TOOLS
Hand Tools

The wrist assembly includes Axes 5 & 6 and is a complete exchangeable unit that contains motor units and gears. Two different types of wrist can be supplied, standard and foundry. See the parts list for part numbers.

Two different types of motors are supplied for axes 4, 5, & 6; ELMO or SIEMENS. The same type must be used for all three axes - motor types cannot be mixed.

If you should decide to change ALL the motor types, the robot control program must be reloaded and the correct type be defined

You can perform some maintenance and repair work on the wrist components, as listed below. For any other kind of work, the complete wrist assembly should be returned to ABB for proper service

1. **Oil change per instructions in Section 4**
2. **Change of motor and gear for Axis 6**
3. **Change of motor for Axis 5**
4. **Checking play in Axes 5 & 6**
5. **Adjusting play in Axis 5.**

1. **TURN MAIN ELECTRICAL DISCONNECT SWITCH OFF AND LOCK IT IN THE OFF POSITION.**

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

2. **REMOVE TOOLING.**

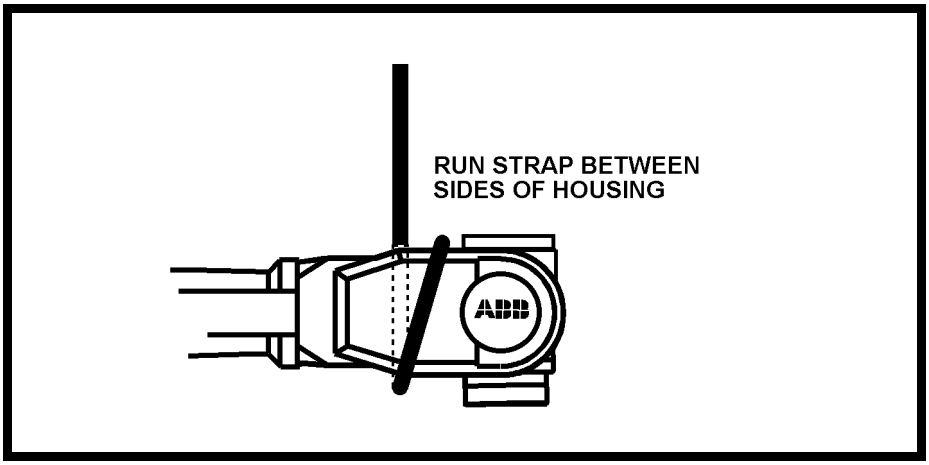
3. **POSITION WRIST TO GAIN EASIEST ACCESS. POINT WRIST FACE PLATE TOWARD THE GROUND.**

4. **DISCONNECT THE UPPER PART OF UPPER CABLE (U14) THAT CONNECTS TO THE WRIST AXIS 6.**
   a. Remove screws (U4) and access cover (U5).
   b. Remove screws (U6) and access cover (U7).
   c. Remove cover on back of Axis 6 motor.
   d. Disconnect plugs R4.MP6, R4.PTC6, & R4.FB6.
   e. Remove screws on cable cover on left side of Axis 6 motor.

f. Remove screws (U16-17) from cable.

g. Carefully route cables through casting and allow to hang free.

5. ATTACH A HOIST TO WRIST ASSEMBLY (U10)



6. REMOVE SCREWS (U20) WITH WASHERS (U21)

WRIST ASSEMBLY WEIGHS APPROX. 250 LB.

7. REMOVE WRIST ASSEMBLY (U10)

C

CAUTION: BE CAREFULL THAT WRIST DOESN'T SWING ABOUT AND BREAK THE CONNECTORS.

a. Pull wrist assembly (U10) out from tube shaft (U19) just far enough to disconnect connectors at the back of axis 5 motor (W52).

b. Disconnect connectors R4.MP5 & R4.FB5 at back of axis 5 motor (W52).

c. Lift wrist assembly (U10) away and set on a safe working surface. Protect connectors when setting assembly down.

8. IF WRIST ASSEMBLY IS GOING TO BE SHIPPED FOR SERVICE, drain oil from wrist housing (W8) as outlined in Section 4. Reinstall all magnetic plugs after draining oil

WRIST ASSEMBLY (U10) Installation

REFERENCE DRAWINGS
Exploded Views:
"U" (pg 8-9, 12-4)
"W" (pg 8-10, 12-5)

Assemblies:
3HAA 0001-GX (pg 13-18)
3HAA 0001-AAH (pg 13-13)
3HAA 0001-GX (pg 13-21)
3HAA 0001-AAS (pg 14-A)
3HAB 4254-2 (pg 14-J)

REQUIRED TOOLS
Hand Tools
Torque Wrench (90 ft-lb)
Molycote 1000 Grease

NOTE: The wrist assembly includes Axes 5 & 6 and is a complete exchangeable unit containing motor units and gears. Two different types of wrist can be supplied, standard and foundry. See the parts list for part numbers.

Two different types of motors are supplied for axes 4, 5, & 6; ELMO or SIEMENS. The same type must be used for all three axes - motor types cannot be mixed.

If the motor type is for ALL axes is changed, the robot control program must be reloaded and the correct type be selected.

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

1. **MOUNT WRIST ASSEMBLY (U10).**

WRIST ASSEMBLY WEIGHS APPROX. 250 LB.

   a. Be sure that roll pin (U35) is installed in tube shaft (U19).
   b. Lift wrist assembly (U10) and position in front of tube shaft (U19) where Axis 5 motor connectors can be connected.
   c. Connect motor connectors R4.MP5 & R4.FB5.

CAUTION: BE CAREFUL THAT WRIST DOESN'T SWING ABOUT AND BREAK THE CONNECTORS.

   d. Move wrist assembly (U10) into tube shaft (U19), ready for mounting. Make sure motor cables are aren't binding inside tube shaft.
   e. Lubricate screws (U20) and washers (U21) with Molycote 1000 grease.
   f. Insert screws (U20) with washers (U21). Torque to 90 ft-lb.

2. **CONNECT THE UPPER PART OF UPPER CABLE (U14) THAT CONNECTS TO THE WRIST AXIS 6.**

   a. Carefully feed cables through wrist casting to back of Axis 6 Motor.
   b. Install screws (U16-17).

3. **REMOVE HOIST.**

4. **FILL WRIST HOUSING WITH OIL as outlined in Section 4**

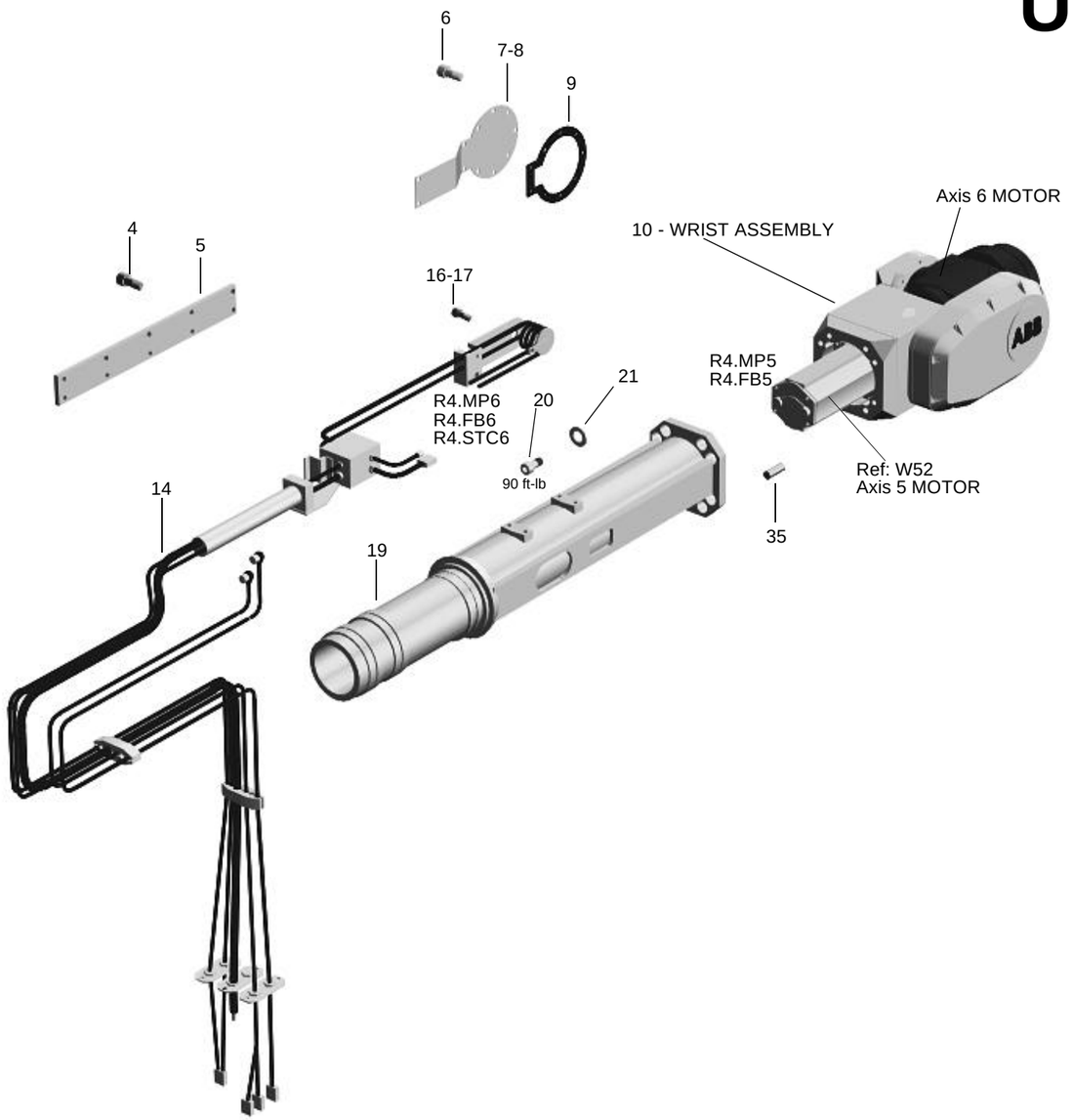
5. **CALIBRATE AXES 5 & 6 as outlined in Section 11**

ITEM	QTY.	DESCRIPTION	ABB PART NO .
1	2	Screw	2121 2411-287
2	2	Washer	2151 2062-136
3	3	Sync. Plate - Axis 4	3HAA 1001-76
4	4	Screw	2121 2411-368
5	1	Cover - 2.8-120, S/2.9-20	3HAA 1001-302
	1	Cover - 3.0-75	3HAA 1001-305
6	7	Screw	2121 2411-368
7	1	Cover	3HAA 1001-500
8	-	Sealant	1236 0012-227
9	1	Gasket	3HAA 1001-166
10	1	Wrist Assy.- 120 kg. Elmo	3HAB 4196-1
	1	Wrist Assy.- 120 kg. Siemens	3HAB 4590-1
	1	Wrist Assy.- 150 kg. Elmo	3HAB 4196-2
	1	Wrist Assy.- 150 kg. Siemens	3HAA 0001-ABR
11	2	Screw	2121 1519-536
12	-	Loctite 242	1269 0014-410
13	1	Stop - Axis 4	3HAA 1001-102
14	1	Upper Cable Complete:	3HAB 4165-3
		With Cust. Connections	3HAB4165-3
		S/2.9-120	3HAB 4183-2
		PE /2.25-75	3HAB 4483-2
15	2	Screw - M6x30	2121 2411-374
16	2	Screw - M6x16	2121 2411-368
17	2	Screw - M4x12	2121 2411-291
18	1	Protecting Plug	2522 726-4
19	1	Upper Arm Tube Shaft	3HAB 4452-1
		Upper Arm - PE/2.25-75	3HAB 4453-1
20	8	Screw	3HAB 3409-69
21	8	Washer	3HAB 1001-134
22	4	Screw	2121 2519-453
23	-	Loctite 242	1269 0014-410
24	4	Washer	2151 2062-165
25	1	Stop - Axis 4	3HAA 1001-17
26	1	Damper	3HAA 1001-100
27	1	Gasket	3HAA 1001-98
28	1	Cover	3HAA 1001-719
29	2	Screw	2121 2411-287
30	2	Washer	2151 2062-136
31	1	Sync. Plate	3HAA 1001-79
32	4	Screw	2121 2411-366
33	1	Cover	3HAA 1001-161
34	2	Screw	2121 2411-372
35	1	Roll Pin	2111 2835-416
36	12	Screw	2121 2411-370
37	12	Washer	2154 2022-4
38	1	Magnetic Plug	2522 0122-1
39	1	Washer	2152 0441-1
40	1	Seal Ring	3HAA 1001-628
41	1	Gear	3HAA 1001-24
42	1	Spacer	3HAA 1001-103
43	1	Bearing	2213 0253-5
44	1	Seal Ring	2216 0261-18
45	1	Seal	2216 0086-4
46	1	Bearing	2213 0253-5
47	-	Grease	1171 4013-301
48	1	Seal	3HAB 4217-1
49	3	Screw	2121 2411-368
50	3	Washer	2151 2062-153
51	1	Cover	3HAA 1001-176
52	2	Screw	2121 2411-368

ITEM	QTY.	DESCRIPTION	ABB PART NO .
53	1	Cable Holder	3HAA 1001-201
54	1	Cover	3HAA 1001-33
55	1	Gasket	3HAA 1001-97
56	4	Screw	2121 2518-634
57	4	Washer	2151 2062-185
58	2	Clamp	3HAA 1001-13
59	1	Magnetic Plug	2522 0122-1
60	1	Washer	2152 0441-1
61	1	Housing	3HAA 0001-AA
62	2	Support Ring	3HAA 1001-124
63	2	Set Screw - M10	2122 2719-401
64	1	Sync.Plate Axis 3	3HAA 1001-75
65	2	Washer	2151 2062-136
66	2	Screw	2121 2411-287
67	3	Screw	3HAB 3409-62
68	3	Washer	2151 2062-173
69	1	Nut (in Item 73)	2126 2851-104
70	-	Loctite 242 (in Item 73)	1269 0014-410
71	1	Bearing (in Item 73)	3HAA 1001-129
72	1	Hub Axis 4 (in Item 73)	3HAA 1001-16
73	-	Bearing	2213 3802-11
74	1	Gear Unit	3HAA 0001-M
75	1	Intermediate Wheel Assem.	3HAA 0001-AN
76	13	Nut	2126 2011-117
77	6	Spring Washers	2154 2033-9
78	3	Wedge	3HAA 1001-99
79	3	Stud	2122 2011-465
80	-	Loctite 601	1269 0014-407
81	1	O-Ring	2152 2012-430
82	1	Pinion	3HAA 1001-21
83	1	Motor - 120 kg. Elmo	3HAB 4041-1
	1	Motor - 120 kg. Siemens	3HAB 4584-1
	1	Motor - 150 kg. Elmo	3HAB 4044-1
	1	Motor - 150 kg. Siemens	3HAA 1001-ZH
84	4	Washer	2151 2062-165
85	4	Screw	2121 2519-453
86	-	Loctite 242	1269 0014-410

A	8	Screw	3HAB 3409-69
B	8	Washer	3HAA 1001-134
C	1	Extension:	
		2.8-120, S/2.9-120	3HAA 1001-301
		3.0-75	3HAA 1001-304
D	1	Roll Pin	2111 2835-416

120 kg:	Upper Arm Assy.	
	2.4 - Elmo	3HAB 4194-1
	2.4 - Siemens	3HAB 4591-1
	2.8 - Elmo	3HAB 4194-3
	2.8 - Siemens	3HAB 4592-1
	S/2.9	3HAB 4194-3
	Drive Unit Assy. - Elmo	3HAB 4195-1
	Drive Unit Assy. - Siemens	3HAB 4585-1
150 kg:	Upper Arm Assy. - Elmo	3HAB 4194-2
	Upper Arm Assy. - Siemens	3HAA 0001-AAE
	Drive Unit Assy. - Elmo	3HAB 4195-2
	Drive Unit Assy. - Siemens	3HAA 0001-ABN
3.0-75	Upper Arm Assy. - Elmo	3HAB 4194-4
	Upper Arm Assy. - Siemens	3HAB 4593-1



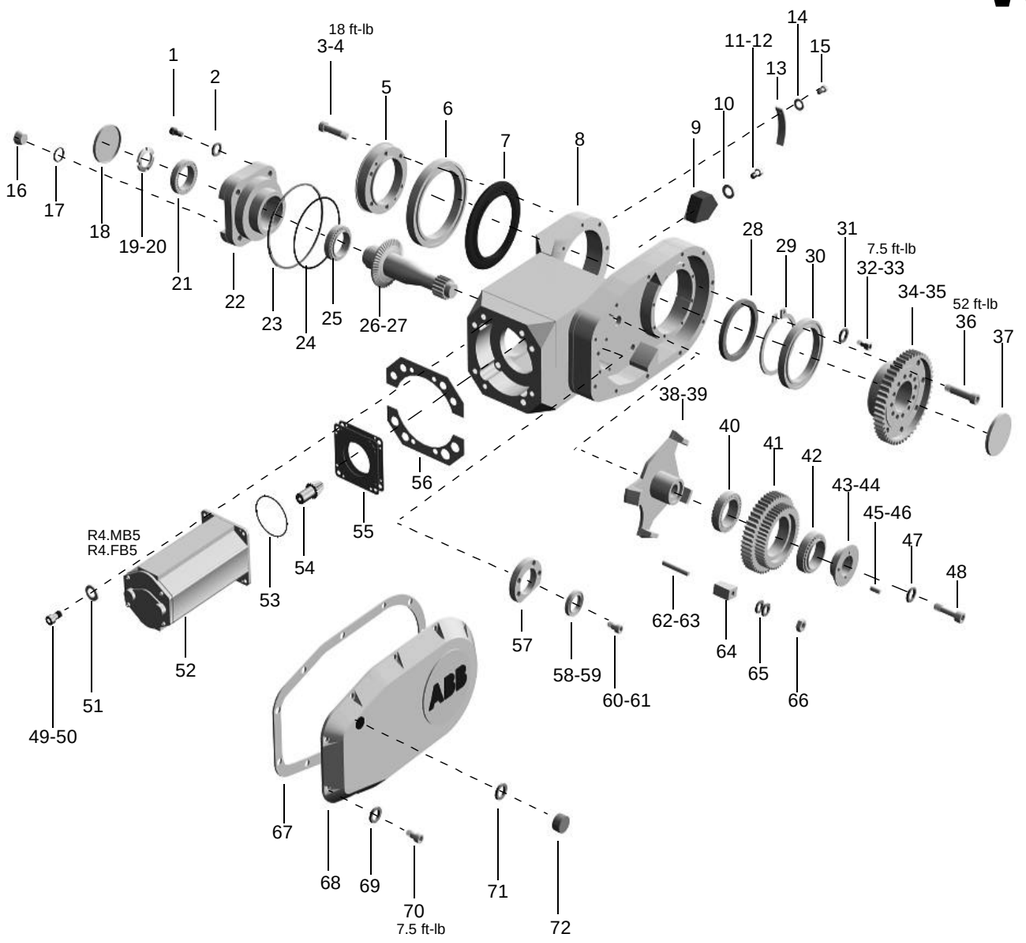
ITEM	QTY.	DESCRIPTION	ABB PART NO .
1	4	Screw - M10x25 12.9	3HAB 3409-50
2	4	Washer - 11x17x2	3HAB 4233-1
3	6	Screw - M8x30	2121 2519-455
4	-	Loctite 242	1269 0014-410
5	1	Bearing Retainer	3HAA 1001-107
6	1	Bearing	3HAA 1001-132
7	1	Spacer	3HAA 1001-108
8	1	Wrist Housing	3HAA 1001-35
9	2	Damper Axis 5	3HAA 1001-101
10	2	Washer - 6.4x12x1.6	2151 2062-153
11	2	Screw - M6x20	2121 2411-370
12	-	Loctite 242	1269 0014-410
13	1	Sync. Plate	3HAA 1001-79
14	2	Washer - 4.3x9x0.8	2151 2062-136
15	2	Screw - M4x8	2121 2411-287
16	1	Magnetic Plug	2522 122-1
17	1	Washer - 13.5x18x1.5	2152 0441-1
18		Cover	3HAA 2166-11
19	1	Lock Nut	2126 2851-108
20	-	Loctite 290	1269 0014-409
21	1	Bearing	3HAA 1001-162
22	1	Bearing Housing	3HAA 1001-41
23	1	Shim Set	3HAA 0001-AF
24	1	O-Ring	2152 2011-529
25	1	Bearing	3HAA 1001-168
26	1	Gear Axis 5	3HAA 0001-AO
27	1	Gear Axis 5 Assem.	3HAA 0001-AG
28	1	Seal	3HAB 4409-1
29	1	Retaining Ring	2154 2226-171
30	1	Bearing	2213 253-21
31	8	Washer - 6.4x15x3	3HAA 1001-106
32	8	Screw	2121 2411-370
33	-	Loctite 242	1269 0014-410
34	1	Gear Axis 5	3HAA 1001-262
35	1	Gear Axis 5 Assem.	3HAA 0001-HA
36	1	Screw - M10x60 12.9	3HAB 3409-57
37	1	Cover Lid	2158 0399-4
38	1	Intermediate Gear Hub	3HAA 1001-39
39	1	Intermediate Gear Assem.	3HAA 0001-GY
40	1	Bearing	3HAA 1001-130
41	1	Gear	3HAA 0001-E
42	1	Bearing	3HAA 1001-130
43	1	Nut	3HAA 1001-109
44	-	Loctite 290	1269 0014-409
45	1	Set Screw	2122 2711-287
46	-	Loctite 242	1269 0014-410
47	1	Washer - 16.5x25x4	3HAA 1001-267
48	1	Screw - M16x60	3HAA 1001-266
49	4	Screw - M8x30	2121 2519-455
50	-	Loctite 242	1269 0014-410
51	4	Washer	2151 2062-165
52	1	Motor	(see NOTE)
53	1	O-Ring	2152 2012-430
54	1	Pinion	(see NOTE)
55	1	Shim Set	3HAA 0001-AE
56		Friction Washer Insert	3HAA 1001-297
57	1	Bearing Support	3HAA 1001-271
58	1	Bearing	3HAA 1001-131
59	-	Loctite 601	1269 0014-407
60	4	Screw - M8x25	2121 2519-453

ITEM	QTY.	DESCRIPTION	ABB PART NO .
61	-	Loctite 242	1269 0014-410
62	4	Stud - M8x70	2122 2011-465
63	-	Loctite 242	1269 0014-410
64	4	Wedge	3HAA 1001-99
65	8	Tension Washer	2154 2033-9
66	4	Nut - M8	2126 2011-117
67	1	Gasket	3HAA 1001-112
68	1	Cover	3HAA 1001-276
69	11	Washer - Spring 6.4 FZB	2154 2022-4
70	11	Screw - M6x20	2121 2411-370
71	1	Magnetic Plug 1/4”	2522 122-1
72	1	Washer - 13.5x18x1.5	2152 0441-1
73	-	Loctite 242	1269 0014-410
74	-	Gear Oil	1171 2016-604

NOTE:

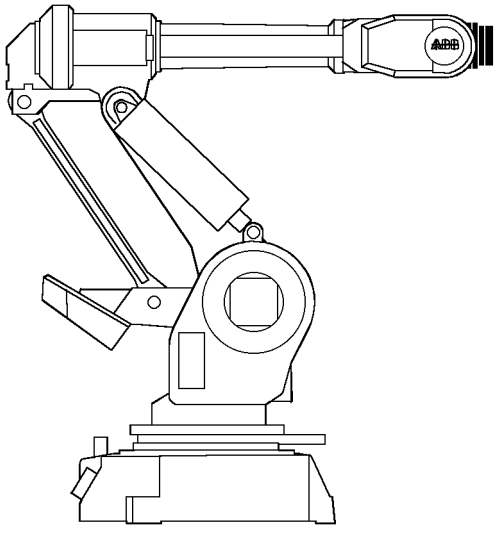
120kg:			
		Wrist Unit - Elmo	3HAB 4196-1
		Wrist Unit - Siemens	3HAB 4590-1
		Wrist Unit - Foundry	3HAB 4506-1
		Drive Unit - Axis 5 Elmo	3HAB 4171-1
		Drive Unit - Axis 5 Siemens	3HAB 4586-1
52	1	Motor - Elmo	3HAB 4041-1
52	1	Motor - Siemens	3HAB 4584-1
54	1	Pinion (part of item 27)	3HAA 1001-58
150 kg:			
		Wrist Unit 150 kg Elmo	3HAB 4196-2
		Wrist Unit 150 kg Siemens	3HAA 0001-ABR
		Wrist Unit 150 kg Foundry	3HAB 4506-2
		Drive Unit - Axis 5 Elmo	3HAB 4171-1
		Drive Unit - Axis 5 Siemens	3HAA 0001-ABU
52	1	Motor - Elmo	3HAB 4044-1
52	1	Motor - Siemens	3HAA 0001-ZH
54	1	Pinion (part of item 27)	3HAA 1001-58

W



SECTION 9

Axis 6 Disassembly/Assembly



Disassembly/Assembly Guidelines
IRB 6400

AXIS 6

Table of Contents

MOTOR & GEAR REDUCTION UNIT ASSEMBLY Removal

REFERENCE DRAWINGS

Exploded Views:
- **"U" (pg 9-5, 12-4)**
- **"W" (pg 9-6, 12-5)**
- **"F" (pg 9-7, 12-6)**

Assemblies:
- **3HAA 0001-GX (pg 13-18)**
- **3HAA 0001-AAH (pg 13-13)**
- **3HAB 4172-1 (pg 13-22)**

REQUIRED TOOLS

Hand Tools
ABB #3HAA 7601-043
ABB #3HAA 7601-047
M8x65 Screws (2)

NOTE: It is not necessary to remove wrist assembly from tube shaft to remove axis 6 motor and gear reduction unit assembly.

NOTE: Axes 4, 5, & 6 are either all ELMO motors or all Siemens motors. If replacing motor, do not mix manufacturers.

1. **TURN OFF MAIN ELECTRICAL DISCONNECT SWITCH AND LOCK IT IN THE OFF POSITION.**

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

2. **DISCONNECT THE UPPER PART OF UPPER CABLE (U14) THAT CONNECTS TO THE WRIST AXIS 6**
   a. Remove screws (U4) and access cover (U5).
   b. Remove screws (U6) and access cover (U7).
   c. Remove cover on back of motor.
   d. Disconnect plugs R4.MP6, R4.PTC6, & R4.FB6.
   e. Remove screws on cable cover on left side of Axis 6 motor.
   f. Remove screws (U17) from cable.
   g. Carefully route cables through casting and allow to hang free.
3. **DRAIN OIL FROM WRIST ASSEMBLY (U10) as outlined in Section 4**
4. **REMOVE COVER (W68):**
   a. Remove screws (W70) with washers (W69).
   b. Remove cover (W68) and gasket (W67).
5. **REMOVE BEARING (W6):**
   a. Remove screws (W3).
   b. Remove bearing retainer (W5) with help of M8x65 pin screws.
   c. Remove bearing (W6).
   d. Remove spacer (W7).
6. **REMOVE FLANGE (F20):**

a. Remove screws (F21).

b. Remove flange (F20).

c. Remove O-Ring (F18).

7. REMOVE AXIS 6 DRIVE UNIT (F10)

a. Remove cover lid (W37). Lid must be pried out and if damaged too much, a new lid installed on reassembly.

b. Remove screws (W36).

c. Remove Axis 6 drive unit (F10) and set it on a work bench for further work.

DRIVE UNIT WEIGHS APPROX. 30 LB.

8. REMOVE GEAR REDUCTION UNIT (F17)

a. Remove screws (F23) with washers (F22).

b. Remove gear reduction unit (F17) from drive unit (F10) with the help of two screws in the M8 holes in motor flange.

GEAR UNIT WEIGHS APPROX. 20 LB.

c. Remove O-Ring (F14).

9. REMOVE PINION (F15) FROM MOTOR SHAFT

CAUTION: DO NOT TAP OR HIT MOTOR SHAFT.

C

a. Remove screw (F16)

b. Remove pinion with tool ABB# 3HAA 7601-043. Use tool ABB #3HAA 7601-047 for pinion (F15). DO NOT tap or hit the end of the motor shaft in any way.

MOTOR & GEAR REDUCTION UNIT ASSEMBLY Installation

REFERENCE DRAWINGS

Exploded Views:
- "U" (pg 9-5, 12-4)
- "W" (pg 9-6, 12-5)

Assemblies:
- 3HAA 0001-GX (pg 13-18)
- 3HAA 0001-AAH (pg 13-13)
- 3HAA 0001-GX (pg 13-21)
- 3HAA 0001-AAS (pg 14-A)
- 3HAB 4254-2 (pg 14-J)

REQUIRED TOOLS

Hand Tools
Torque Wrench (10-70 Nm)
M8x120 Screw
M8 Hex Nut
M8 Washer
Loctite 242

NOTE: Axes 4, 5, & 6 are either all ELMO motors or all Siemens motors. If replacing motor, do not mix manufacturers.

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

1. MOUNT PINION (F15) ON MOTOR SHAFT

a. Insert an M8x120 threaded pin screw into threaded hole in center of motor shaft.

b. Insert pinion (F15) onto shaft and press on by threading an M8 nut with washer onto pin screw.

c. Remove M8x120 pin screw.

d. Apply Loctite 242 to screw (F16) and insert. Torque 16 ft-lb.

2. MOUNT GEAR REDUCTION UNIT (F17)

a. Lightly grease O-Ring (F14) and set in place.

b. Set gear reduction unit (F17) into mounting position on motor drive (F10). Rotate so screw hole and magnetic oil plug come in the right position.

c. Insert screws (F23) with washers (F22). Torque 26 ft-lb.

3. MOUNT FLANGE (f20):

a. Lightly grease O-Ring (F18) and set in place.

b. Light grease O-Rings (F19) and set in place.

c. Set flange (F20) in place on gear reduction unit (F17).

d. Insert and tighten screws (F21).

4. **MOVE SYNC PLATES & CONNECTOR HOLDER**

   a. If new motor is being installed, move sync plate (F1) & connector holder on the resolver side over to new motor.

   b. If new gear reduction unit (F17) is being installed, sync plate (F13) on old gear reduction unit is glued on & cannot be moved. Mount a new sync plate on new gear reduction plate. Clean surface bedore mounting.

5. **MOUNT DRIVE UNIT (F10) INTO MOUNTING POSITION IN WRIST HOUSING (W8):**

   a. Insert drive unit (F10) into position in wrist housing (W8). Position drive unit onto pilot diameter on gear (W34).

   b. Insert screws (W36). Torque to 52 ft-lb.

   c. Insert cover lit (W37). Use a new cover if old one was damaged in removal.

6. **INSTALL BEARING (W6):**

   a. Install bearing (W6) and spacer (W7) onto bearing retainer (W5). Set in place in wrist housing (W8) with bearing retainer pilot diameter inserted into motor (F10) mounting bore.

   b. Apply Loctite 242 to screws (W3).

   c. Insert screws (W3) and torque to 18 ft-lb.

7. **MOUNT COVER (W68):**

   a. Set cover (W68) with seal (W67) in place on wrist housing (W8).

   b. Insert screws (W70) with washers (W69) and torque 7.5 ft-lb.

8. **CONNECT MOTOR (F10) CABLING as outlined in Section 9, page 10**

9. **FILL AXIS 5 WITH OIL as spceified in Section 4, page 11**

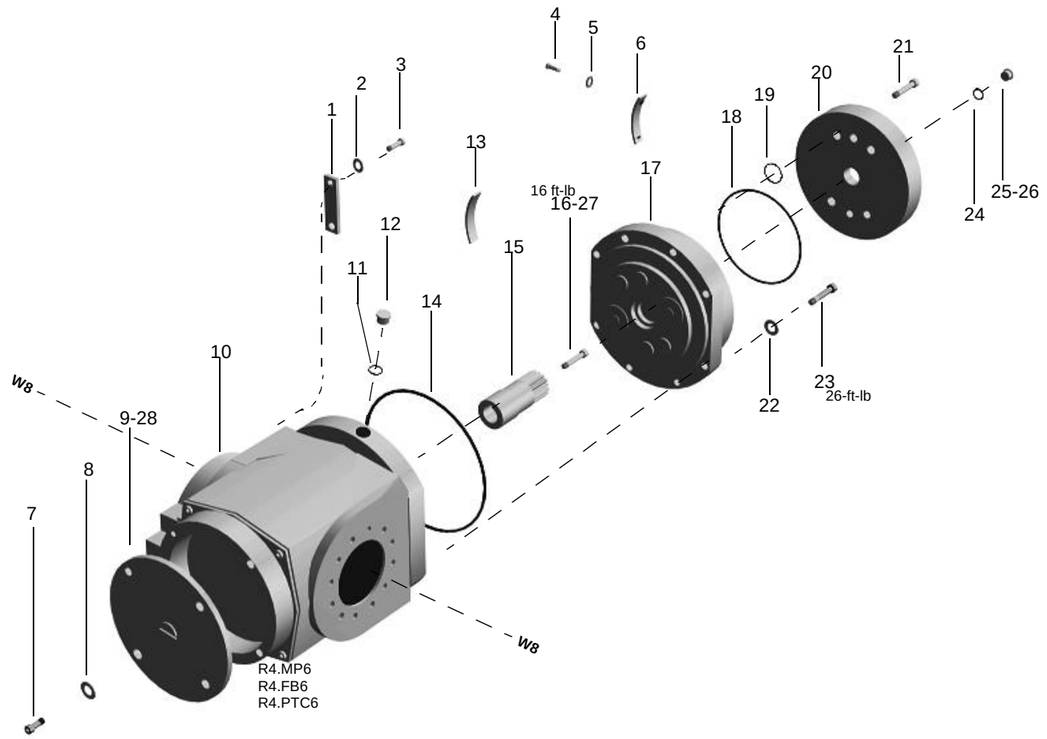
10. **FILL AXIS 6 WITH GREASE as specified in Section 4, page 12.**

11. **CALIBRATE AXES 5 & 6 as outlined in Section 11**

ITEM	QTY.	DESCRIPTION	ABB PART NO
1	1	Sync. Plate Axis 5	3HAA 1001-77
2	2	Washer - 4.3X9X0.8	2151 2062-136
3	2	Screw - M4x8	2121 2411-287
4	2	Screw - M4x8	2121 2411-287
5	2	Washer - 4.3x9x0.8	2151 2062-136
6	1	Sync. Plate Axis 6	3HAA 1001-78
7	4	Screw	(incl. in item 10)
8	4	Washer	(incl. in item 10)
9	1	Cover	(incl. in item 10)
10	1	Motor - Elmo	3HAB 4042-1
	1	Motor - Siemens	3HAA 0001-XK
		Drove Unit - Elmo	3HAB 4172-1
		Drive Unit - Siements	EHAA 0001-ABU
11	1	Washer - 13.5x18x1.5	2152 0441-1
12	1	Magnetic Plug - R 1/4”	2522 0122-1
13	1	Sync. Plate	3HAA 1001-174
14	1	O-Ring - 151.99x3.53	2152 0431-12
15	1	Input Pinion Gear	3HAA 1001-522
16	1	Screw	2121 2519-341
17	1	Reduction Gear	3HAA 0001-HJ

ITEM	QTY.	DESCRIPTION	ABB PART NO
18	1	O-Ring	2151 0431-21
19	1	O-Ring	2152 0431-20
20	1	Flange	3HAA 1001-222
21	6	Screw	2121 2518-577
22	8	Washer - 8.4x13x1.5	3HAA 1001-172
23	8	Screw - M8x40	3HAB 3409-40
24	1	Washer	(ref.)
25	1	Plug	(ref.)
26	-	Grease	3HAA 1001-294
27	-	Loctite 242	1290 0014-410
28	-	Sealant	1236 0012-227

F

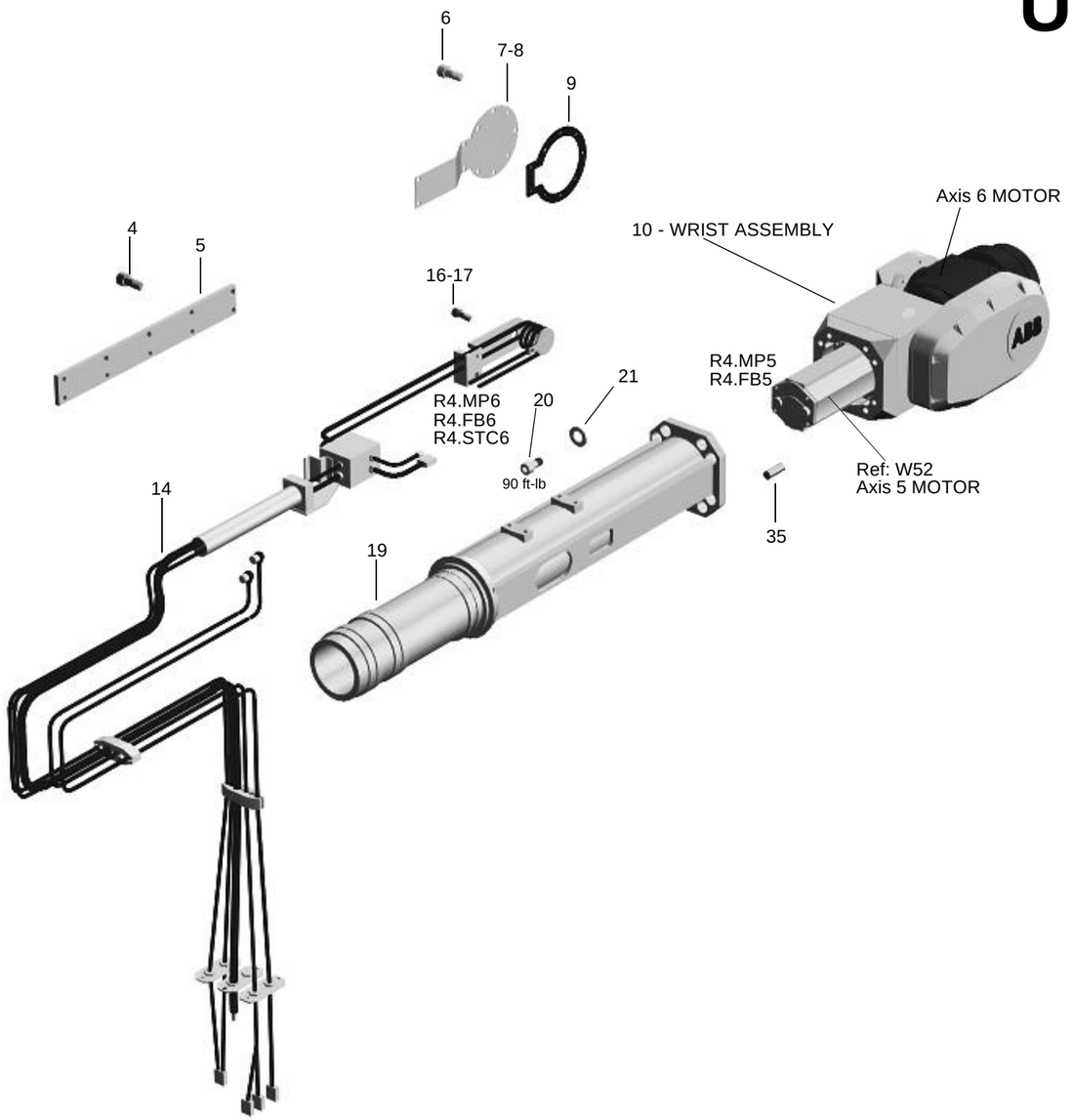


ITEM	QTY.	DESCRIPTION	ABB PART NO .
1	2	Screw	2121 2411-287
2	2	Washer	2151 2062-136
3	3	Sync. Plate - Axis 4	3HAA 1001-76
4	4	Screw	2121 2411-368
5	1	Cover - 2.8-120, S/2.9-20	3HAA 1001-302
	1	Cover - 3.0-75	3HAA 1001-305
6	7	Screw	2121 2411-368
7	1	Cover	3HAA 1001-500
8	-	Sealant	1236 0012-227
9	1	Gasket	3HAA 1001-166
10	1	Wrist Assy.- 120 kg. Elmo	3HAB 4196-1
	1	Wrist Assy.- 120 kg. Siemens	3HAB 4590-1
	1	Wrist Assy.- 150 kg. Elmo	3HAB 4196-2
	1	Wrist Assy.- 150 kg. Siemens	3HAA 0001-ABR
11	2	Screw	2121 1519-536
12	-	Loctite 242	1269 0014-410
13	1	Stop - Axis 4	3HAA 1001-102
14	1	Upper Cable Complete:	3HAB 4165-3
		With Cust. Connections	3HAB4165-3
		S/2.9-120	3HAB 4183-2
		PE /2.25-75	3HAB 4483-2
15	2	Screw - M6x30	2121 2411-374
16	2	Screw - M6x16	2121 2411-368
17	2	Screw - M4x12	2121 2411-291
18	1	Protecting Plug	2522 726-4
19	1	Upper Arm Tube Shaft	3HAB 4452-1
		Upper Arm - PE/2.25-75	3HAB 4453-1
20	8	Screw	3HAB 3409-69
21	8	Washer	3HAB 1001-134
22	4	Screw	2121 2519-453
23	-	Loctite 242	1269 0014-410
24	4	Washer	2151 2062-165
25	1	Stop - Axis 4	3HAA 1001-17
26	1	Damper	3HAA 1001-100
27	1	Gasket	3HAA 1001-98
28	1	Cover	3HAA 1001-719
29	2	Screw	2121 2411-287
30	2	Washer	2151 2062-136
31	1	Sync. Plate	3HAA 1001-79
32	4	Screw	2121 2411-366
33	1	Cover	3HAA 1001-161
34	2	Screw	2121 2411-372
35	1	Roll Pin	2111 2835-416
36	12	Screw	2121 2411-370
37	12	Washer	2154 2022-4
38	1	Magnetic Plug	2522 0122-1
39	1	Washer	2152 0441-1
40	1	Seal Ring	3HAA 1001-628
41	1	Gear	3HAA 1001-24
42	1	Spacer	3HAA 1001-103
43	1	Bearing	2213 0253-5
44	1	Seal Ring	2216 0261-18
45	1	Seal	2216 0086-4
46	1	Bearing	2213 0253-5
47	-	Grease	1171 4013-301
48	1	Seal	3HAB 4217-1
49	3	Screw	2121 2411-368
50	3	Washer	2151 2062-153
51	1	Cover	3HAA 1001-176
52	2	Screw	2121 2411-368

ITEM	QTY.	DESCRIPTION	ABB PART NO .
53	1	Cable Holder	3HAA 1001-201
54	1	Cover	3HAA 1001-33
55	1	Gasket	3HAA 1001-97
56	4	Screw	2121 2518-634
57	4	Washer	2151 2062-185
58	2	Clamp	3HAA 1001-13
59	1	Magnetic Plug	2522 0122-1
60	1	Washer	2152 0441-1
61	1	Housing	3HAA 0001-AA
62	2	Support Ring	3HAA 1001-124
63	2	Set Screw - M10	2122 2719-401
64	1	Sync.Plate Axis 3	3HAA 1001-75
65	2	Washer	2151 2062-136
66	2	Screw	2121 2411-287
67	3	Screw	3HAB 3409-62
68	3	Washer	2151 2062-173
69	1	Nut (in Item 73)	2126 2851-104
70	-	Loctite 242 (in Item 73)	1269 0014-410
71	1	Bearing (in Item 73)	3HAA 1001-129
72	1	Hub Axis 4 (in Item 73)	3HAA 1001-16
73	-	Bearing	2213 3802-11
74	1	Gear Unit	3HAA 0001-M
75	1	Intermediate Wheel Assem.	3HAA 0001-AN
76	13	Nut	2126 2011-117
77	6	Spring Washers	2154 2033-9
78	3	Wedge	3HAA 1001-99
79	3	Stud	2122 2011-465
80	-	Loctite 601	1269 0014-407
81	1	O-Ring	2152 2012-430
82	1	Pinion	3HAA 1001-21
83	1	Motor - 120 kg. Elmo	3HAB 4041-1
	1	Motor - 120 kg. Siemens	3HAB 4584-1
	1	Motor - 150 kg. Elmo	3HAB 4044-1
	1	Motor - 150 kg. Siemens	3HAA 1001-ZH
84	4	Washer	2151 2062-165
85	4	Screw	2121 2519-453
86	-	Loctite 242	1269 0014-410

A	8	Screw	3HAB 3409-69
B	8	Washer	3HAA 1001-134
C	1	Extension:	
		2.8-120, S/2.9-120	3HAA 1001-301
		3.0-75	3HAA 1001-304
D	1	Roll Pin	2111 2835-416

120 kg:	Upper Arm Assy.	
	2.4 - Elmo	3HAB 4194-1
	2.4 - Siemens	3HAB 4591-1
	2.8 - Elmo	3HAB 4194-3
	2.8 - Siemens	3HAB 4592-1
	S/2.9	3HAB 4194-3
	Drive Unit Assy. - Elmo	3HAB 4195-1
	Drive Unit Assy. - Siemens	3HAB 4585-1
150 kg:	Upper Arm Assy. - Elmo	3HAB 4194-2
	Upper Arm Assy. - Siemens	3HAA 0001-AAE
	Drive Unit Assy. - Elmo	3HAB 4195-2
	Drive Unit Assy. - Siemens	3HAA 0001-ABN
3.0-75	Upper Arm Assy. - Elmo	3HAB 4194-4
	Upper Arm Assy. - Siemens	3HAB 4593-1



ITEM	QTY.	DESCRIPTION	ABB PART NO .
1	4	Screw - M10x25 12.9	3HAB 3409-50
2	4	Washer - 11x17x2	3HAB 4233-1
3	6	Screw - M8x30	2121 2519-455
4	-	Loctite 242	1269 0014-410
5	1	Bearing Retainer	3HAA 1001-107
6	1	Bearing	3HAA 1001-132
7	1	Spacer	3HAA 1001-108
8	1	Wrist Housing	3HAA 1001-35
9	2	Damper Axis 5	3HAA 1001-101
10	2	Washer - 6.4x12x1.6	2151 2062-153
11	2	Screw - M6x20	2121 2411-370
12	-	Loctite 242	1269 0014-410
13	1	Sync. Plate	3HAA 1001-79
14	2	Washer - 4.3x9x0.8	2151 2062-136
15	2	Screw - M4x8	2121 2411-287
16	1	Magnetic Plug	2522 122-1
17	1	Washer - 13.5x18x1.5	2152 0441-1
18		Cover	3HAA 2166-11
19	1	Lock Nut	2126 2851-108
20	-	Loctite 290	1269 0014-409
21	1	Bearing	3HAA 1001-162
22	1	Bearing Housing	3HAA 1001-41
23	1	Shim Set	3HAA 0001-AF
24	1	O-Ring	2152 2011-529
25	1	Bearing	3HAA 1001-168
26	1	Gear Axis 5	3HAA 0001-AO
27	1	Gear Axis 5 Assem.	3HAA 0001-AG
28	1	Seal	3HAB 4409-1
29	1	Retaining Ring	2154 2226-171
30	1	Bearing	2213 253-21
31	8	Washer - 6.4x15x3	3HAA 1001-106
32	8	Screw	2121 2411-370
33	-	Loctite 242	1269 0014-410
34	1	Gear Axis 5	3HAA 1001-262
35	1	Gear Axis 5 Assem.	3HAA 0001-HA
36	1	Screw - M10x60 12.9	3HAB 3409-57
37	1	Cover Lid	2158 0399-4
38	1	Intermediate Gear Hub	3HAA 1001-39
39	1	Intermediate Gear Assem.	3HAA 0001-GY
40	1	Bearing	3HAA 1001-130
41	1	Gear	3HAA 0001-E
42	1	Bearing	3HAA 1001-130
43	1	Nut	3HAA 1001-109
44	-	Loctite 290	1269 0014-409
45	1	Set Screw	2122 2711-287
46	-	Loctite 242	1269 0014-410
47	1	Washer - 16.5x25x4	3HAA 1001-267
48	1	Screw - M16x60	3HAA 1001-266
49	4	Screw - M8x30	2121 2519-455
50	-	Loctite 242	1269 0014-410
51	4	Washer	2151 2062-165
52	1	Motor	(see NOTE)
53	1	O-Ring	2152 2012-430
54	1	Pinion	(see NOTE)
55	1	Shim Set	3HAA 0001-AE
56		Friction Washer Insert	3HAA 1001-297
57	1	Bearing Support	3HAA 1001-271
58	1	Bearing	3HAA 1001-131
59	-	Loctite 601	1269 0014-407
60	4	Screw - M8x25	2121 2519-453

ITEM	QTY.	DESCRIPTION	ABB PART NO .
61	-	Loctite 242	1269 0014-410
62	4	Stud - M8x70	2122 2011-465
63	-	Loctite 242	1269 0014-410
64	4	Wedge	3HAA 1001-99
65	8	Tension Washer	2154 2033-9
66	4	Nut - M8	2126 2011-117
67	1	Gasket	3HAA 1001-112
68	1	Cover	3HAA 1001-276
69	11	Washer - Spring 6.4 FZB	2154 2022-4
70	11	Screw - M6x20	2121 2411-370
71	1	Magnetic Plug 1/4”	2522 122-1
72	1	Washer - 13.5x18x1.5	2152 0441-1
73	-	Loctite 242	1269 0014-410
74	-	Gear Oil	1171 2016-604

NOTE:

120kg:			
		Wrist Unit - Elmo	3HAB 4196-1
		Wrist Unit - Siemens	3HAB 4590-1
		Wrist Unit - Foundry	3HAB 4506-1
		Drive Unit - Axis 5 Elmo	3HAB 4171-1
		Drive Unit - Axis 5 Siemens	3HAB 4586-1
52	1	Motor - Elmo	3HAB 4041-1
52	1	Motor - Siemens	3HAB 4584-1
54	1	Pinion (part of item 27)	3HAA 1001-58
150 kg:			
		Wrist Unit 150 kg Elmo	3HAB 4196-2
		Wrist Unit 150 kg Siemens	3HAA 0001-ABR
		Wrist Unit 150 kg Foundry	3HAB 4506-2
		Drive Unit - Axis 5 Elmo	3HAB 4171-1
		Drive Unit - Axis 5 Siemens	3HAA 0001-ABU
52	1	Motor - Elmo	3HAB 4044-1
52	1	Motor - Siemens	3HAA 0001-ZH
54	1	Pinion (part of item 27)	3HAA 1001-58

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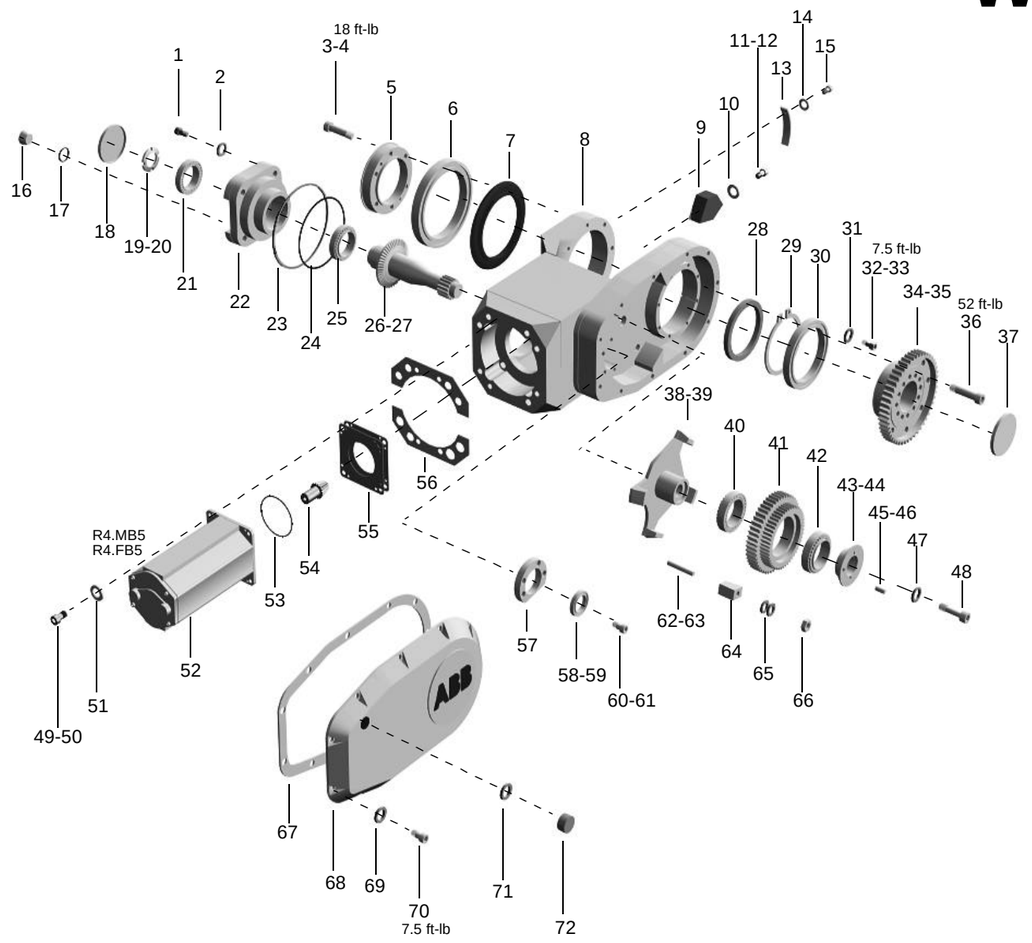


SECTION 10

Cables Guidelines

CABLES GUIDELINES

Table of Contents

LOWER CABLE (B18) Removal

REFERENCE DRAWINGS

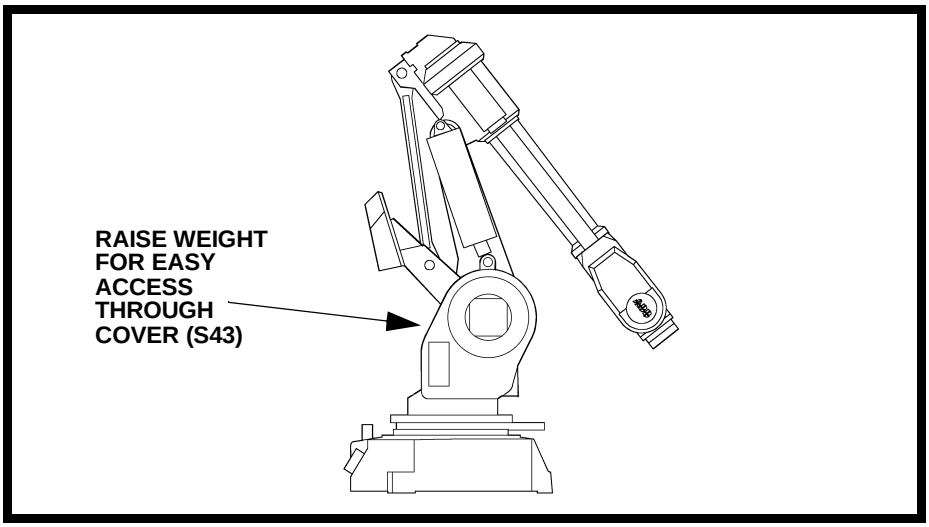
Exploded Views:
- "B" (pg 10-11, 12-1)
- "S" (pg 10-12, 12-2)

Assemblies:
- 3HAB 4161-4 (pg 13-12)
- 3HAB 4161-4 (pg 13-2)
- 3HAA 0001-AAS (pg 14-A)
- 3HAB 4248-2 (pg 14-G)

REQUIRED TOOLS

Hand Tools

1. **POSITION ROBOT IN A POSITION WHERE THE BALANCE WEIGHT IS RAISED UP AND OUT OF THE WAY OF ACCESS TO THE REAR OF SHOULDER FRAME HOUSING (S21)**



2. **TURN OFF ALL ELECTRICAL POWER TO ROBOT AND LOCK IT IN THE OFF POSITION.**

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

3. **REMOVE SCREWS (S42) AND COVER (S43).**

4. **REMOVE SCREWS (B8) AND COVER (B9).**

5. **DISCONNECT LOWER CABLE (B18) MOUNTING PLATE FROM BASE HOUSING (B24):**
   a. Remove screws (B1).
   b. Remove cable protector (B2).
   c. Pull lower cable (B18) mounting plate out from base housing (B24) as far as it will go.

6. **DISCONNECT EARTH WIRE FROM CONTACT PLATE IN BASE HOUSING (B24).**

7. **DISCONNECT ALL LOWER CABLE (B18) CONNECTORS INSIDE SHOULDER FRAME HOUSING (S21)**
    a. Disconnect connectors R2.MP1, R2.MP2, R2.MP3, R2.MP4, R2.MP5-6, R2.FAN (if equipped), R2.CP (if equipped), and R2.CS (if equipped).
    b. Remove screws (S12) and pull measure card unit (S10) out far enough to disconnect R2.SMB1(X2).
    c. Remove screws (S65) and pull brake release unit (S64) out far enough to disconnect R3.BU1-6(X8), R3.BU1-3(X9), and R3.BU4-6(X10).

8. **DISCONNECT CABLE GUIDE RAIL (B16) FROM BASE HOUSING (B24):**
    a. Loosen screws (B13). Do not remove yet.
    b. Move cable guide rail (B16) out of the way.
    c. Remove the right side screw (B13) and washer (B15) so it won't snag on the cable or your hands. Leave the left side screw (B13) to hold frictionless plate (B23) in position.

9. **DISCONNECT LOWER CABLE (B18)**
    a. Remove screws (B20) and washers (B19) holding lower cable (B18) to support rail.
    b. Remove screws (B10) and washers (B12) holding lower cable (B18) to base housing (B24).

10. **REMOVE LOWER CABLE (B18) FROM BASE HOUSING (B24)**
    a. Carefully feed lower cable out through left rear access hole in base housing (B24).
    b. Disconnect and remove customer connections and air hose as required.

LOWER CABLE (B18) Installation

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION

REFERENCE DRAWINGS

Exploded Views:
"B" (pg 10-11, 12-1)
"S" (pg 10-12, 12-2)

Assemblies:
3HAB 4161-4 (pg 13-1)
3HAB 4161-4 (pg 13-2)
3HAA 0001-AAS (pg 14-A)
3HAB 4248-2 (pg 14-G)

REQUIRED TOOLS

Hand Tools

1. INSERT LOWER CABLE (B18) INTO BASE HOUSING (B24).

a. Carefully feed lower cable (B18) into access hole at left rear of base housing (B24).

b. Pull cable ends through the holes in the shoulder frame housing (S21) and position them ready for connection.

c. Use Loctite 242 (B11) on screws (B10) and fasten lower cable to base housing (B24). Use washers (B12) with screws (B10).

d. Use Loctite 242 on screws (B20) and fasten cable (B18) to support rail. Use washers (B19) with screws (B20).

3. INSTALL CABLE GUIDE RAIL (B16)

a. Position cable guide rail (B16) against lower cable (B18) and engaged with loosened screw (B13).

b. Use Loctite 242 on right side screw (B13) and fasten cable guide rail (B16) to base housing (B24). Use washer (B15) with screw (B13).

c. Remove left side screw (B13), apply Loctite (B14), and reinsert with washer (B15). Tighten to secure guide rail (B16).

4. CHECK THAT LOWER CABLE IS FREE TO MOVE AS ROBOT ROTATES. LOOSEN (B10) AND (B13) TO ADJUST CABLE AND RAIL AS NECESSARY. RETIGHTEN SCREWS AFTER ADJUSTMENTS

5. CONNECT LOWER CABLE (B18) CONNECTORS

a. Connect R3.BU1-6(X8), R3.BU1-3(X9), & R3.BU4-6(X10) to the brake release unit (S64). Mount the unit into housing (S21) and secure with screws (S65).

b. Connect R2.SMB1(X2) to the signal measuring board on the measure card unit (S10). Mount the unit (S10) with screws (S12).

c. Connect R2.MP1, R2.MP2, R2.MP3, R2.MP4, R2.MP5-6, R2.FAN (if equipped), R2.CP (if equipped), R2.CS (if equipped).

6. CONNECT EARTH WIRE TO CONTACT PLATE IN BASE HOUSING (B24).

7. **MOUNT LOWER CABLE (B18) MOUNTING PLATE TO BASE HOUSING (B24):**
   a. Position lower cable (B18) mounting plate over access hole at left rear of base housing (B24).
   b. Insert screws (B1) thorough cable protector (B2) and lower cable (B18) mounting plate. Tighten screws.
8. **INSTALL COVER (B9) WITH SCREWS (B8)**
9. **INSTALL COVER (S43) WITH SCREWS (S42)**
10. **CALIBRATE AXES as outlined in Section 11**

UPPER CABLE (U14) Removal

REFERENCE DRAWINGS

Exploded Views:

"S" (pg 10-12, 12-2)
"U" (pg 10-13, 12-4)
"W" (pg 10-14, 12-5)
"F" (pg 10-15, 12-6)

Assemblies:

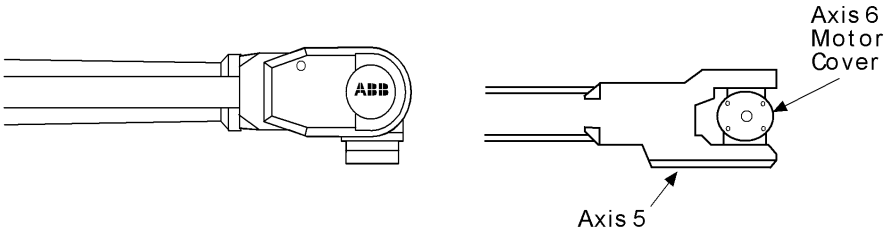
3HAA 0001-AAH (pg 13-13)
3HAB 4163-2 (pg 13-23)
3HAA 0001-AAS (pg 14-A)
3HAA 0001-ACA (pg 14-D)
3HAB 4254-2 (pg 14-J)

REQUIRED TOOLS

Hand Tools

1. **POSITION ROBOT WHERE THE BALANCE WEIGHT IS RAISED UP AND OUT OF THE WAY OF ACCESS TO THE REAR OF SHOULDER FRAME HOUSING (S21). MOVE AXIS 5 TO ACCESS COVER.**

2. **MOVE AXIS 5 TO ACCESS COVER OF MOTOR 6**



3. **TURN OFF ALL ELECTRICAL POWER TO ROBOT AND LOCK IT IN THE OFF POSITION.**

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION

4. **DISCONNECT CABLE CONNECTORS IN FRAME HOUSING (S21)**
   a. Remove screws (S42) and cover (S43).
   b. Disconnect connectors (R2.MP4), (R2.MP5-6),[optional (R2.CP), & (R2.CS)].

5. **DISCONNECT CONNECTOR ON SIGNAL MEASURE BOARD**
   a. Remove screws (S12).
   b. Pull measuring card unit (S10) out.
   c. Disconnect R2.SMB3-6(X5) from signal measuring board.

6. **UNCOUPLE CUSTOMER AIR HOSE by accessing clamp through measuring card unit (S10) opening**

7. **LOOSEN SMALL COVERS HOLDING CABLES TO COVER (S6). CAREFULLY FEED CABLES UP AND OUT OF FRAME HOUSING (S21) THROUGH THE THREE HOLES IN COVER (S6).**

8. **REMOVE CABLE TUBE HOLDER (U53)**
   a. Remove screws (U49) and washers (U50).
   b. Remove cover (U51).
   c. Remove screws (U52).
   d. Remove cable tube holder (U53).

9. **DISCONNECT MOTOR (U83) CONNECTORS R3.FB4 & R3.MP4 AT MOTOR.**

10. **DETACH UPPER CABLE (U14) CLAMPS**
    a. Detach upper cable (U14) clamps at lower arm (L17). Leave clamp clamped to cable to maintain location.
    b. Detach upper cable (U14) clamp at housing (U61). Leave clamp clamped to cable to maintain location.
    c. Detach any cable straps holding cables to robot.

11. **REMOVE CABLE ACCESS COVERS**
    a. Remove screw (U4) and cover (U5).
    b. Remove screws (U6), cover (U7), and gasket (U9).
    c. Remove screws (F7), washers (F8), and cover (F9). Cover is sealed to motor (F10) and must be carefully pulled or pried off.
    d. Remove screws holding cable pit on motor (F10) to loosen right-angle channel so cable connectors can be pulled through later.

12. **DISCONNECT MOTOR (F10) CONNECTORS**
    a. Disconnect motor connectors R4.MP6, R4.FB6, and R4.PTC6 at rear of motor (F10).
    b. Pull cable and connectors through right angle channel.
    c. Remove screws (U16) and (U17) to free cable mounting.

13. **DISCONNECT ANY AIR CONNECTION & CUSTOMER CONNECTORS (R3.CP) (R3.CS) ON RIGHT SIDE OF TUBE SHAFT (U19), USUALLY MOUNTED ON OR BEHIND COVERS (U28) AND (U33).**

14. **REMOVE SCREWS (U15). REMOVE ANGLE BRACKET HOLDING CABLE JUNCTION BOX.**

15. **DISCONNECT MOTOR (W52) CONNECTORS**
    a. Pull upper cable junction box backwards and reach inside tube shaft to disconnect axis 5 connectors R4.MP5 & R4.FB5 from rear of motor (W52).

16. **PULL UPPER END OF CABLE (U14) OUT THROUGH BACK OF TUBE SHAFT (U19) AND AT SAME TIME FEED LOWER END OF CABLE (U14) UP FROM LOWER ARM FRAME (L17).**

17. **LAY CABLE OUT FULL LENGTH IN A SAFE PLACE**

UPPER CABLE (U14) Installation

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION

REFERENCE DRAWINGS

Exploded Views:
- "S" (pg 10-12, 12-2)
- "U" (pg 10-13, 12-4)
- "W" (pg 10-14, 12-5)
- "F" (pg 10-15, 12-6)

Assemblies:
- 3HAA 0001-AAH (pg 13-13)
- 3HAB 4163-2 (pg 13-23)
- 3HAA 0001-AAS (pg 14-A)
- 3HAA 0001-ACA (pg 14-D)
- 3HAB 4254-2 (pg 14-J)

REQUIRED TOOLS

Hand Tools

1. INSERT UPPER CABLE (U14)

a. Carefully feed upper part of upper cable (U14) into rear of tube shaft (U19).

b. At same time feed lower part of upper cable (U14) under housing (U61) and down through lower arm (L17).

c. Adjust cable clamps to mounting position under housing (U61) and inside front lower arm frame (L17). Do not actually mount clamps at this time.

2. CONNECT MOTOR (W52) CONNECTORS

a. Reach inside tube shaft at left side and connect connectors R4.MP5 and R4.FB5 to rear of motor (W52).

3. CONNECT MOTOR (F10) CONNECTORS

a. Mount cable bracket with screws (U17) and (U18).

b. Push cable and connectors through right angle channel.

c. Connect connectors R4.MP6, R4.FB6, & R4.PTC6 at rear of motor (F10).

4. MOUNT CABLE ANGLE BRACKET FOR JUNCTION BOX WITH SCREWS (U15).

5. CONNECT AIR CONNECTION & CUSTOMER CONNECTORS (R3.CP) (R3.CS) ON RIGHT SIDE OF TUBE SHAFT (U19), IF SO EQUIPPED

6. INSTALL CABLE ACCESS COVERS

a. Mount right angle channel over cable pit on motor (F10). Use sealant (F28). Mounting must be liquid tight.

b. Mount cover (F9) with screws (F7) and washers (F8). Use sealant (F28). Mounting must be liquid tight.

c. Install cover (U7) and gasket (U9) with screws (U6) and sealant (U8). Joint must be liquid tight.

d. Install cover (U5) with screws (U4).

7. **INSTALL CABLE HOLDER (U53)**
    a. Set cable holder in place and over cable tube.
    b. Insert screws (U52) and tighten in place.
    c. Set cover (U51) in place and secure with screws (U49) and washers (U50).

8. **FEED THE THREE SMALL COVERS THROUGH THE SMALL HOLES IN COVER (S6). FASTEN THE THREE SMALL COVERS TO COVER (S6).**

9. **FASTEN UPPER CABLE (U14) CLAMPS**
    a. Fasten upper cable (U14) clamp under housing (U61).
    b. Fasten upper cable (U14) clamp inside lower arm housing (L17).

10. **CONNECT CABLES AT MOTOR (U83)**
    a. Connect connector R3.FB4 at rear of motor (U83).
    b. Connect connector R3.MP4 at rear of motor (U83).

11. **CONNECT CUSTOMER AIR HOSE by accessing clamp through measuring card unit (S10) opening**

12. **CONNECT CONNECTOR (R2.SMB3-6(X5) ON SIGNAL MEASURING BOARD.**
    a. Connect connector R2.SMB3-6 (X5) to sigmal measuring board in the measuring card unit (S10).
    b. Mount measuring card unit (S10) in place with screws (S12).

13. **CONNECT CABLE (U14) CONNECTORS IN FRAME HOUSING (S21)**
    a. Connect connectors (R2.MP4), (R2.MP5-6), (R2.CP), & (R2.CS).
    b. Set cover (S43) in place and secure with screws (S42)

14. **CALIBRATE AXES as outlined in Section 11**

AXIS 6 MOTOR (F10) CABLE Removal

REFERENCE DRAWINGS

Exploded Views:

"U" (pg 10-13, 12-4)
"F" (pg 10-15, 12-6)

Assemblies:

3HAA 0001-GX (pg 13-18)
3HAA 0001-AAH (pg 13-13)
3HAB 4163-2 (pg 13-22)
3HAA 0001-AAS (pg 14-A)
3HAA 0001-ACA (pg 14-D)
3HAB 4254-2 (pg 14-J)

REQUIRED TOOLS

Hand Tools

1. **POSITION ROBOT TO BEST ACCESS WRIST (U10) CABLING.**
2. **TURN ELECTRICAL DISCONNECT SWITCH OFF AND LOCK IT IN THE OFF POSITION.**

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

3. **REMOVE SCREWS (U6), COVER (U7), AND GASKET (U9).**
4. **REMOVE SCREWS (U4) AND COVER (U5).**
5. **REMOVE SCREWS (F7), WASHERS (F8), AND COVER (F9). COVER IS SEALED TO MOTOR (F10) AND MUST BE CAREFULLY PULLED OFF WITH A GEAR PULLER. USE THREADED HOLE IN CENTER OF COVER.**
6. **REMOVE SCREWS HOLDING ANGLE CHANNEL COVERING CABLE PIT ON MOTOR (F10) SO CABLE CONNECTORS CAN MORE EASILY BE PULLED THROUGH WHEN DISCONNECTED**
7. **REMOVE SCREWS (U16) AND (U17) TO DISCONNECT CABLE CARRIER FROM WRIST ASSEMBLY (U10)**
8. **REMOVE AXIS 6 CABLING:**
   a. Remove cover from cable junction box inside opening on left side of tube (U19) and disconnect connectors R3.MP6 and R3.FB6. It may be necessary to loosen junction box mounting screws (U15) to be able to move junction box around a little.
   b. Disconnect connectors R4.MP6, R4.FB6, and R4.PTC6 at rear of motor (F10). Pull connectors at motor through loosened angle channel.
   c. Remove wrist cable and lay it out in a safe place.

AXIS 6 MOTOR (F10) CABLE Installation

WARNING! BE SURE ELECTRICAL DISCONNECT SWITCH IS OFF AND LOCKED IN OFF POSITION!

REFERENCE DRAWINGS

Exploded Views:

"U" (pg 10-13, 12-4)
"F" (pg 10-15, 12-6)

Assemblies:

3HAA 0001-GX (pg 13-18)
3HAA 0001-AAH (pg 13-13)
3HAB 4163-2 (pg 13-22)
3HAA 0001-AAS (pg 14-A)
3HAA 0001-ACA (pg 14-D)
3HAB 4254-2 (pg 14-J)

REQUIRED TOOLS

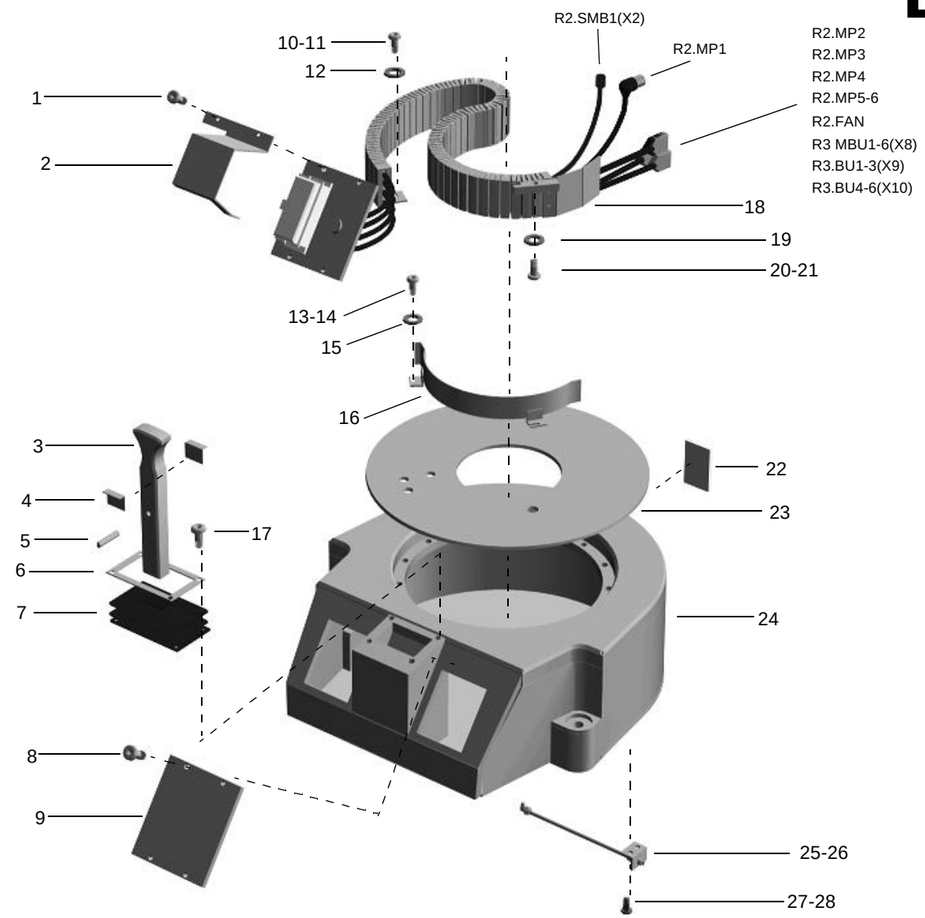
Hand Tools

1. **POSITION AXIS 6 CABLING FOR INSTALLATION.**
   a. Lay cable along tube (U19) and in position for installation.
   b. Thread connectors through angle channel at rear of motor (F10). Connect connectors R4.MP6, R4.FB6, & R4.PTC6.
   c. Connect connectors R3.MP6 & R3.FB6 inside junction box, inside left side of tube (U19). Mount cover to junction box. Ttighten screws (U15), if loosened when cable was removed.
2. **CONNECT CABLE CARRIER TO WRIST ASSEMBLY (U10) WITH SCREWS (U16) AND (U17).**
3. **INSTALL ANGLE CHANNEL OVER CABLE PIT ON MOTOR (F10). USE SEALANT (F28). BE SURE JOINT IS LIQUID TIGHT**
4. **INSTALL COVER (F9) WITH SCREWS (F7) AND WASHERS (F8). USE SEALANT (F28). BE SURE JOINT IS LIQUID TIGHT**
5. **INSTALL COVER (U7) AND GASKET (U9) WITH SCREWS (U6). USE SEALANT (U8). BE SURE JOINT IS LIQUID TIGHT**
6. **INSTALL COVER (U5) WITH SCREWS (U4).**
7. **CALIBRATE AXES as outlined in Section 11**

BASE . . .
including Lower Cable

ITEM	QTY.	DESCRIPTION	ABB PART NO
1	4	Screw - M6x20	2121 2411-370
2	1	Cable Protector	3HAA 1001-718
3	1	Stop Shaft	3HAB 4082-1
4	2	Angle	3HAA 1001-154
5	1	Roll Pin	2111 2835-389
6	1	Bellows Plate	3HAA 1001-136
7	1	Bellows	3HAA 1001-135
8	4	Screw - M6x20	2121 2411-370
9	1	Cover	3HAA 1001-700
-	1	Nipple (If used)	2524 0256-1
-	1	Protective Hood (if used)	2522 2101-15
10	2	Screw - M6x16	2121 2416-368
11	-	Loctite 242	1209 0014-410
12	2	Washer - 6.4x12x1.6	3151 2062-153
13	2	Screw - M6x16	2121 2416-368
14	-	Loctite 242	1269 0014-410
15	2	Washer - 6.4x12x1.6	2151 2062-153
16	1	Cable Guide Rail	3HAA 1001-691
17	4	Screw - M6x8	2121 2416-368
18	1	Lower Cable Assembly:	
		without cust connect.	3HAB 4248-1
		with cust. connection & S/2.9-120	3HAB 4249-1
-	1	Earth sign	2940 0412-1
-	1	Screw - M6x20	2121 2411-370
-	1	Washer - 6.4x12x1.6	2151 2062-153
19	2	Washer - 8.4x16x1.6	2151 2062-165
20	2	Screw - M8x40 8.8	2121 2519-459
21	-	Loctite 242	1269 0014-410
22	3	WARNING Label	3HAA 0001-SL
23	1	Frictionless Plate	3HAA 1001-695
24	1	Base Housing	3HAA 1001-653
25	1	Grease Tube Assembly	3HAA 1001-716
26	-	Loctite 577	1269 1907-1
27	2	Screw - M6x16	2121 2411-368
28	-	Loctite 577	1268 1907-1
		Base Sync Plate:	
-	1	Sync Bracket	3HAB 4135-1
-	1	Sync Plate	3HAA 1001-73
-	4	Screw - M4x8	2121 2411-287
-	1	Sync Plate	2155 0187-11
-	4	Washer - 4.3x9x0.8	2151 2062-136
-	1	Bracket	3HAA 1001-144
-	-	Loctite 242	1269 0014-410
		Protective Plate:	
-	1	Protective Plate	2155 0187-11
-	1	Screw	2121 0596-31

B



SHOULDER . . .
including Axes 1, 2, & 3 Drives

S

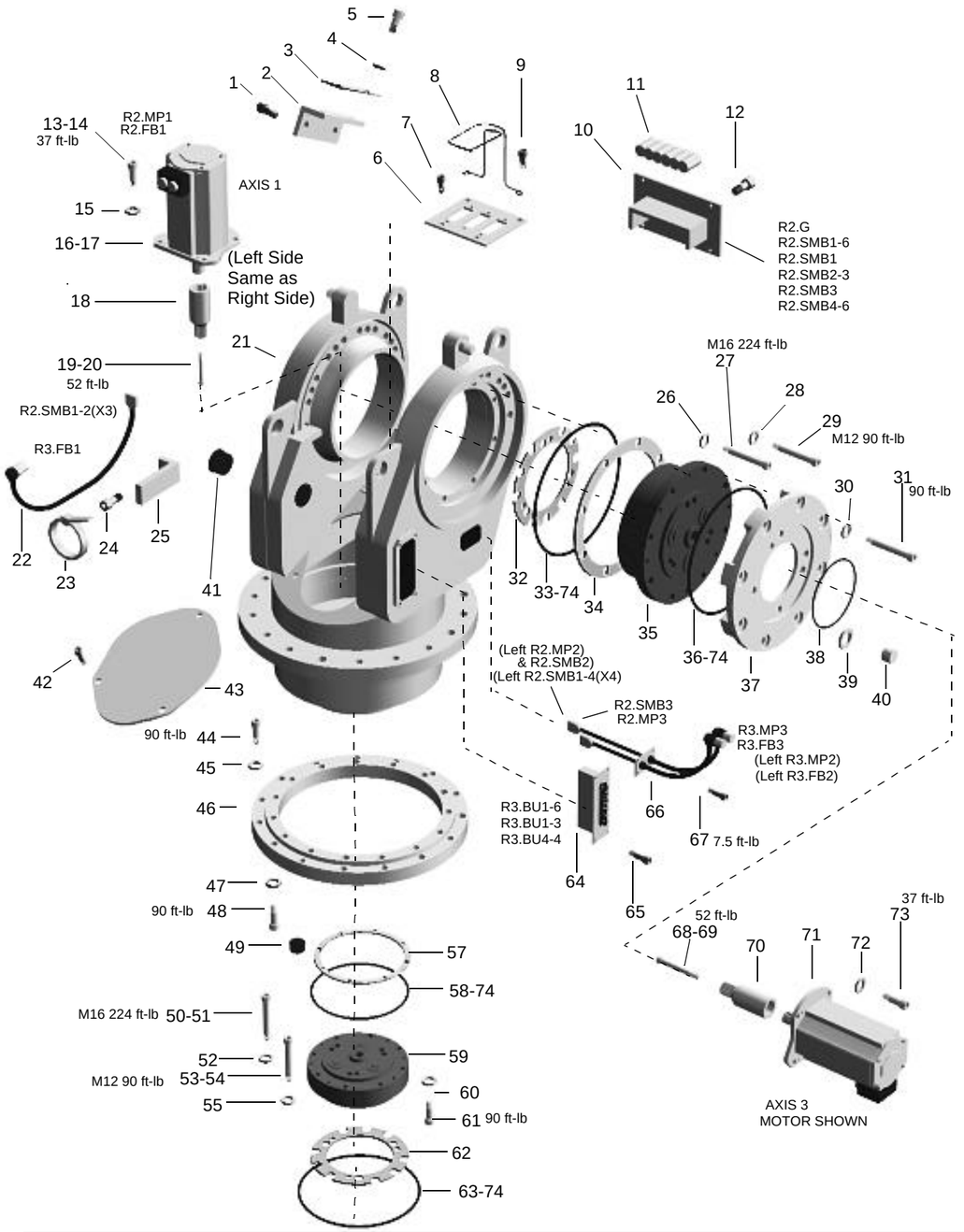
ITEM	QTY.	DESCRIPTION	ABB PART NO .
1	2	Screw - M6x12	2321 2416-366
2	1	Bracket	3HAA 1001-104
3	1	Sync. Plate	3HAA 1001-79
4	2	Washer - Plain 4.3x19x0.8	2151 2062-136
5	2	Screw - M4x6	2121 2416-285
6	1	Cover	3HAA 0001-ZK
7	2	Screw - M6x16 2.8	2121 2411-368
8	1	Cable Guide	3HAA 1001-721
9	2	Screw - M6x30	2121 2411-374
10	1	Measure Card Unit	3HAB 4259-1
-	1	Serial Measurement Board	3HAB 2213-1
11	1	Battery Pack	4944 026-4
12	4	Screw - M6x16 8.8	2121 2411-368
13	4	Screw - M10x25	2121 2519-493
14	-	Loctite 242	1269 0014-410
15	4	Washer - Plain 10.5x22x2	2151 2062-173
16	1	Motor - Axis 1	3HAB 4039-1
-	1	Motor - Axis 1 PE/2.25-75	EHAB 4043-1
17	-	Permatex 3	1236 0012-202
18	1	Pinion	(Incl. in item 59)
19	1	Screw - M10x100 12.9	3HAB 3409-62
20	-	Loctite 242	1269 0014-410
21	1	Frame Housing	3HAB 4150-1
22	1	Cable - Axis 1 Signal	3HAB 4250-1
23	7	Strap	2166 2055-3
24	1	Screw M6x16	2121 2411-368
25	1	Holder	3HAA 1001-668
26	6*	Washer - Spring	3HAA 1001-181
27	6*	Screw- M16x140 12.9	3HAB 3409-95
28	6*	Washer - 12.5x24x5.9	3HAA 1001-200
29	6*	Screw - M12x140 12.9	3HAB 3409-200
30	16*	Washer - Plain 13x21x2	3HAA 1001-632
31	16*	Screw - M12x80 12.9	3HAB 3409-74
32	2*	Friction Ring	3HAA 1001-613
33	2*	O-Ring - 234.54x3.53	2152 0431-17
34	2*	Friction Ring	3HAA 1001-616
35	2*	Reduction Gear RV-250A	3HAB 4080-1
36	2*	O-Ring 269.3x5.7	2152 2012-550
37	2*	Plate - Motor Socket	3HAB 4056-1
38	2*	O-Ring 124.5x3	2152 2012-437
39	4*	Washer 13.5x18x1.5	2152 0441-1
40	4*	Magnetic Plug 1/4”	2522 122-1
41	3	Cap	3HAA 1001-199
42	3	Screw M6x20	2121 2411-370
43	1	Cover	3HAA 0001-SZ
44	15	Screw - M12x70 12.9	3HAB 3409-73
45	15	Washer - Plain 13x24x2.5	3HAA 1001-632
46	1	Bearing	3HAA 1001-1
47	15	Washer - Plain 13x24x2.5	2551 2062-177
48	15	Screw - M12x70 12.9	3HAB 3409-73
49	1	Plug - KR 1/2”	2522 2021-113
50	3	Screw - M16x140 12.9	3HAB 3409-95
51	-	Loctite 577	1269 1907-1
52	3	Washer - Spring	3HAA 1001-181
53	3	Screw - M12x140 12.9	3HAB 3409-200
54	-	Loctite 577	1269 1907-1
55	3	Washer - Support	3HAA 1001-200

ITEM	QTY.	DESCRIPTION	ABB PART NO .
56	Ref	Installation Aid Tool	3HAB 1067-6
57	1	Friction Ring	3HAA 1001-614
58	1	O-Ring 245.0x3.0	2152 0431-15
59	1	Gear Reduction Unit	3HAB 4079-1
60	8	Washer - Plain 13x24x2.5	2551 2062-177
61	8	Screw - M12x90 12.9	3HAB 3409-75
62	1	Friction Ring	3HAA 1001-613
63	1	O-Ring 234.54x3.53	2152 0431-17
64	1	Brake Release Unit	3HAA 0001-ADY
65	4	Screw M6x16 8.8	2121 2411-368
66	1	Cable - Axis 2	3HAB 4252-1
	1	Cable - Axis 3	3HAA 0001-YY
67	4	Screw - M6x16	2121 2411-368
68	2*	Screw - M10x100 12.9	3HAB 3409-62
69	-*	Loctite 242	1269 0014-410
70	2*	Pinion	(Incl. in Item 35)
71	2*	Motor - Axis 2 & 3	3HAB 4040-1
-	2*	Motor - Axis 2&3 PE/2.25-75	3HAB 4226-1
72	4	Washer - Plain 10.5x22.2	2151 2062-173
73	4	Screw - M10x25 8.8	2121 2419-493
74	-	Lubricating Grease	1171 4012-201

* The left side drive components for Axis 2 are the same as the same as the right side drive components for Axis 3. Quantities shown are for both sides combined, Axis 2 plus Axis 3.

FORK LIFT BRACKETS (not shown on drawing)			
		2.4-120, 2.4-150, 2.8-120,3.0-75: Lifting Device Set Compl.	3HAA 0001-SY
	8	Screw - M16x60 8.8	2121 2518-632
	8	Washer - 17x30x3	3HAA 1001-186
	2	Lifting Bracket	3HAA 1001-257
	2	Lifting Bracket	3HAA 1001-258

		Axis 1 Complete :	
		No Cust. Connections	3HAB 4161-1
		With Cust. Connections	3HAB4161-2



UPPER ARM . . .
including Axis 4 Drive

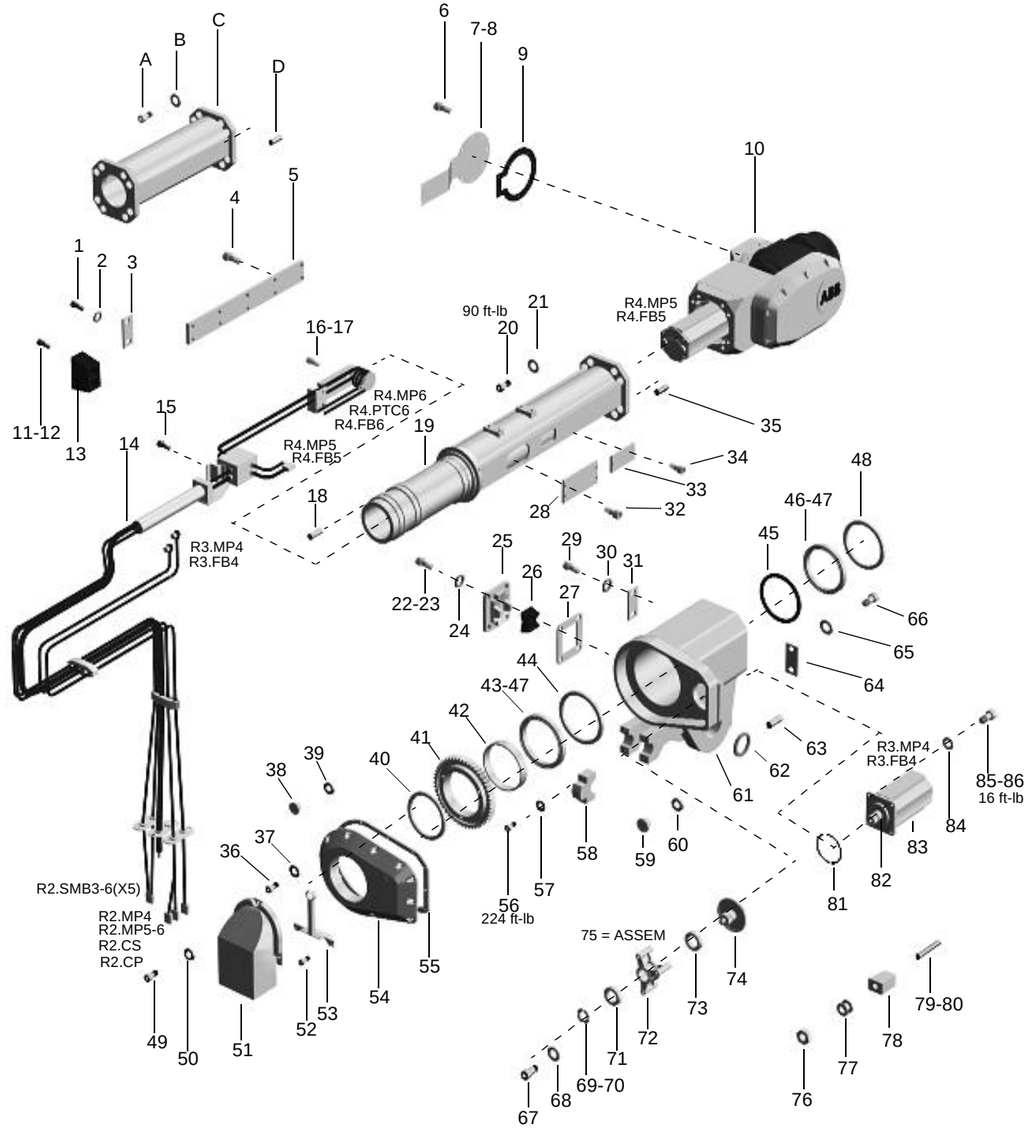
U

ITEM	QTY.	DESCRIPTION	ABB PART NO .
1	2	Screw	2121 2411-287
2	2	Washer	2151 2062-136
3	3	Sync. Plate - Axis 4	3HAA 1001-76
4	4	Screw	2121 2411-368
5	1	Cover - 2.8-120, S/2.9-20	3HAA 1001-302
	1	Cover - 3.0-75	3HAA 1001-305
6	7	Screw	2121 2411-368
7	1	Cover	3HAA 1001-500
8	-	Sealant	1236 0012-227
9	1	Gasket	3HAA 1001-166
10	1	Wrist Assy.- 120 kg. Elmo	3HAB 4196-1
	1	Wrist Assy.- 120 kg. Siemens	3HAB 4590-1
	1	Wrist Assy.- 150 kg. Elmo	3HAB 4196-2
	1	Wrist Assy.- 150 kg. Siemens	3HAA 0001-ABR
11	2	Screw	2121 1519-536
12	-	Loctite 242	1269 0014-410
13	1	Stop - Axis 4	3HAA 1001-102
14	1	Upper Cable Complete:	3HAB 4165-3
		With Cust. Connections	3HAB4165-3
		S/2.9-120	3HAB 4183-2
		PE /2.25-75	3HAB 4483-2
15	2	Screw - M6x30	2121 2411-374
16	2	Screw - M6x16	2121 2411-368
17	2	Screw - M4x12	2121 2411-291
18	1	Protecting Plug	2522 726-4
19	1	Upper Arm Tube Shaft	3HAB 4452-1
		Upper Arm - PE/2.25-75	3HAB 4453-1
20	8	Screw	3HAB 3409-69
21	8	Washer	3HAB 1001-134
22	4	Screw	2121 2519-453
23	-	Loctite 242	1269 0014-410
24	4	Washer	2151 2062-165
25	1	Stop - Axis 4	3HAA 1001-17
26	1	Damper	3HAA 1001-100
27	1	Gasket	3HAA 1001-98
28	1	Cover	3HAA 1001-719
29	2	Screw	2121 2411-287
30	2	Washer	2151 2062-136
31	1	Sync. Plate	3HAA 1001-79
32	4	Screw	2121 2411-366
33	1	Cover	3HAA 1001-161
34	2	Screw	2121 2411-372
35	1	Roll Pin	2111 2835-416
36	12	Screw	2121 2411-370
37	12	Washer	2154 2022-4
38	1	Magnetic Plug	2522 0122-1
39	1	Washer	2152 0441-1
40	1	Seal Ring	3HAA 1001-628
41	1	Gear	3HAA 1001-24
42	1	Spacer	3HAA 1001-103
43	1	Bearing	2213 0253-5
44	1	Seal Ring	2216 0261-18
45	1	Seal	2216 0086-4
46	1	Bearing	2213 0253-5
47	-	Grease	1171 4013-301
48	1	Seal	3HAB 4217-1
49	3	Screw	2121 2411-368
50	3	Washer	2151 2062-153
51	1	Cover	3HAA 1001-176
52	2	Screw	2121 2411-368

ITEM	QTY.	DESCRIPTION	ABB PART NO .
53	1	Cable Holder	3HAA 1001-201
54	1	Cover	3HAA 1001-33
55	1	Gasket	3HAA 1001-97
56	4	Screw	2121 2518-634
57	4	Washer	2151 2062-185
58	2	Clamp	3HAA 1001-13
59	1	Magnetic Plug	2522 0122-1
60	1	Washer	2152 0441-1
61	1	Housing	3HAA 0001-AA
62	2	Support Ring	3HAA 1001-124
63	2	Set Screw - M10	2122 2719-401
64	1	Sync.Plate Axis 3	3HAA 1001-75
65	2	Washer	2151 2062-136
66	2	Screw	2121 2411-287
67	3	Screw	3HAB 3409-62
68	3	Washer	2151 2062-173
69	1	Nut (in Item 73)	2126 2851-104
70	-	Loctite 242 (in Item 73)	1269 0014-410
71	1	Bearing (in Item 73)	3HAA 1001-129
72	1	Hub Axis 4 (in Item 73)	3HAA 1001-16
73	-	Bearing	2213 3802-11
74	1	Gear Unit	3HAA 0001-M
75	1	Intermediate Wheel Assem.	3HAA 0001-AN
76	13	Nut	2126 2011-117
77	6	Spring Washers	2154 2033-9
78	3	Wedge	3HAA 1001-99
79	3	Stud	2122 2011-465
80	-	Loctite 601	1269 0014-407
81	1	O-Ring	2152 2012-430
82	1	Pinion	3HAA 1001-21
83	1	Motor - 120 kg. Elmo	3HAB 4041-1
	1	Motor - 120 kg. Siemens	3HAB 4584-1
	1	Motor - 150 kg. Elmo	3HAB 4044-1
	1	Motor - 150 kg. Siemens	3HAA 1001-ZH
84	4	Washer	2151 2062-165
85	4	Screw	2121 2519-453
86	-	Loctite 242	1269 0014-410

A	8	Screw	3HAB 3409-69
B	8	Washer	3HAA 1001-134
C	1	Extension:	
		2.8-120, S/2.9-120	3HAA 1001-301
		3.0-75	3HAA 1001-304
D	1	Roll Pin	2111 2835-416

120 kg:	Upper Arm Assy.	
	2.4 - Elmo	3HAB 4194-1
	2.4 - Siemens	3HAB 4591-1
	2.8 - Elmo	3HAB 4194-3
	2.8 - Siemens	3HAB 4592-1
	S/2.9	3HAB 4194-3
	Drive Unit Assy. - Elmo	3HAB 4195-1
	Drive Unit Assy. - Siemens	3HAB 4585-1
150 kg:	Upper Arm Assy. - Elmo	3HAB 4194-2
	Upper Arm Assy. - Siemens	3HAA 0001-AAE
	Drive Unit Assy. - Elmo	3HAB 4195-2
	Drive Unit Assy. - Siemens	3HAA 0001-ABN
3.0-75	Upper Arm Assy. - Elmo	3HAB 4194-4
	Upper Arm Assy. - Siemens	3HAB 4593-1



WRIST . . .
including Axis 5 Drive

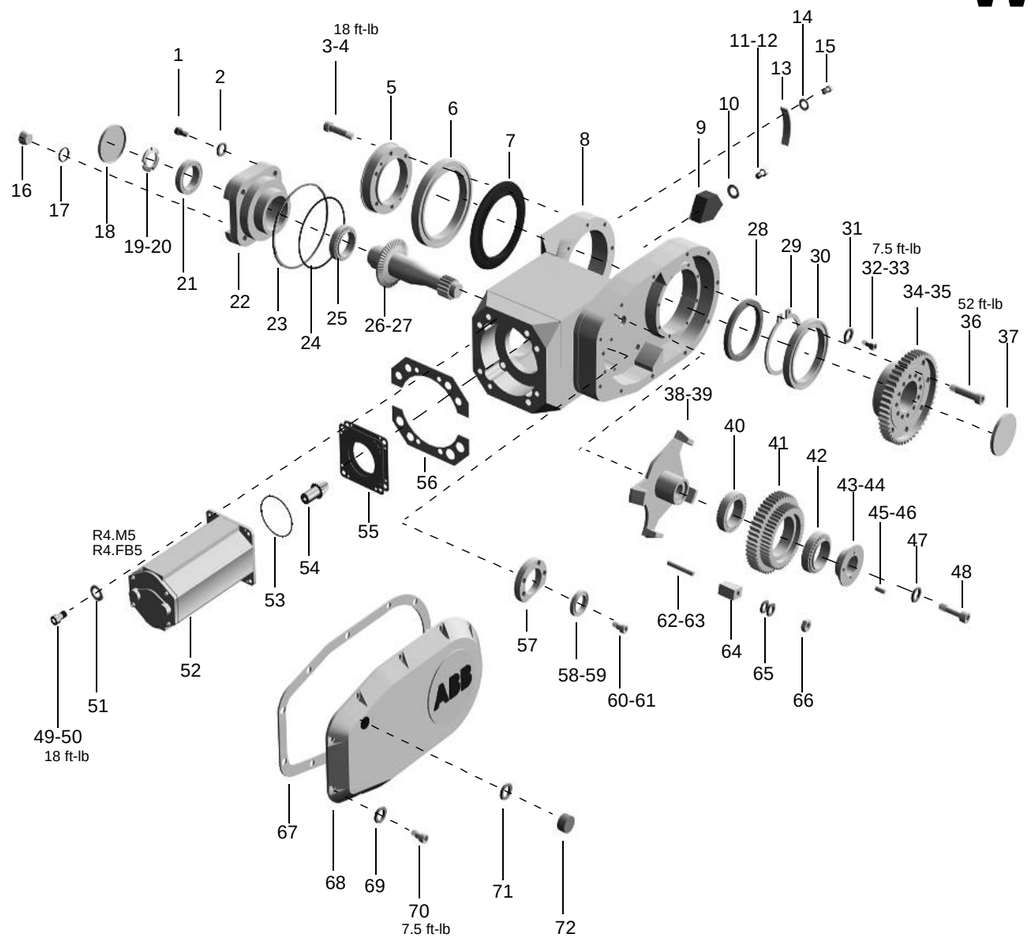
W

ITEM	QTY.	DESCRIPTION	ABB PART NO .
1	4	Screw - M10x25 12.9	3HAB 3409-50
2	4	Washer - 11x17x2	3HAB 4233-1
3	6	Screw - M8x30	2121 2519-455
4	-	Loctite 242	1269 0014-410
5	1	Bearing Retainer	3HAA 1001-107
6	1	Bearing	3HAA 1001-132
7	1	Spacer	3HAA 1001-108
8	1	Wrist Housing	3HAA 1001-35
9	2	Damper Axis 5	3HAA 1001-101
10	2	Washer - 6.4x12x1.6	2151 2062-153
11	2	Screw - M6x20	2121 2411-370
12	-	Loctite 242	1269 0014-410
13	1	Sync. Plate	3HAA 1001-79
14	2	Washer - 4.3x9x0.8	2151 2062-136
15	2	Screw - M4x8	2121 2411-287
16	1	Magnetic Plug	2522 122-1
17	1	Washer - 13.5x18x1.5	2152 0441-1
18		Cover	3HAA 2166-11
19	1	Lock Nut	2126 2851-108
20	-	Loctite 290	1269 0014-409
21	1	Bearing	3HAA 1001-162
22	1	Bearing Housing	3HAA 1001-41
23	1	Shim Set	3HAA 0001-AF
24	1	O-Ring	2152 2011-529
25	1	Bearing	3HAA 1001-168
26	1	Gear Axis 5	3HAA 0001-AO
27	1	Gear Axis 5 Assem.	3HAA 0001-AG
28	1	Seal	3HAB 4409-1
29	1	Retaining Ring	2154 2226-171
30	1	Bearing	2213 253-21
31	8	Washer - 6.4x15x3	3HAA 1001-106
32	8	Screw	2121 2411-370
33	-	Loctite 242	1269 0014-410
34	1	Gear Axis 5	3HAA 1001-262
35	1	Gear Axis 5 Assem.	3HAA 0001-HA
36	1	Screw - M10x60 12.9	3HAB 3409-57
37	1	Cover Lid	2158 0399-4
38	1	Intermediate Gear Hub	3HAA 1001-39
39	1	Intermediate Gear Assem.	3HAA 0001-GY
40	1	Bearing	3HAA 1001-130
41	1	Gear	3HAA 0001-E
42	1	Bearing	3HAA 1001-130
43	1	Nut	3HAA 1001-109
44	-	Loctite 290	1269 0014-409
45	1	Set Screw	2122 2711-287
46	-	Loctite 242	1269 0014-410
47	1	Washer - 16.5x25x4	3HAA 1001-267
48	1	Screw - M16x60	3HAA 1001-266
49	4	Screw - M8x30	2121 2519-455
50	-	Loctite 242	1269 0014-410
51	4	Washer	2151 2062-165
52	1	Motor	(see NOTE)
53	1	O-Ring	2152 2012-430
54	1	Pinion	(see NOTE)
55	1	Shim Set	3HAA 0001-AE
56		Friction Washer Insert	3HAA 1001-297
57	1	Bearing Support	3HAA 1001-271
58	1	Bearing	3HAA 1001-131
59	-	Loctite 601	1269 0014-407
60	4	Screw - M8x25	2121 2519-453

ITEM	QTY.	DESCRIPTION	ABB PART NO .
61	-	Loctite 242	1269 0014-410
62	4	Stud - M8x70	2122 2011-465
63	-	Loctite 242	1269 0014-410
64	4	Wedge	3HAA 1001-99
65	8	Tension Washer	2154 2033-9
66	4	Nut - M8	2126 2011-117
67	1	Gasket	3HAA 1001-112
68	1	Cover	3HAA 1001-276
69	11	Washer - Spring 6.4 FZB	2154 2022-4
70	11	Screw - M6x20	2121 2411-370
71	1	Magnetic Plug 1/4”	2522 122-1
72	1	Washer - 13.5x18x1.5	2152 0441-1
73	-	Loctite 242	1269 0014-410
74	-	Gear Oil	1171 2016-604

NOTE:

120kg:			
		Wrist Unit - Elmo	3HAB 4196-1
		Wrist Unit - Siemens	3HAB 4590-1
		Wrist Unit - Foundry	3HAB 4506-1
		Drive Unit - Axis 5 Elmo	3HAB 4171-1
		Drive Unit - Axis 5 Siemens	3HAB 4586-1
52	1	Motor - Elmo	3HAB 4041-1
52	1	Motor - Siemens	3HAB 4584-1
54	1	Pinion (part of item 27)	3HAA 1001-58
150 kg:			
		Wrist Unit 150 kg Elmo	3HAB 4196-2
		Wrist Unit 150 kg Siemens	3HAA 0001-ABR
		Wrist Unit 150 kg Foundry	3HAB 4506-2
		Drive Unit - Axis 5 Elmo	3HAB 4171-1
		Drive Unit - Axis 5 Siemens	3HAA 0001-ABU
52	1	Motor - Elmo	3HAB 4044-1
52	1	Motor - Siemens	3HAA 0001-ZH
54	1	Pinion (part of item 27)	3HAA 1001-58

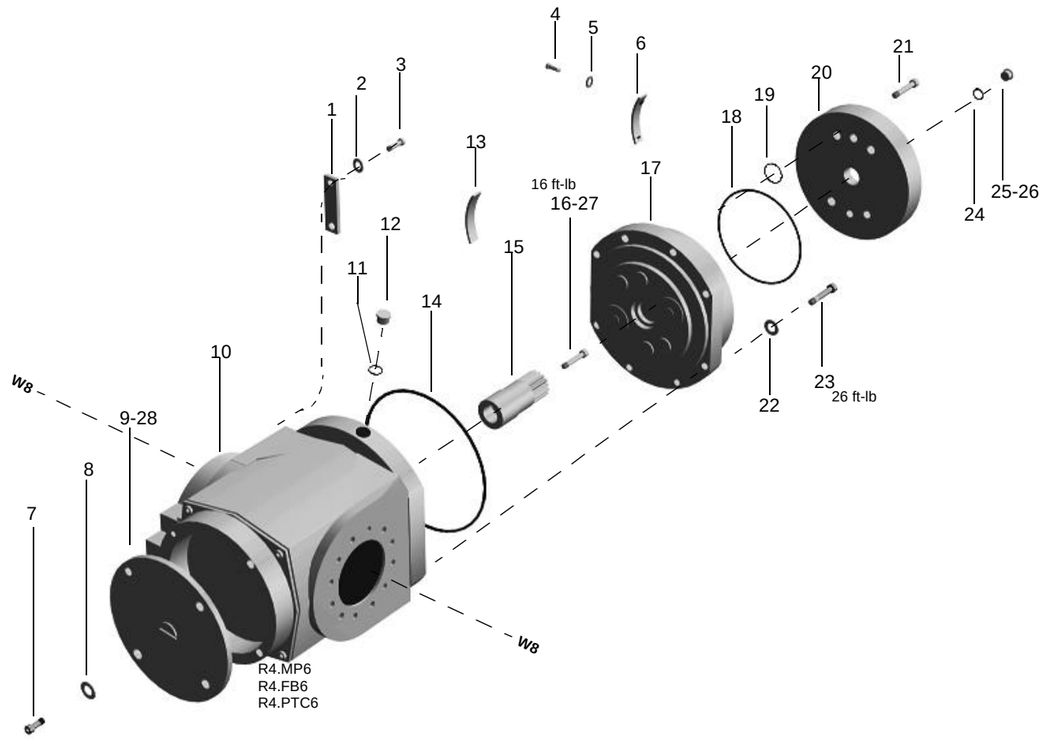


FACE . . .
including Axis 6 Drive

ITEM	QTY.	DESCRIPTION	ABB PART NO
1	1	Sync. Plate Axis 5	3HAA 1001-77
2	2	Washer - 4.3X9X0.8	2151 2062-136
3	2	Screw - M4x8	2121 2411-287
4	2	Screw - M4x8	2121 2411-287
5	2	Washer - 4.3x9x0.8	2151 2062-136
6	1	Sync. Plate Axis 6	3HAA 1001-78
7	4	Screw	(incl. in item 10)
8	4	Washer	(incl. in item 10)
9	1	Cover	(incl. in item 10)
10	1	Motor - Elmo	3HAB 4042-1
	1	Motor - Siemens	3HAA 0001-XK
		Drove Unit - Elmo	3HAB 4172-1
		Drive Unit - Siements	EHAA 0001-ABU
11	1	Washer - 13.5x18x1.5	2152 0441-1
12	1	Magnetic Plug - R 1/4”	2522 0122-1
13	1	Sync. Plate	3HAA 1001-174
14	1	O-Ring - 151.99x3.53	2152 0431-12
15	1	Input Pinion Gear	3HAA 1001-522
16	1	Screw	2121 2519-341
17	1	Reduction Gear	3HAA 0001-HJ

ITEM	QTY.	DESCRIPTION	ABB PART NO
18	1	O-Ring	2151 0431-21
19	1	O-Ring	2152 0431-20
20	1	Flange	3HAA 1001-222
21	6	Screw	2121 2518-577
22	8	Washer - 8.4x13x1.5	3HAA 1001-172
23	8	Screw - M8x40	3HAB 3409-40
24	1	Washer	(ref.)
25	1	Plug	(ref.)
26	-	Grease	3HAA 1001-294
27	-	Loctite 242	1290 0014-410
28	-	Sealant	1236 0012-227

F



SECTION 11

Robot Calibration

ROBOT CALIBRATION

Table of Contents

NOTES

Calibration Procedures

Overview

The IRB 6400 measurement system consists of one resolver for each axis connected to a SMB (serial measurement board). The resolvers provide an analog voltage corresponding to the resolvers rotated position. Then the SMB converts this analog voltage to a digital signal and sends the information serially to the robot computer board. The serial measurement board also keeps track of the current resolver revolution count. To keep track of these revolution counts even when power is turned off the SMB has a rechargeable battery attached to it. When a new machine is shipped from the factory this battery may not be charged. The control must be connected to the robot and with the main disconnect turned on it takes 18 hours to fully charge this battery and it should maintain a charge for approximately 1000 hours. If this battery loses its charge an error *"20032 Rev counter not updated"* will be given after a power outage.

When the robots are assembled they are accurately calibrated using digital levels and calibration fixturing. The calibration values are recorded on a paper stuck to the robots casting next to the axis 1 motor and they are also saved on the "Boot Disk 4" which is shipped with each robot.

In this chapter four calibration procedures will be discussed. They are:

— Rough resolver calibration procedure.
— Manually entering calibration values.
— Precision resolver calibration procedure.
— Counter updating procedures.

Each procedures purpose and when it should be used is explained in each procedure.

"Rough" Resolver Calibration Procedure

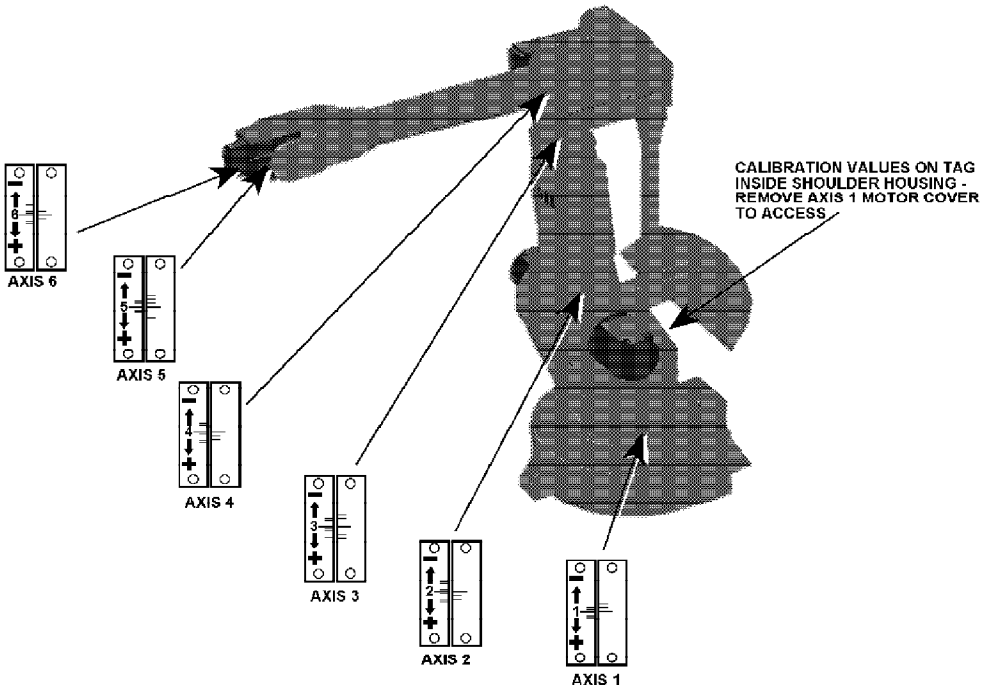
The only time that the resolvers should be calibrated using this method is when the resolver has been mechanically disassembled from the mechanical unit. (Such as if a motor is removed.)

The term “rough” resolver calibration is used to indicate that this is not the most accurate way to calibrate the resolvers. However it is the easiest and fastest way to calibrate the resolvers in most cases. After performing this procedure program touch up may be required.

NOTE: If your application can not tolerate this rough calibration then you may want to use the precision resolver calibration procedure in this chapter.

1. Move the axis (by using the joystick) to be calibrated to the calibration position. The more accurate this is done the better the calibration will work. The calibration position is shown in the figure below.

   There are calibration plates mounted on each axis to indicate when the robot is at its calibration position.

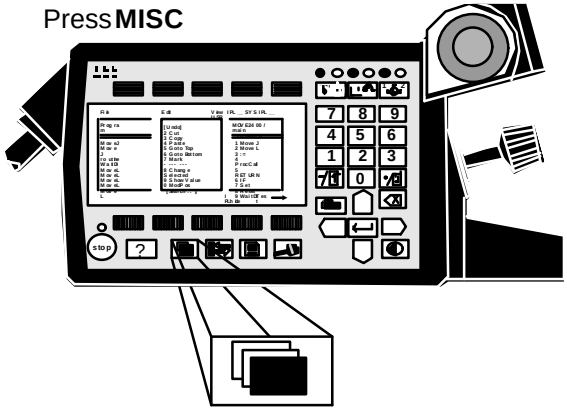


NOTE: If Axis 3 is to be moved to its calibration position you must move Axis 2 to its calibration position first.

Rough Resolver Calibration Procedure (Cont)

2. After the axis has been moved to its calibration position the resolver value must be recorded. Release the enable device before continuing with this procedure. This is done on the teach pendant.

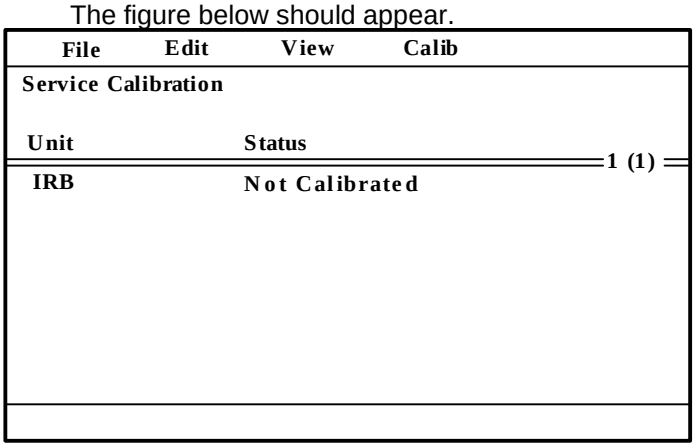
   Press **MISC**



   Select:

   SERVICE
   VIEW
   CALIBRATION.

   The figure below should appear.



   The calibration status will appear on the screen.

Rough Resolver Calibration Procedure (Cont)

The calibration status can be any of the following:

Synchronized - Indicates that there are calibration values for each axis and that the counters are updated. This does **NOT** necessarily mean that they are correct.

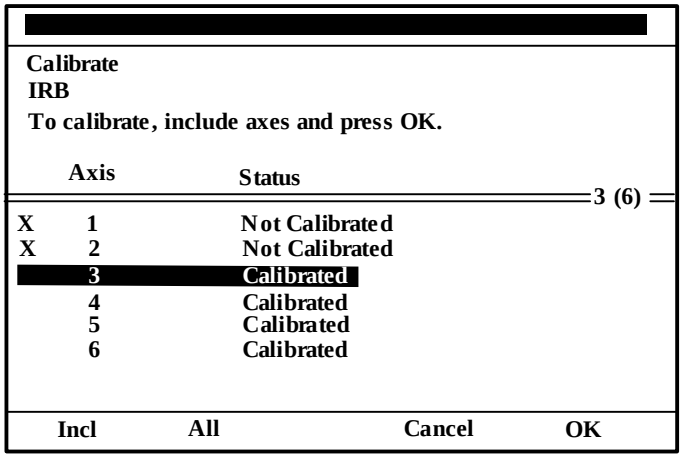
Not updated rev. counter - Indicates that one or more axis revolution counter is not updated.

Not calibrated - Indicates that one or more axis do not have calibration values stored.

3. Press:

   CALIB
   CALIBRATE

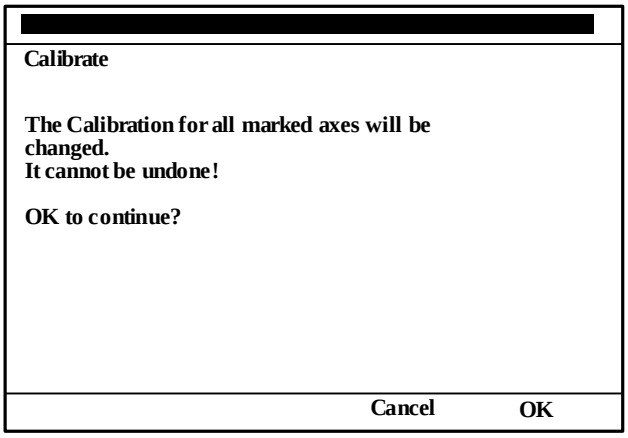
   The window below will appear.



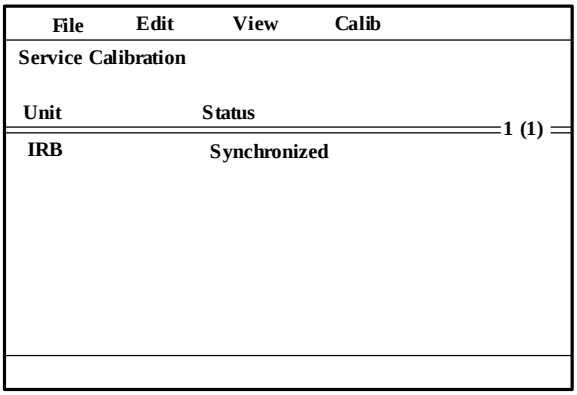
4. The "X" indicates chosen axes. Press the **ALL** function button to select all axis to be calibrated or move the cursor to the desired axis or axes and press **INCL** to include the axes to be calibrated.

Rough Resolver Calibration Procedure (Cont)

5. Press **OK.** The window below will appear.



6. After receiving the warning if you wish to continue press **OK** again.
   The following screen should appear.

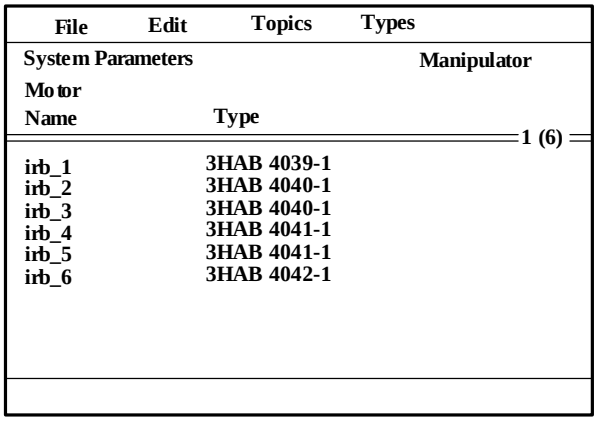


Rough Resolver Calibration Procedure (Cont)

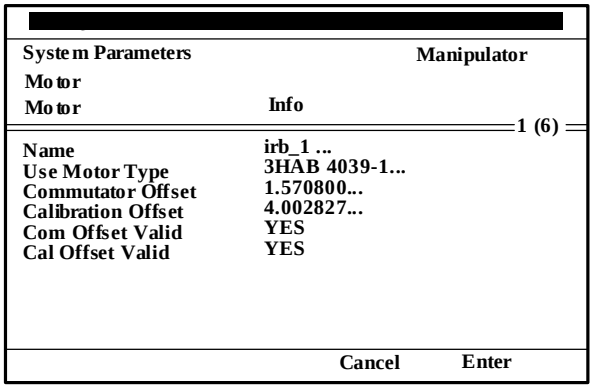
7. Now the calibration values need to be recorded on the paper in the Axis 1 casting.
   To see the new resolver values press:

   MISC
   SYSTEM PARAMETERS
   MANIPULATOR
   TYPES
   MOTOR

   You should see the screen below.



8. Then select the axis desired. See the screen below.



Rough Resolver Calibration Procedure (Cont)

9. The information shown is:

NAME	The name given to the axis (example: motor_1).
CAL OFFSET	The value of the resolver when it is at the calibration position. This value is in radians.
COM OFFSET	The commutation value for the motor. On the IRB 6400 this value is always `1.570800`. This value is in radians.
CAL OFFSET VALID	Confirmation that the calibration values are valid. This should be "YES".
COM OFFSET VALID	Confirmation that the commutation values are valid. This should be "YES".

10. The value to put on the paper is the CAL OFFSET value.

11. The CAL OFFSET value must also be stored on the floppy disk. This is done while you are still looking at the resolver values by pressing:

    `FILE`
    `SAVE AS`

    The resolver values will automatically use the file name of `MOC.CFG`. You may use a different filename if desired but it is not recommended. Save these values to your Boot Disk 4 and all back up copies.

Manually Entering Calibration Values

Manually entering calibration values should be done when:

a) Robot is installed.
b) After system software is loaded.
c) After replacement of the Main computer, Robot Computer, or Memory Boards.

There are two ways to enter the calibration values into the control they are:

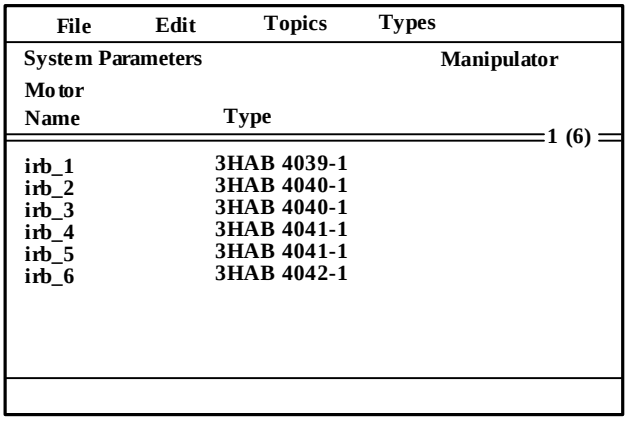
1. By disk
2. Manually entering calibration values.

To enter the calibration values by disk:

1. Press:

   MISC
   SYSTEM PARAMETERS
   TOPIC
   MANIPULATOR

   The following screen should be seen.

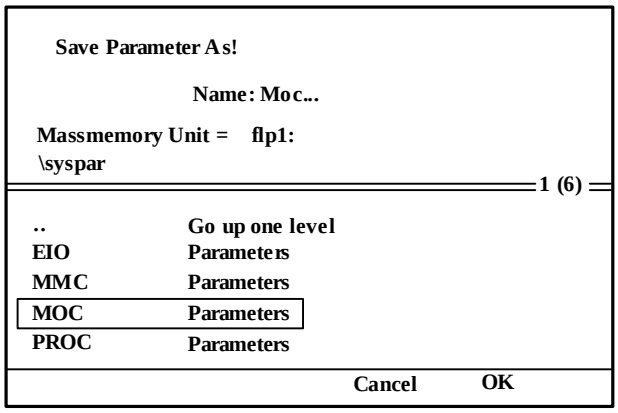


Manually Entering Calibration Values (Cont)

2. Insert the disk that has the resolver values saved on it. This should be Boot Disk 4 or another disk. Press:

   ```
   FILE
   LOAD SAVED PARAMETERS
   ```

   Select the file with the resolver values in it. This should be a file named "MOC.CFG". Press **OK**.



Manually Entering Calibration Values (Cont)

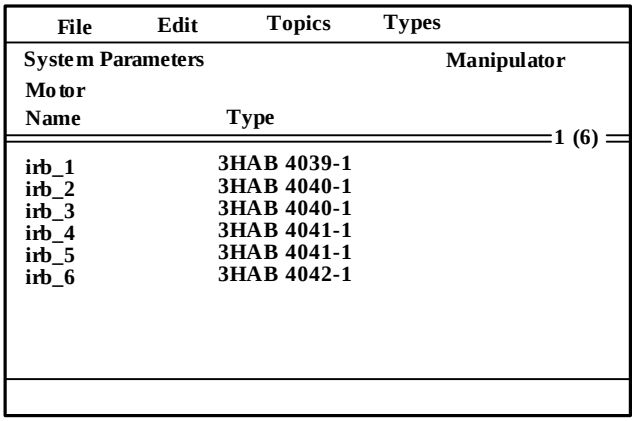
Another way to enter calibration values manually:

1. Get the correct resolver values from the paper next to the Axis 1 motor or wherever you have them recorded.

2. Press:

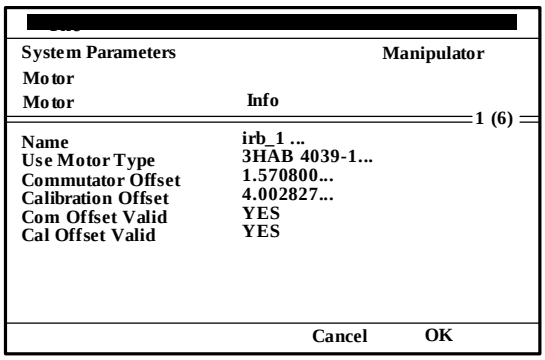
   ```
   MISC
   SYSTEM PARAMETERS
   TOPICS
   MANIPULATOR
   TYPES
   MOTOR
   ```

You will see the screen below.



Manually Entering Calibration Values (Cont)

3. Then select the axis desired and press ENTER. See the screen below.



4. The information shown is:

NAME	The name given to the axis (example: motor_1).
CAL OFFSET	The value of the resolver when it is at the calibration position. This value is in radians.
COM OFFSET	The commutation value for the motor. On the IRB 6400 this value is always 1.570800. This value is in radians.
CAL OFFSET VALID	Confirmation that the calibration values are valid. This should be “YES”.
COM OFFSET VALID	Confirmation that the commutation values are valid. This should be “YES”.

5. Move the cursor to CAL OFFSET . Press ENTER and type the correct calibration values.

6. When completed press **OK**.

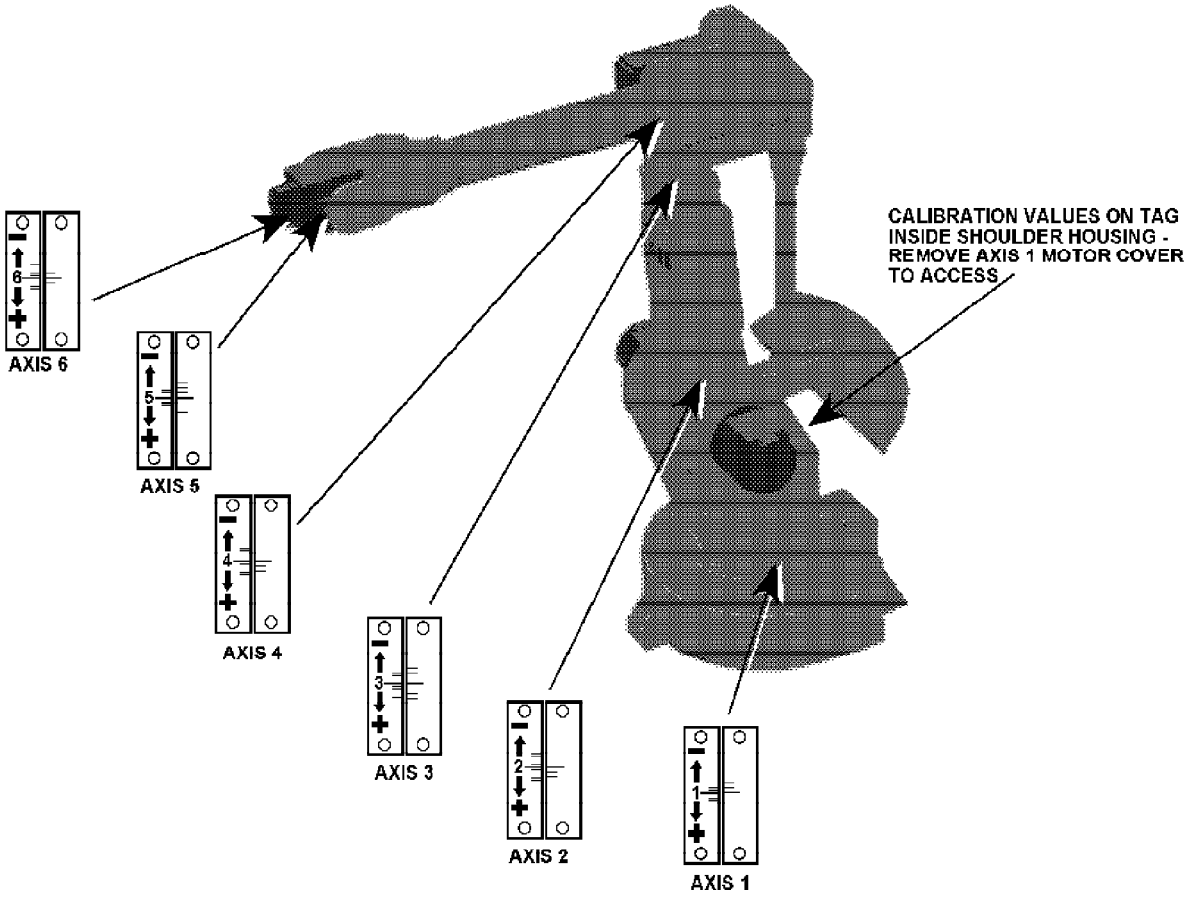
Precision Resolver Calibration Procedure

The precision resolver calibration procedure is used when proper alignment after a motor replacement is critical. An example of a program that would need the precision resolver calibration procedure is a program that run many different part routines. To perform this procedure it is required to use the calibration equipment (3HAA 0001-MZ). Also needed to accomplish this procedure will be digital leveling equipment. This equipment does not come with the robot. This equipment can be purchased through ABB.

The only time that the resolvers should be calibrated using this method is when the resolver has been mechanically disassembled from the mechanical unit. (Such as if a motor is removed.)

Adjust axes in increasing sequence, i.e., 1, 2, 3, 4, 5, then 6.

1. Position the robot approximately in calibration position 0 as shown below.



Precision Resolver Calibration Procedure (Cont)

2. Select the **MOTORS OFF** mode.

Calibrating Axis 1

3. Remove cover plate on the reference surface on gearbox 1.

4. Attach the synchronization fixture (ABB# 6896 0011-YM) to the flat surface and insert the corresponding measuring rod (6896 0011-YN) in one of the three holes in the base.

5. Use the Manual Brake Release Switch for Axis 1 and manually push the robot until the measuring rod is positioned within the flat surface on the calibration fixture's elbow.

WARNING! BE ESPECIALLY CAREFUL OPERATING THE ROBOT WHILE IN THE ROBOT WORKING AREA OR PERSONAL INJURY MAY OCCUR!

6. Align the pin and tool with a sliding caliper.

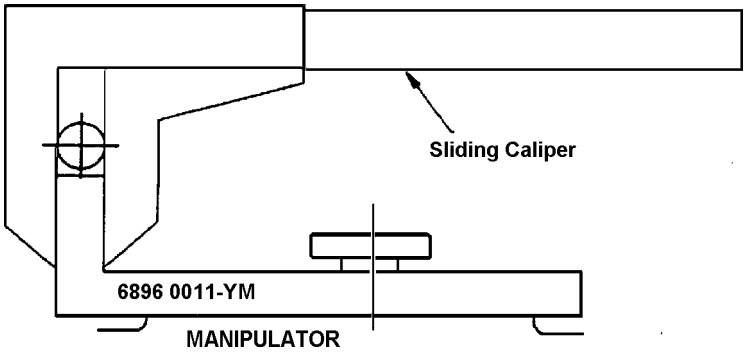


Figure 1 - Aligning the Pin & Tool with a Sliding Caliper for Axis 1

Precision Resolver Calibration Procedure (Cont)

Calibrate the sensors against each other using a reference plane surface in the same direction. The sensors must be calibrated every time they are used for a new direction.

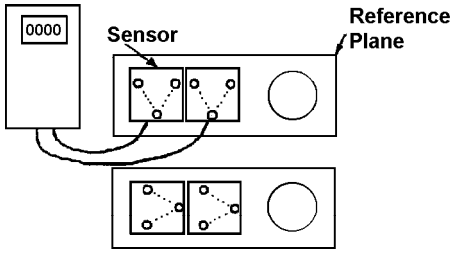


Figure 2 - Calibrating the Sensors

Calibrating Axis 2-6

7. Release the enabling device.
8. Mount sensor fixture (6896 0011-GM) on the base reference plane.
9. Mount elbow fixture (6896 0011-LP) on the lower arm calibration plane.
10. Mount sensor fixture (6808 0011-GM) on the wrist calibration plane turned upwards.
11. Mount intermediate plate (6896 134-GZ) on the turn disc. Mount elbow fixture (6808 0011-GU) on the intermediate plate. Note that the elbow fixture position is adjusted with a guide pin.
12. Mount inclination instrument (6807 081-D). One sensor is to be mounted on the reference plane and the other on the elbow fixture for Axis 2. Both sensors are to be positioned in the same direction. See also Figure 3.

NOTE: The sensor unit must always be mounted on top of the fixture.

Precision Resolver Calibration Procedure (Cont)

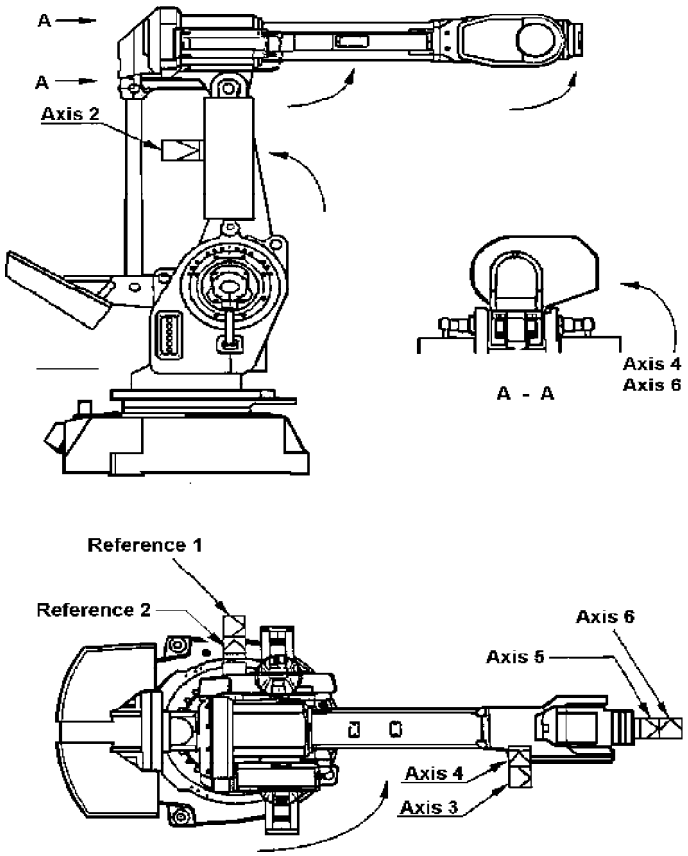


Figure 3 - Movement Directions for Calibration, Reference Surface

13. Press the enabling device and operate the joystick manually in the directions in Figure 3 until the digital leveling gauge indicates zero. The gauge should read 0±12 increments (0.3 mm/m).

    The reason the calibration position is always adjusted in the directions shown in Figure 3 is that friction and gravity forces work together against the direction of movement. This simplifies adjustment.

14. Turn the reference sensor and move the other sensor. Continue the calibration procedure for the other axes.

15. When all axes have been adjusted, the resolver values are stored by executing commands listed (following steps 16 through 25) on the teach pendant.

Precision Resolver Calibration Procedure (Cont)

16. After the axis has been moved to its calibration position the resolver value must be recorded. This is done on the teach pendant. Press:

    MISC

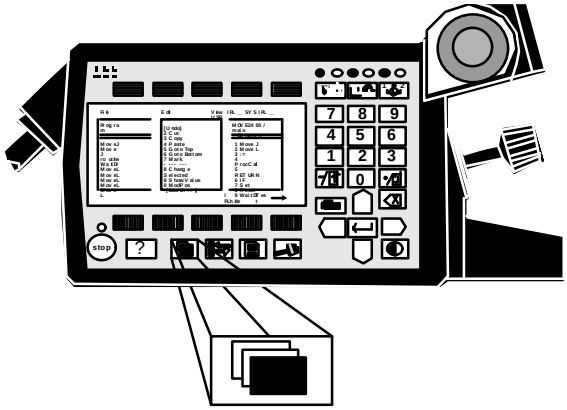
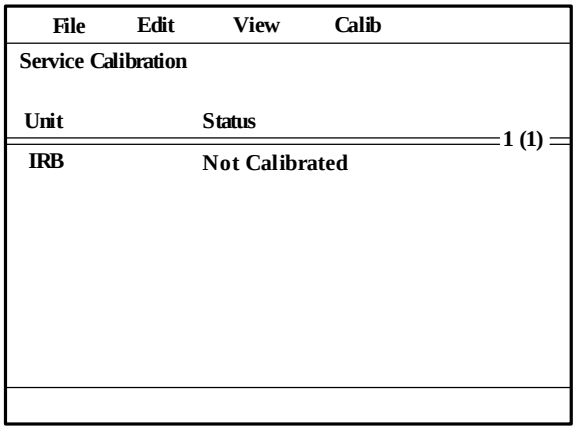


Figure 4 - Misc. Window Key to Select Service Window

Select:

SERVICE
VIEW
CALIBRATION.

The figure below should appear.



Precision Resolver Calibration Procedure (Cont)

The type of calibration status will appear on the screen. The status can be any of the following:

Synchronized - Indicates that there are calibration values for each axis and that the counters are updated. This does **NOT** necessarily mean that they are correct.

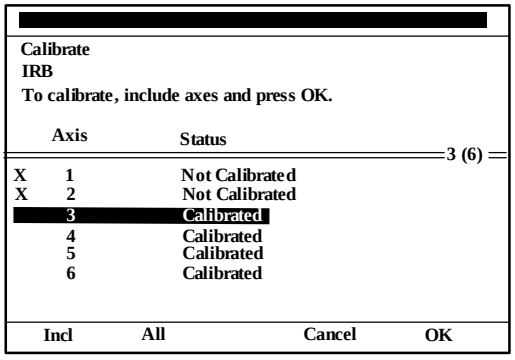
Not updated rev. Counter - Indicates that one or more axis revolution counter is not updated.

Not calibrated - Indicates that one or more axis do not have calibration values stored.

17. Press:

    CALIB
    CALIBRATE

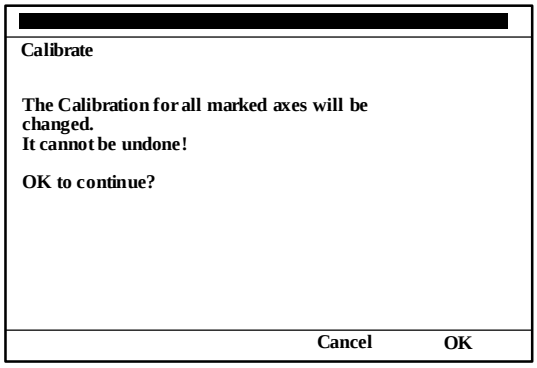
    The window below will appear.



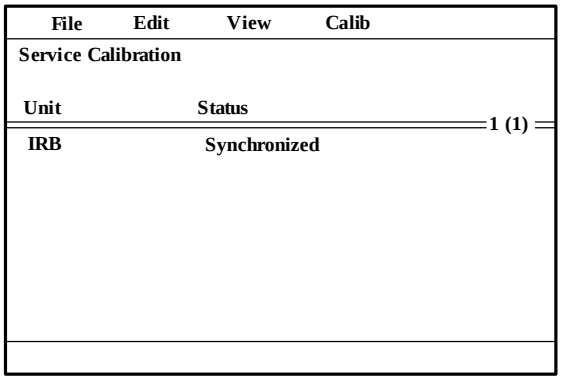
18. The “X” indicates chosen axes. Press the ALL function button to select all axis to be calibrated or move the cursor to the desired axis or axes and press INCL to include the axes to be calibrated.

Precision Resolver Calibration Procedure (Cont)

19. Press **OK.** The window below will appear.



20. After receiving the warning if you wish to continue press **OK** again. The following screen will appear.

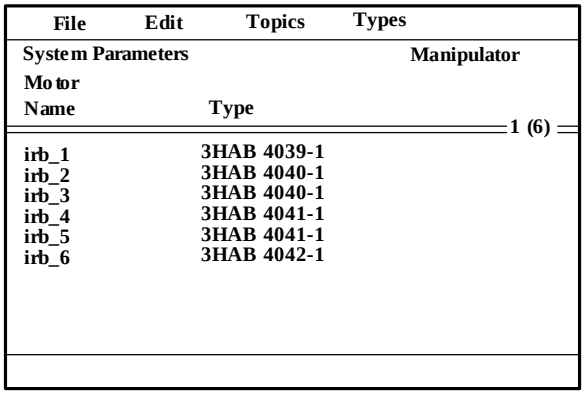


Precision Resolver Calibration Procedure (Cont)

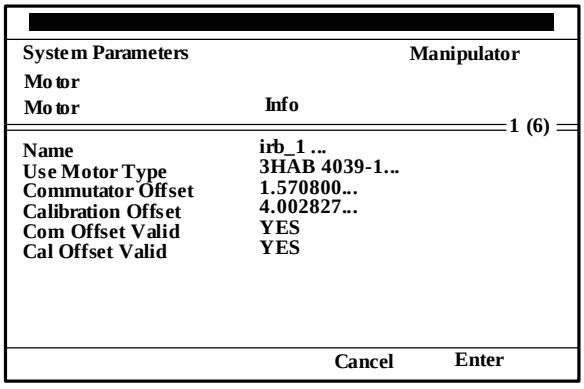
21. Now the calibration values need to be recorded on the paper in the Axis 1 casting. To see the new resolver values press:

    MISC
    SYSTEM PARAMETERS
    MANIPULATOR
    TYPES
    MOTOR

    You will see the screen below.



22. Then select the axis desired. See the screen below.



Precision Resolver Calibration Procedure (Cont)

23. The information shown is:

NAME	The name given to the axis (example: motor_1).
CAL OFFSET	The value of the resolver when it is at the calibration position. This value is in radians.
COM OFFSET	The commutation value for the motor. On the IRB 6400 this value is always 1.570800. This value is in radians.
CAL OFFSET VALID	Confirmation that the calibration values are valid. This should be “YES”.
COM OFFSET VALID	Confirmation that the commutation values are valid. This should be “YES”.

24. The value to put on the paper is the CAL OFFSET value.

25. The CAL OFFSET value must also be stored on floppy disk. This is done while you are still looking at the resolver values by pressing:

    FILE
    SAVE AS

    The resolver values will automatically use the file name of MOC.CFG. You may use a different filename if desired but it is not recommended. Save these values to your Boot Disk 4 and all back up copies.

Counter Updating Procedure

The Serial Measurement Board (SMB) keeps track of the current resolver revolution count. To keep track of these revolution counts even when power is turned off, the SMB has a rechargeable battery attached to it. When a new machine is shipped from the factory this battery may not be charged. The control must be connected to the robot, and with the main disconnect turned ON, it takes 18 hours to fully charge this battery. It should maintain a charge for approximately 1000 hours. If this battery looses its charge, an error *"20032 Rev counter not updated"* will be given after a power outage.

Other reasons for having to update counters are:

- When a resolver error has occurred
- When the signal between the resolver and SMB has been interrupted.
- When one of the manipulator axis has been moved without the controller being connected.

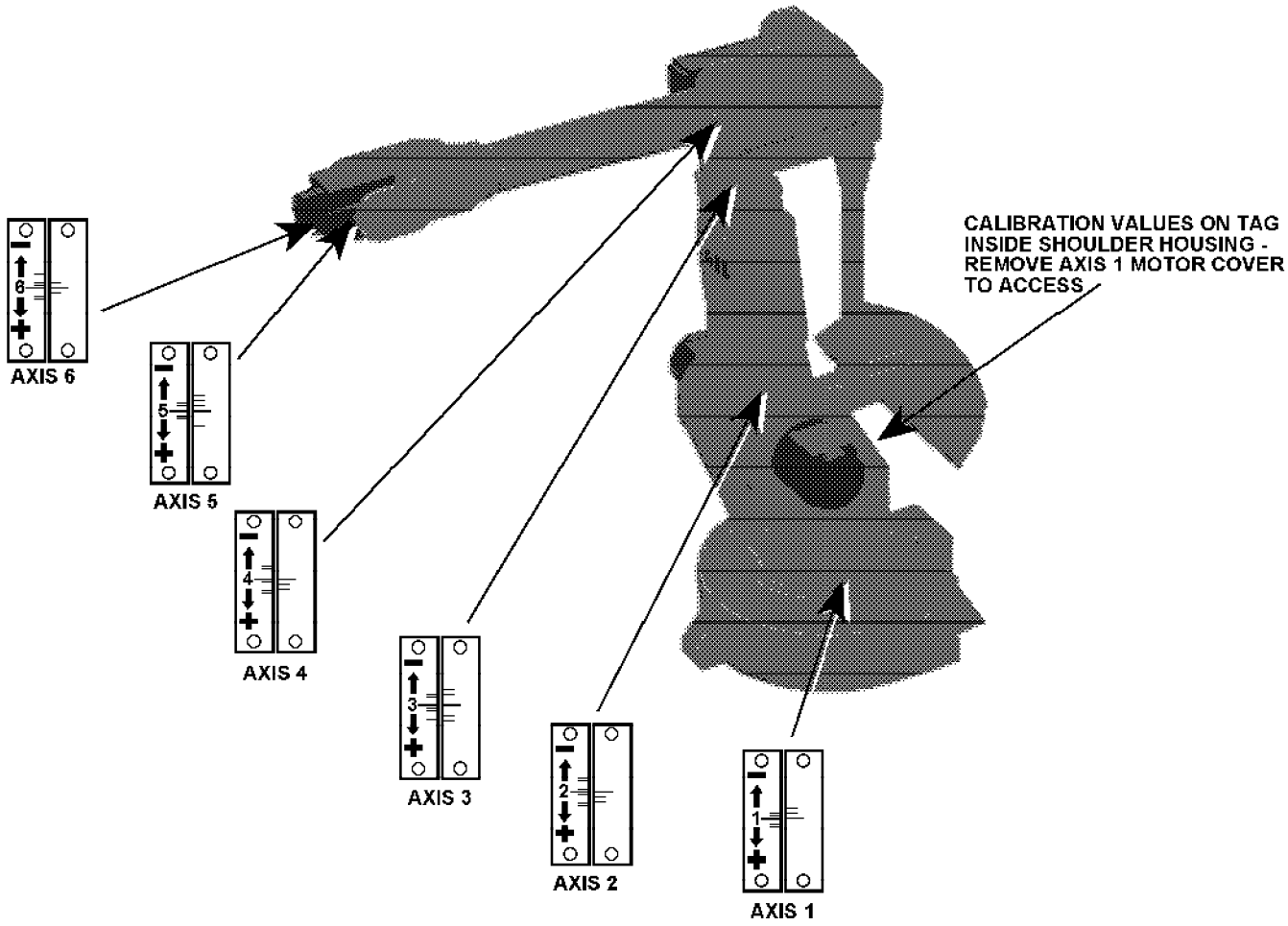
You should NOT have to update the counter upon powering off and back on again. If you do there is a problem in the system.

1. Move the robot to the calibration position. Axis may be moved and updated individually, except for axis three. Axis threes position depends on axis two's position. Always have axis two in position before moving axis three into position.

IMPORTANT **Axis 6 has no hard stops which means that when a robot does not have its revolution counters Axis 6 is allowed to rotate endlessly. However the revolution counter will only be correct at one position and being multiple axis revolutions off won't work.**

Counter Updating Procedure (Cont)

The figure below shows all six axis in the calibration position. NOTE if counter values are lost the robot will not move in linear motion.

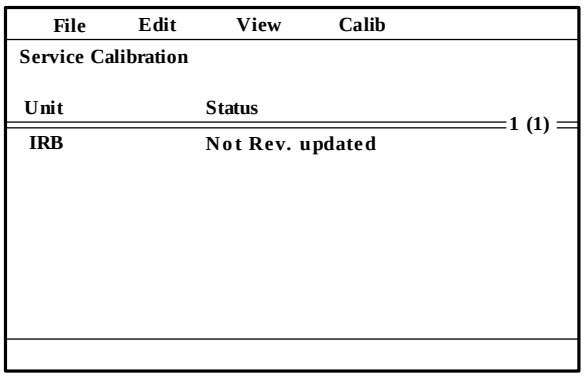


Counter Updating Procedure (Cont)

2. When the robot has been moved into the calibration position press:

   MISC
   SERVICE
   VIEW
   CALIBRATION

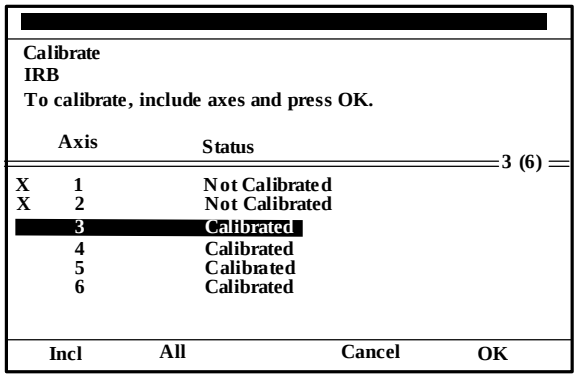
The following screen should be displayed.



3. Press:

   CALIB
   REV. COUNTER UPDATE

   The following screen will be displayed.



Counter Updating Procedure (Cont)

4. Move the cursor to the desired axis to be updated and press **INCL** or press **ALL** to include all axis. The selected axis will be marked with an “X”.

5. Press **OK**. A warning message will be displayed. If everything is correct then press **OK** again.

6. It is very important after completing this procedure to load and run the calibration program on the Boot Disk 4. Explanations on how to do this is in the software loading chapter. If the calibration marks do not line up after running the calibration program repeat procedure for axis that are off. If mispositioning persists the resolver system must be repaired. If a problem occurs for Axis 6 the cause may be that Axis 6 has been rotated to the wrong revolution. If the correct revolution can not be found then the axis must be recalibrated using one of the previous procedures.

NOTES

NOTES

SECTION 12

Parts Lists & Illustrations

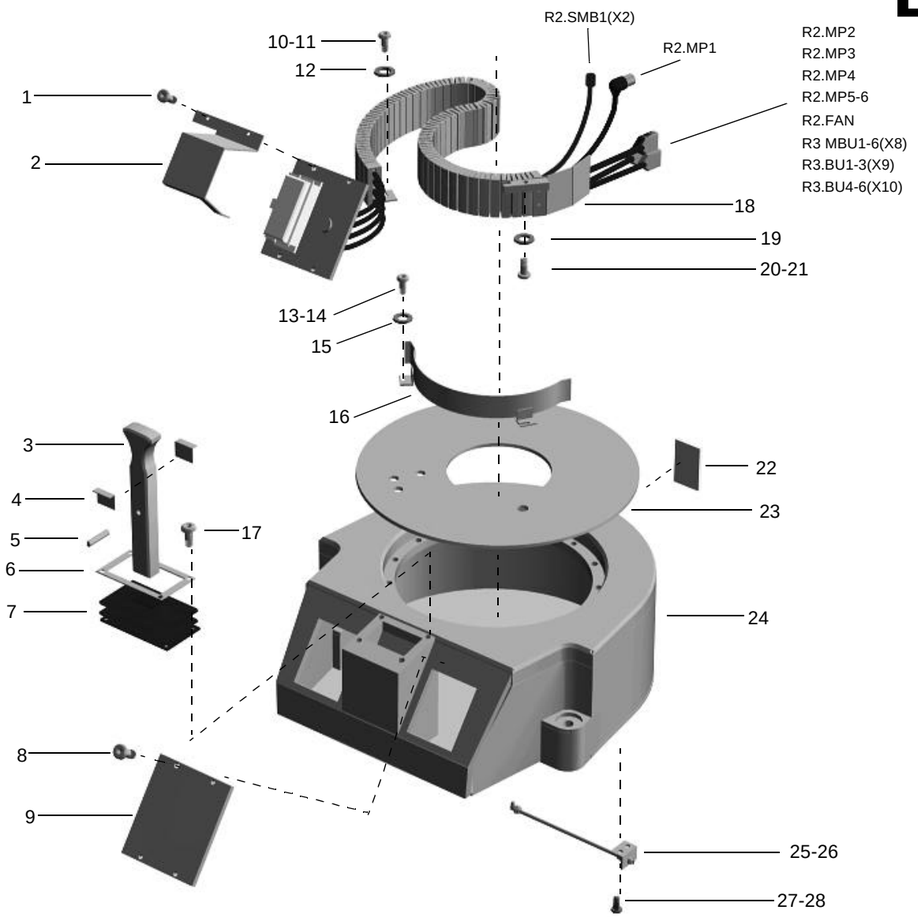
PARTS LISTS & ILLUSTRATIONS

Table of Contents

BASE . . .
including Lower Cable

ITEM	QTY.	DESCRIPTION	ABB PART NO
1	4	Screw - M6x20	2121 2411-370
2	1	Cable Protector	3HAA 1001-718
3	1	Stop Shaft	3HAB 4082-1
4	2	Angle	3HAA 1001-154
5	1	Roll Pin	2111 2835-389
6	1	Bellows Plate	3HAA 1001-136
7	1	Bellows	3HAA 1001-135
8	4	Screw - M6x20	2121 2411-370
9	1	Cover	3HAA 1001-700
-	1	Nipple (If used)	2524 0256-1
-	1	Protective Hood (if used)	2522 2101-15
10	2	Screw - M6x16	2121 2416-368
11	-	Loctite 242	1209 0014-410
12	2	Washer - 6.4x12x1.6	3151 2062-153
13	2	Screw - M6x16	2121 2416-368
14	-	Loctite 242	1269 0014-410
15	2	Washer - 6.4x12x1.6	2151 2062-153
16	1	Cable Guide Rail	3HAA 1001-691
17	4	Screw - M6x8	2121 2416-368
18	1	Lower Cable Assembly:	
		without cust connect.	3HAB 4248-1
		with cust. connection & S/2.9-120	3HAB 4249-1
-	1	Earth sign	2940 0412-1
-	1	Screw - M6x20	2121 2411-370
-	1	Washer - 6.4x12x1.6	2151 2062-153
19	2	Washer - 8.4x16x1.6	2151 2062-165
20	2	Screw - M8x40 8.8	2121 2519-459
21	-	Loctite 242	1269 0014-410
22	3	WARNING Label	3HAA 0001-SL
23	1	Frictionless Plate	3HAA 1001-695
24	1	Base Housing	3HAA 1001-653
25	1	Grease Tube Assembly	3HAA 1001-716
26	-	Loctite 577	1269 1907-1
27	2	Screw - M6x16	2121 2411-368
28	-	Loctite 577	1268 1907-1
		Base Sync Plate:	
-	1	Sync Bracket	3HAB 4135-1
-	1	Sync Plate	3HAA 1001-73
-	4	Screw - M4x8	2121 2411-287
-	1	Sync Plate	2155 0187-11
-	4	Washer - 4.3x9x0.8	2151 2062-136
-	1	Bracket	3HAA 1001-144
-	-	Loctite 242	1269 0014-410
		Protective Plate:	
-	1	Protective Plate	2155 0187-11
-	1	Screw	2121 0596-31

B



SHOULDER . . .
including Axes 1, 2, & 3 Drives

S

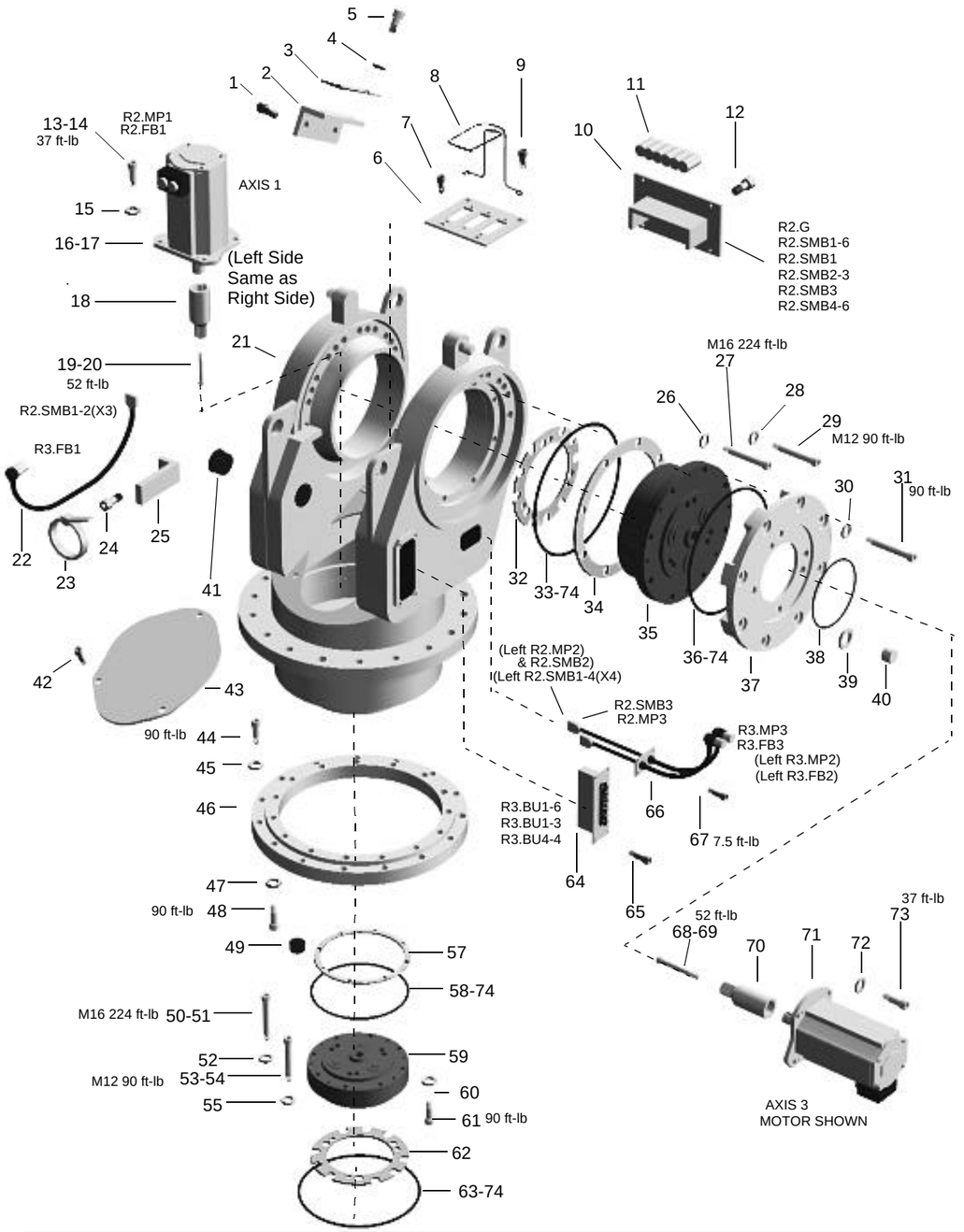
ITEM	QTY.	DESCRIPTION	ABB PART NO .
1	2	Screw - M6x12	2321 2416-366
2	1	Bracket	3HAA 1001-104
3	1	Sync. Plate	3HAA 1001-79
4	2	Washer - Plain 4.3x19x0.8	2151 2062-136
5	2	Screw - M4x6	2121 2416-285
6	1	Cover	3HAA 0001-ZK
7	2	Screw - M6x16 2.8	2121 2411-368
8	1	Cable Guide	3HAA 1001-721
9	2	Screw - M6x30	2121 2411-374
10	1	Measure Card Unit	3HAB 4259-1
-	1	Serial Measurement Board	3HAB 2213-1
11	1	Battery Pack	4944 026-4
12	4	Screw - M6x16 8.8	2121 2411-368
13	4	Screw - M10x25	2121 2519-493
14	-	Loctite 242	1269 0014-410
15	4	Washer - Plain 10.5x22x2	2151 2062-173
16	1	Motor - Axis 1	3HAB 4039-1
-	1	Motor - Axis 1 PE/2.25-75	EHAB 4043-1
17	-	Permatex 3	1236 0012-202
18	1	Pinion	(Incl. in item 59)
19	1	Screw - M10x100 12.9	3HAB 3409-62
20	-	Loctite 242	1269 0014-410
21	1	Frame Housing	3HAB 4150-1
22	1	Cable - Axis 1 Signal	3HAB 4250-1
23	7	Strap	2166 2055-3
24	1	Screw M6x16	2121 2411-368
25	1	Holder	3HAA 1001-668
26	6*	Washer - Spring	3HAA 1001-181
27	6*	Screw- M16x140 12.9	3HAB 3409-95
28	6*	Washer - 12.5x24x5.9	3HAA 1001-200
29	6*	Screw - M12x140 12.9	3HAB 3409-200
30	16*	Washer - Plain 13x21x2	3HAA 1001-632
31	16*	Screw - M12x80 12.9	3HAB 3409-74
32	2*	Friction Ring	3HAA 1001-613
33	2*	O-Ring - 234.54x3.53	2152 0431-17
34	2*	Friction Ring	3HAA 1001-616
35	2*	Reduction Gear RV-250A	3HAB 4080-1
36	2*	O-Ring 269.3x5.7	2152 2012-550
37	2*	Plate - Motor Socket	3HAB 4056-1
38	2*	O-Ring 124.5x3	2152 2012-437
39	4*	Washer 13.5x18x1.5	2152 0441-1
40	4*	Magnetic Plug 1/4”	2522 122-1
41	3	Cap	3HAA 1001-199
42	3	Screw M6x20	2121 2411-370
43	1	Cover	3HAA 0001-SZ
44	15	Screw - M12x70 12.9	3HAB 3409-73
45	15	Washer - Plain 13x24x2.5	3HAA 1001-632
46	1	Bearing	3HAA 1001-1
47	15	Washer - Plain 13x24x2.5	2551 2062-177
48	15	Screw - M12x70 12.9	3HAB 3409-73
49	1	Plug - KR 1/2”	2522 2021-113
50	3	Screw - M16x140 12.9	3HAB 3409-95
51	-	Loctite 577	1269 1907-1
52	3	Washer - Spring	3HAA 1001-181
53	3	Screw - M12x140 12.9	3HAB 3409-200
54	-	Loctite 577	1269 1907-1
55	3	Washer - Support	3HAA 1001-200

ITEM	QTY.	DESCRIPTION	ABB PART NO .
56	Ref	Installation Aid Tool	3HAB 1067-6
57	1	Friction Ring	3HAA 1001-614
58	1	O-Ring 245.0x3.0	2152 0431-15
59	1	Gear Reduction Unit	3HAB 4079-1
60	8	Washer - Plain 13x24x2.5	2551 2062-177
61	8	Screw - M12x90 12.9	3HAB 3409-75
62	1	Friction Ring	3HAA 1001-613
63	1	O-Ring 234.54x3.53	2152 0431-17
64	1	Brake Release Unit	3HAA 0001-ADY
65	4	Screw M6x16 8.8	2121 2411-368
66	1	Cable - Axis 2	3HAB 4252-1
	1	Cable - Axis 3	3HAA 0001-YY
67	4	Screw - M6x16	2121 2411-368
68	2*	Screw - M10x100 12.9	3HAB 3409-62
69	-*	Loctite 242	1269 0014-410
70	2*	Pinion	(Incl. in Item 35)
71	2*	Motor - Axis 2 & 3	3HAB 4040-1
-	2*	Motor - Axis 2&3 PE/2.25-75	3HAB 4226-1
72	4	Washer - Plain 10.5x22.2	2151 2062-173
73	4	Screw - M10x25 8.8	2121 2419-493
74	-	Lubricating Grease	1171 4012-201

* The left side drive components for Axis 2 are the same as the same as the right side drive components for Axis 3. Quantities shown are for both sides combined, Axis 2 plus Axis 3.

FORK LIFT BRACKETS (not shown on drawing)			
		2.4-120, 2.4-150, 2.8-120,3.0-75: Lifting Device Set Compl.	3HAA 0001-SY
	8	Screw - M16x60 8.8	2121 2518-632
	8	Washer - 17x30x3	3HAA 1001-186
	2	Lifting Bracket	3HAA 1001-257
	2	Lifting Bracket	3HAA 1001-258

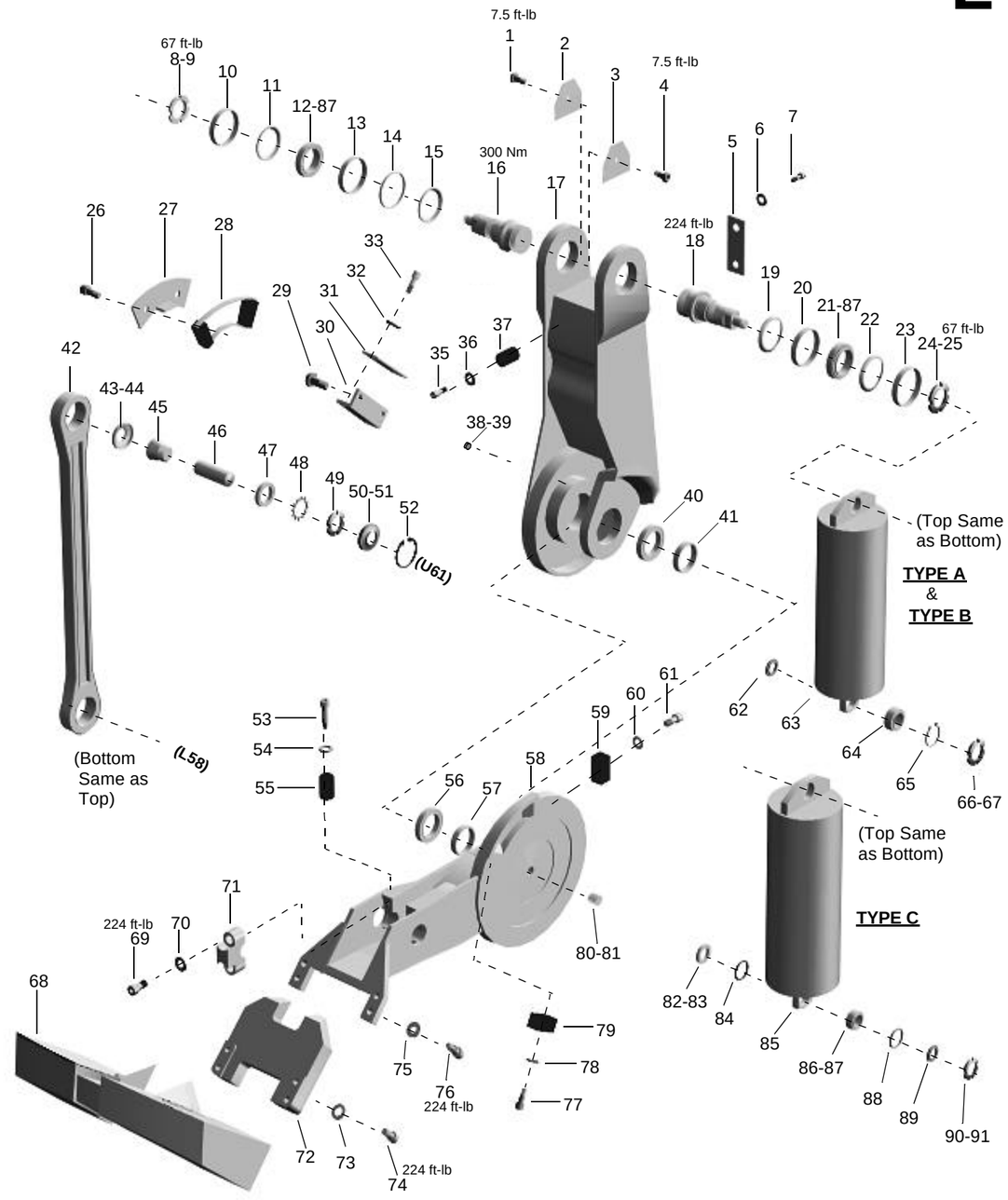
		Axis 1 Complete :	
		No Cust. Connections	3HAB 4161-1
		With Cust. Connections	3HAB4161-2



LOWER ARM . . .
including Parallel Arm & Balancing System

ITEM	QTY.	DESCRIPTION	ABB PART NO .
1	1	Screw - M6x10	2121 2763-364
2	1	Protective Plate	3HAA 1001-164
3	1	Protective Plate	3HAA 1001-164
4	1	Screw - M6x10	2121 2763-364
5	1	Sync. Plate	3HAA 1001-79
6	2	Washer - 4.3x9x0.8	2151 2062-136
7	2	Screw - M4x6	2121 2416-285
8	1	Lock Nut	2126 2851-112
9	-	Loctite 242	1269 0014-410
10	1	Spacer	3HAA 1001-126
11	1	NILOS Ring	2216 0085-5
12	1	Bearing - 32013X	2213 3802-8
13	1	Sealing Ring 6.4x15x3	3HAA 1001-173
14	1	Spacer (left side only)	3HAA 1001-125
15	1	V-Ring	2216 264-16
16	1	Shaft	3HAA 1001-127
		Shaft - S/2.9-120	3HAA 1001-317
17	1	Lower Arm Frame	3HAB 4168-1
18	1	Shaft	3HAA 1001-127
		Shaft - S/2.9-120	3HAA 1001-317
19	1	V-Ring	2216 264-16
20	1	Sealing Ring	3HAA 1001-173
21	1	Bearing - 32013X	2213 3802-8
22	1	NILOS Ring	2216 0085-5
23	1	Spacer	3HAA 1001-126
24	1	Lock Nut	2126 2851-112
25	-	Loctite 242	1269 0014-410
26	2	Screw - M6x10	2121 2763-364
27	1	Support Plate - Damper	3HAA 1001-282
28	1	Damper	3HAA 1001-90
29	2	Screw - M6x12	2121 2416-366
30	1	Bracker - Sync. Plate	3HAA 1001-104
31	1	Sync. Plate - Axis 2	3HAA 1001-74
32	2	Washer - Plain 6.4x12x0.8	2151 2062-153
33	2	Screw - M6x6	2121 2416-285
34		*(number not used)*	
35	2	Screw - M8x25	2121 2519-453
36	2	Washer - 8.4x16x1.5	
37	2	Damper	3HAA 1001-123
38	1	Set Screw - M20x20	2122 2765-99
39	-	Loctite 577	1269-1907-1
40	1	Spherical Roller Bearing	3HAB 4169-1
41	1	Spacer - Sleeve	3HAB 4387-1
42	1	Parallel Bar	3HAA 1001-71
43	2	Ring	3HAA 1001-86
44	-	Grease	1171 4012-201
45	2	Adapter Sleeve	2213 1905-21
46	2	Shaft	3HAA 1001-88
47	2	Spherical Bearing	3HAA 1001-189
48	2	Lock Washer	(Incl. in Item 45)
49	2	Lock Nut	(Incl. in Item 45)
50	2	Ring	3HAA 1001-86
51	-	Grease	1171 4012-201
52	2	Retaining Ring - Snap	2154 2527-160
53	2	Screw - M8x25	2121 2519-453
54	2	Washer - 8.4x16x1.5	2151 2062-165
55	2	Damper	3HAA 1001-81
56	1	Spherical Roller Bearing	3HAB 4169-1
57	1	Spacer - Sleeve	3HAB 4387-1
58	1	Parallel Arm Frame	3HAB 4170-1

ITEM	QTY.	DESCRIPTION	ABB PART NO .
59	1	Damper	3HAA 1001-622
60	2	Washer - Plain 6.4x12x1.6	2151 2062-153
61	2	Screw - M6x16	2121 2416-368
62	4	Spacer Washer	3HAB 4191-1
63	2	Type A - Standard Load	
		Balancing Unit Complete	3HAB 4216-1
		Balancing Unit	3HAB 4175-2
	2	Type B - Additional Load	
		Balancing Unit Complete	3HAB 4217-1
		Balancing Unit	3HAB 4175-3
64	4	Bearing	3HAA 1001-207
65	4	Circlip	3HAB 4190-1
66	4	Lock Nut (Mount in reverse)	2126 2851-106
67	-	Loctite 242	1269 0014-410
68	1	Weight - 314 kg - 2.4-120	3HAB 4022-1
	1	Weight - 400 kg - 2.4-150,	
		S/2.4-120,2.8-120, 3.0-75,	
		S/2.9-120	3HAB 4036-1
69	4	Screw - M16x70 12.9	3HAB 3409-88
70	4	Washer - 17x27x3	3HAA 1001-186
71	2	Clamp	3HAA 1001-13
72	1	Weight Adapter - S/2.9-120	3HAA 1001-334
			3HAA 0001-ST
-	4	Screws M16x60	2121 2518-632
-	4	Washers 17x30x3	2151 2062-185
-	1	Protect. Plate - PE/2.25-75	3HAA 1001-609
73	4	Washer - 17x27x3	3HAA 1001-186
74	4	Screw - M16x60 12.9	3HAB 3409-86
75	4	Washer - 17x27x3	3HAA 1001-186
76	4	Screw - M16x60	2121 2518-632
77	2	Screw - M6x16	2121 2416-368
78	2	Washer - Plain 6.4x12x1.6	2151 2062-153
79	1	Damper	3HAA 1001-622
80	1	Set Screw - M20x20	2122 2765-99
81	-	Loctite 577	1269 1907-1
82	4	Sliding Ring	3HAB 4545-1
83	-	Grease - ESSO Beacon EP2	1171 4013-301
84	4	Washer	3HAB 4546-1
85	2	Type C - S/2.9-120	
		Balancing Unit Complete	3HAB 4218-1
		Balancing Unit	3HAA 0001-US
86	4	Radial Bearing	3HAA 1001-207
87	-	Grease - ESSO Beacon EP2	1171 4013-301
88	4	Sliding Ring	3HAB 4545-1
89	4	Ring	3HAB 4544-1
90	4	Lock Nut (Mount in reverse)	2126 2851-106
91	-	Loctite 242	1269 0014-410



UPPER ARM . . .
including Axis 4 Drive

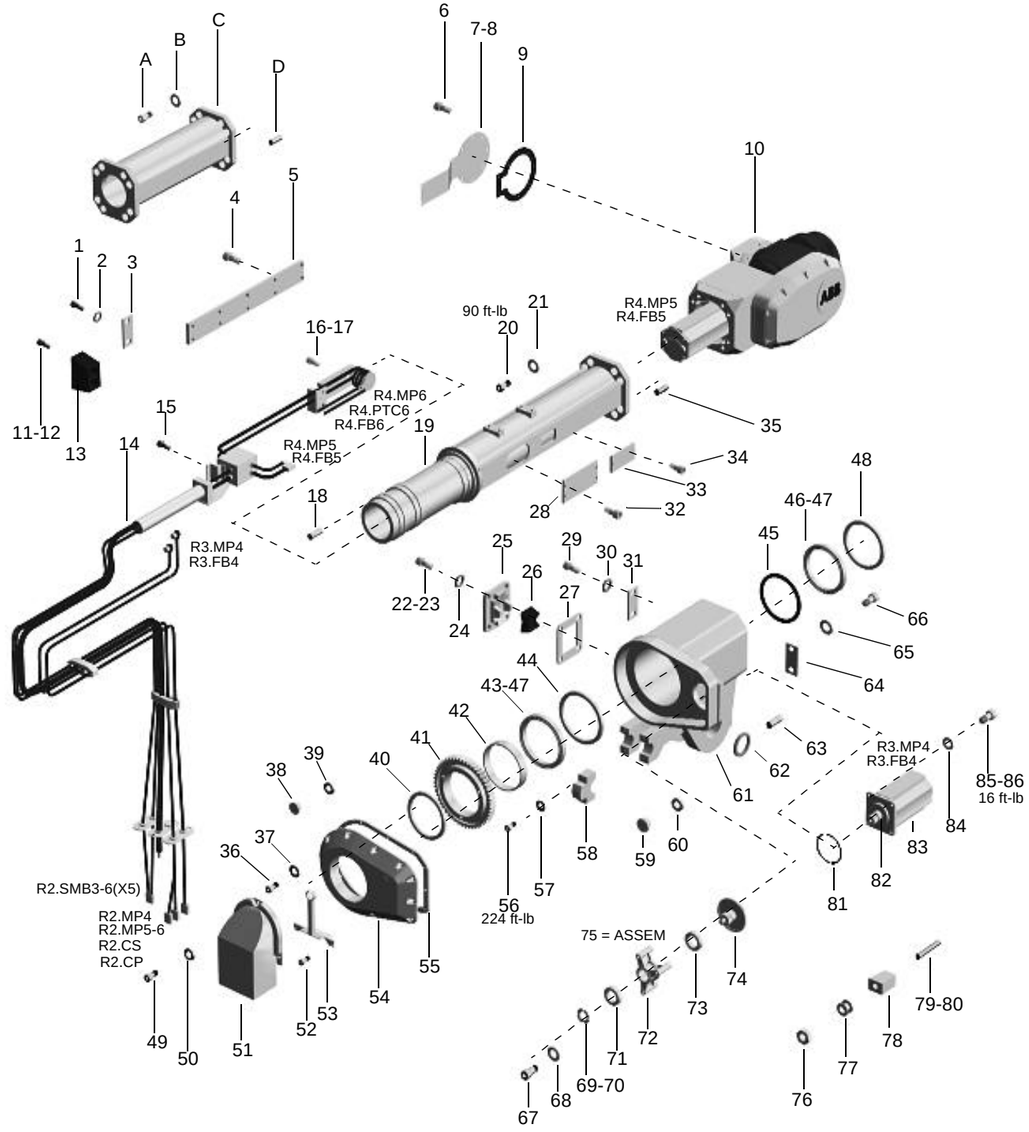
U

ITEM	QTY.	DESCRIPTION	ABB PART NO .
1	2	Screw	2121 2411-287
2	2	Washer	2151 2062-136
3	3	Sync. Plate - Axis 4	3HAA 1001-76
4	4	Screw	2121 2411-368
5	1	Cover - 2.8-120, S/2.9-20	3HAA 1001-302
	1	Cover - 3.0-75	3HAA 1001-305
6	7	Screw	2121 2411-368
7	1	Cover	3HAA 1001-500
8	-	Sealant	1236 0012-227
9	1	Gasket	3HAA 1001-166
10	1	Wrist Assy.- 120 kg. Elmo	3HAB 4196-1
	1	Wrist Assy.- 120 kg. Siemens	3HAB 4590-1
	1	Wrist Assy.- 150 kg. Elmo	3HAB 4196-2
	1	Wrist Assy.- 150 kg. Siemens	3HAA 0001-ABR
11	2	Screw	2121 1519-536
12	-	Loctite 242	1269 0014-410
13	1	Stop - Axis 4	3HAA 1001-102
14	1	Upper Cable Complete:	3HAB 4165-3
		With Cust. Connections	3HAB4165-3
		S/2.9-120	3HAB 4183-2
		PE /2.25-75	3HAB 4483-2
15	2	Screw - M6x30	2121 2411-374
16	2	Screw - M6x16	2121 2411-368
17	2	Screw - M4x12	2121 2411-291
18	1	Protecting Plug	2522 726-4
19	1	Upper Arm Tube Shaft	3HAB 4452-1
		Upper Arm - PE/2.25-75	3HAB 4453-1
20	8	Screw	3HAB 3409-69
21	8	Washer	3HAB 1001-134
22	4	Screw	2121 2519-453
23	-	Loctite 242	1269 0014-410
24	4	Washer	2151 2062-165
25	1	Stop - Axis 4	3HAA 1001-17
26	1	Damper	3HAA 1001-100
27	1	Gasket	3HAA 1001-98
28	1	Cover	3HAA 1001-719
29	2	Screw	2121 2411-287
30	2	Washer	2151 2062-136
31	1	Sync. Plate	3HAA 1001-79
32	4	Screw	2121 2411-366
33	1	Cover	3HAA 1001-161
34	2	Screw	2121 2411-372
35	1	Roll Pin	2111 2835-416
36	12	Screw	2121 2411-370
37	12	Washer	2154 2022-4
38	1	Magnetic Plug	2522 0122-1
39	1	Washer	2152 0441-1
40	1	Seal Ring	3HAA 1001-628
41	1	Gear	3HAA 1001-24
42	1	Spacer	3HAA 1001-103
43	1	Bearing	2213 0253-5
44	1	Seal Ring	2216 0261-18
45	1	Seal	2216 0086-4
46	1	Bearing	2213 0253-5
47	-	Grease	1171 4013-301
48	1	Seal	3HAB 4217-1
49	3	Screw	2121 2411-368
50	3	Washer	2151 2062-153
51	1	Cover	3HAA 1001-176
52	2	Screw	2121 2411-368

ITEM	QTY.	DESCRIPTION	ABB PART NO .
53	1	Cable Holder	3HAA 1001-201
54	1	Cover	3HAA 1001-33
55	1	Gasket	3HAA 1001-97
56	4	Screw	2121 2518-634
57	4	Washer	2151 2062-185
58	2	Clamp	3HAA 1001-13
59	1	Magnetic Plug	2522 0122-1
60	1	Washer	2152 0441-1
61	1	Housing	3HAA 0001-AA
62	2	Support Ring	3HAA 1001-124
63	2	Set Screw - M10	2122 2719-401
64	1	Sync.Plate Axis 3	3HAA 1001-75
65	2	Washer	2151 2062-136
66	2	Screw	2121 2411-287
67	3	Screw	3HAB 3409-62
68	3	Washer	2151 2062-173
69	1	Nut (in Item 73)	2126 2851-104
70	-	Loctite 242 (in Item 73)	1269 0014-410
71	1	Bearing (in Item 73)	3HAA 1001-129
72	1	Hub Axis 4 (in Item 73)	3HAA 1001-16
73	-	Bearing	2213 3802-11
74	1	Gear Unit	3HAA 0001-M
75	1	Intermediate Wheel Assem.	3HAA 0001-AN
76	13	Nut	2126 2011-117
77	6	Spring Washers	2154 2033-9
78	3	Wedge	3HAA 1001-99
79	3	Stud	2122 2011-465
80	-	Loctite 601	1269 0014-407
81	1	O-Ring	2152 2012-430
82	1	Pinion	3HAA 1001-21
83	1	Motor - 120 kg. Elmo	3HAB 4041-1
	1	Motor - 120 kg. Siemens	3HAB 4584-1
	1	Motor - 150 kg. Elmo	3HAB 4044-1
	1	Motor - 150 kg. Siemens	3HAA 1001-ZH
84	4	Washer	2151 2062-165
85	4	Screw	2121 2519-453
86	-	Loctite 242	1269 0014-410

A	8	Screw	3HAB 3409-69
B	8	Washer	3HAA 1001-134
C	1	Extension:	
		2.8-120, S/2.9-120	3HAA 1001-301
		3.0-75	3HAA 1001-304
D	1	Roll Pin	2111 2835-416

120 kg:	Upper Arm Assy.	
	2.4 - Elmo	3HAB 4194-1
	2.4 - Siemens	3HAB 4591-1
	2.8 - Elmo	3HAB 4194-3
	2.8 - Siemens	3HAB 4592-1
	S/2.9	3HAB 4194-3
	Drive Unit Assy. - Elmo	3HAB 4195-1
	Drive Unit Assy. - Siemens	3HAB 4585-1
150 kg:	Upper Arm Assy. - Elmo	3HAB 4194-2
	Upper Arm Assy. - Siemens	3HAA 0001-AAE
	Drive Unit Assy. - Elmo	3HAB 4195-2
	Drive Unit Assy. - Siemens	3HAA 0001-ABN
3.0-75	Upper Arm Assy. - Elmo	3HAB 4194-4
	Upper Arm Assy. - Siemens	3HAB 4593-1



WRIST . . .
including Axis 5 Drive

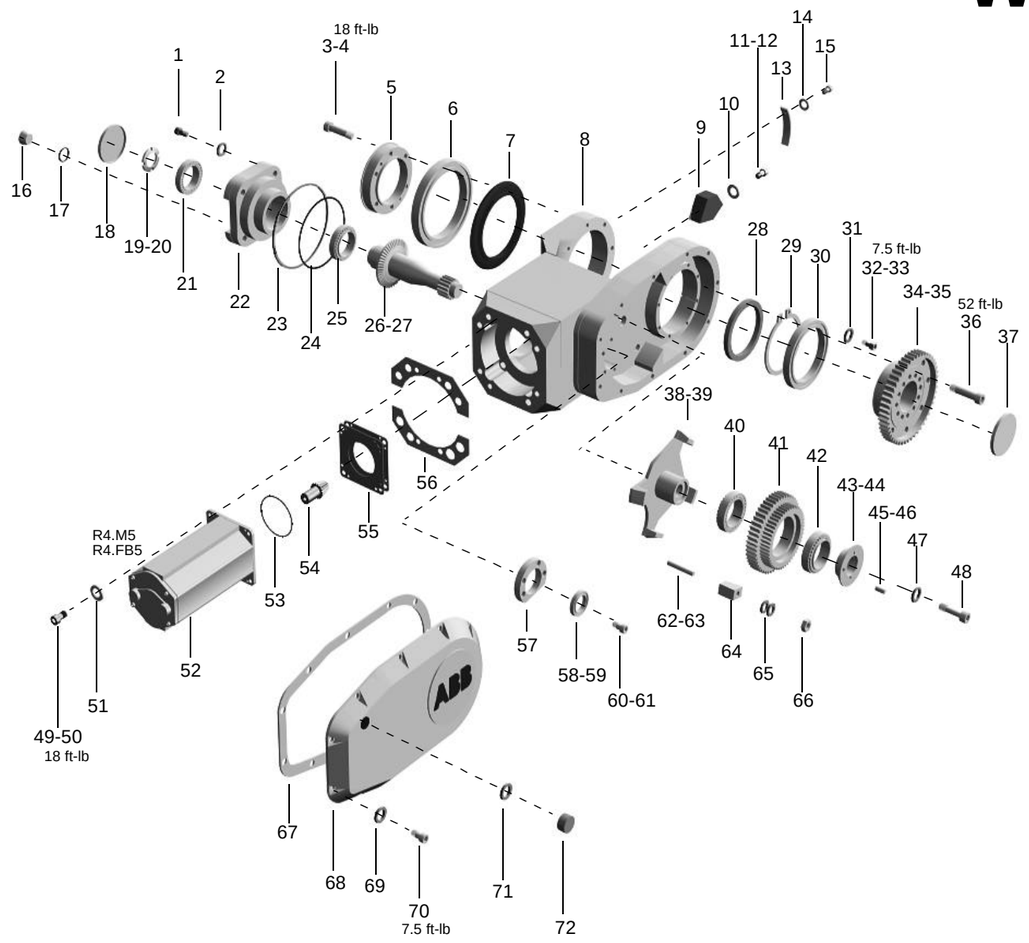
W

ITEM	QTY.	DESCRIPTION	ABB PART NO .
1	4	Screw - M10x25 12.9	3HAB 3409-50
2	4	Washer - 11x17x2	3HAB 4233-1
3	6	Screw - M8x30	2121 2519-455
4	-	Loctite 242	1269 0014-410
5	1	Bearing Retainer	3HAA 1001-107
6	1	Bearing	3HAA 1001-132
7	1	Spacer	3HAA 1001-108
8	1	Wrist Housing	3HAA 1001-35
9	2	Damper Axis 5	3HAA 1001-101
10	2	Washer - 6.4x12x1.6	2151 2062-153
11	2	Screw - M6x20	2121 2411-370
12	-	Loctite 242	1269 0014-410
13	1	Sync. Plate	3HAA 1001-79
14	2	Washer - 4.3x9x0.8	2151 2062-136
15	2	Screw - M4x8	2121 2411-287
16	1	Magnetic Plug	2522 122-1
17	1	Washer - 13.5x18x1.5	2152 0441-1
18		Cover	3HAA 2166-11
19	1	Lock Nut	2126 2851-108
20	-	Loctite 290	1269 0014-409
21	1	Bearing	3HAA 1001-162
22	1	Bearing Housing	3HAA 1001-41
23	1	Shim Set	3HAA 0001-AF
24	1	O-Ring	2152 2011-529
25	1	Bearing	3HAA 1001-168
26	1	Gear Axis 5	3HAA 0001-AO
27	1	Gear Axis 5 Assem.	3HAA 0001-AG
28	1	Seal	3HAB 4409-1
29	1	Retaining Ring	2154 2226-171
30	1	Bearing	2213 253-21
31	8	Washer - 6.4x15x3	3HAA 1001-106
32	8	Screw	2121 2411-370
33	-	Loctite 242	1269 0014-410
34	1	Gear Axis 5	3HAA 1001-262
35	1	Gear Axis 5 Assem.	3HAA 0001-HA
36	1	Screw - M10x60 12.9	3HAB 3409-57
37	1	Cover Lid	2158 0399-4
38	1	Intermediate Gear Hub	3HAA 1001-39
39	1	Intermediate Gear Assem.	3HAA 0001-GY
40	1	Bearing	3HAA 1001-130
41	1	Gear	3HAA 0001-E
42	1	Bearing	3HAA 1001-130
43	1	Nut	3HAA 1001-109
44	-	Loctite 290	1269 0014-409
45	1	Set Screw	2122 2711-287
46	-	Loctite 242	1269 0014-410
47	1	Washer - 16.5x25x4	3HAA 1001-267
48	1	Screw - M16x60	3HAA 1001-266
49	4	Screw - M8x30	2121 2519-455
50	-	Loctite 242	1269 0014-410
51	4	Washer	2151 2062-165
52	1	Motor	(see NOTE)
53	1	O-Ring	2152 2012-430
54	1	Pinion	(see NOTE)
55	1	Shim Set	3HAA 0001-AE
56		Friction Washer Insert	3HAA 1001-297
57	1	Bearing Support	3HAA 1001-271
58	1	Bearing	3HAA 1001-131
59	-	Loctite 601	1269 0014-407
60	4	Screw - M8x25	2121 2519-453

ITEM	QTY.	DESCRIPTION	ABB PART NO .
61	-	Loctite 242	1269 0014-410
62	4	Stud - M8x70	2122 2011-465
63	-	Loctite 242	1269 0014-410
64	4	Wedge	3HAA 1001-99
65	8	Tension Washer	2154 2033-9
66	4	Nut - M8	2126 2011-117
67	1	Gasket	3HAA 1001-112
68	1	Cover	3HAA 1001-276
69	11	Washer - Spring 6.4 FZB	2154 2022-4
70	11	Screw - M6x20	2121 2411-370
71	1	Magnetic Plug 1/4”	2522 122-1
72	1	Washer - 13.5x18x1.5	2152 0441-1
73	-	Loctite 242	1269 0014-410
74	-	Gear Oil	1171 2016-604

NOTE:

120kg:			
		Wrist Unit - Elmo	3HAB 4196-1
		Wrist Unit - Siemens	3HAB 4590-1
		Wrist Unit - Foundry	3HAB 4506-1
		Drive Unit - Axis 5 Elmo	3HAB 4171-1
		Drive Unit - Axis 5 Siemens	3HAB 4586-1
52	1	Motor - Elmo	3HAB 4041-1
52	1	Motor - Siemens	3HAB 4584-1
54	1	Pinion (part of item 27)	3HAA 1001-58
150 kg:			
		Wrist Unit 150 kg Elmo	3HAB 4196-2
		Wrist Unit 150 kg Siemens	3HAA 0001-ABR
		Wrist Unit 150 kg Foundry	3HAB 4506-2
		Drive Unit - Axis 5 Elmo	3HAB 4171-1
		Drive Unit - Axis 5 Siemens	3HAA 0001-ABU
52	1	Motor - Elmo	3HAB 4044-1
52	1	Motor - Siemens	3HAA 0001-ZH
54	1	Pinion (part of item 27)	3HAA 1001-58

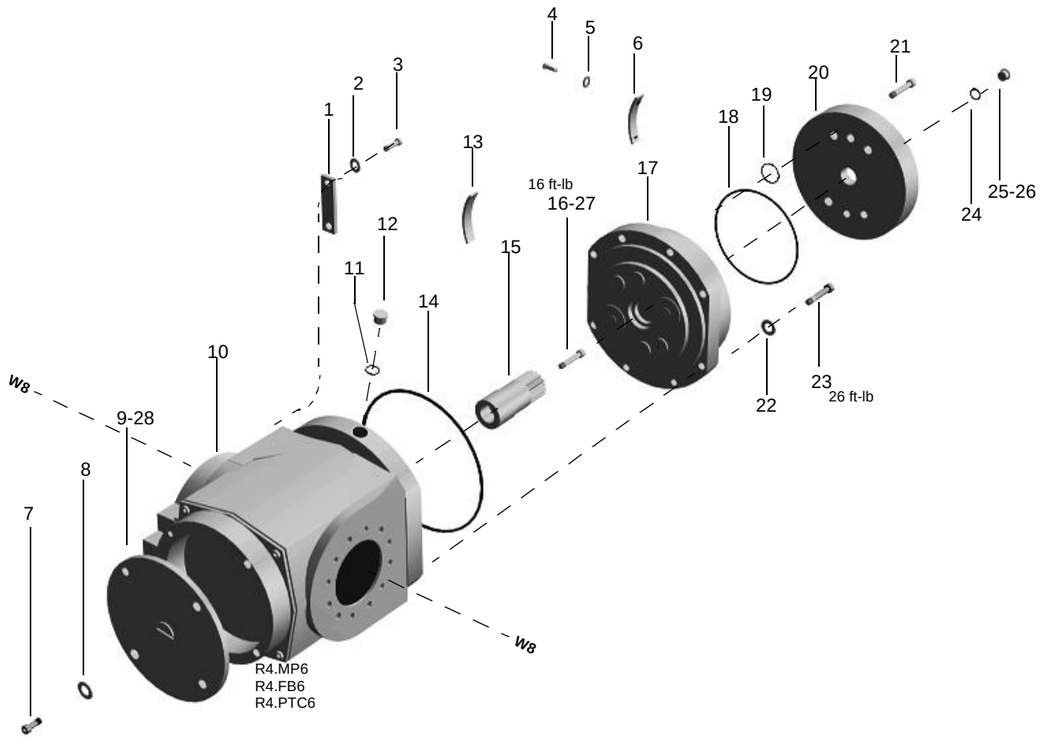


FACE . . .
including Axis 6 Drive

F

ITEM	QTY.	DESCRIPTION	ABB PART NO
1	1	Sync. Plate Axis 5	3HAA 1001-77
2	2	Washer - 4.3X9X0.8	2151 2062-136
3	2	Screw - M4x8	2121 2411-287
4	2	Screw - M4x8	2121 2411-287
5	2	Washer - 4.3x9x0.8	2151 2062-136
6	1	Sync. Plate Axis 6	3HAA 1001-78
7	4	Screw	(incl. in item 10)
8	4	Washer	(incl. in item 10)
9	1	Cover	(incl. in item 10)
10	1	Motor - Elmo	3HAB 4042-1
	1	Motor - Siemens	3HAA 0001-XK
		Drove Unit - Elmo	3HAB 4172-1
		Drive Unit - Siements	EHAA 0001-ABU
11	1	Washer - 13.5x18x1.5	2152 0441-1
12	1	Magnetic Plug - R 1/4”	2522 0122-1
13	1	Sync. Plate	3HAA 1001-174
14	1	O-Ring - 151.99x3.53	2152 0431-12
15	1	Input Pinion Gear	3HAA 1001-522
16	1	Screw	2121 2519-341
17	1	Reduction Gear	3HAA 0001-HJ

ITEM	QTY.	DESCRIPTION	ABB PART NO
18	1	O-Ring	2151 0431-21
19	1	O-Ring	2152 0431-20
20	1	Flange	3HAA 1001-222
21	6	Screw	2121 2518-577
22	8	Washer - 8.4x13x1.5	3HAA 1001-172
23	8	Screw - M8x40	3HAB 3409-40
24	1	Washer	(ref.)
25	1	Plug	(ref.)
26	-	Grease	3HAA 1001-294
27	-	Loctite 242	1290 0014-410
28	-	Sealant	1236 0012-227



SHOULDER (S/2.9-120) . . .
including Axes 1, 2, & 3 Drives

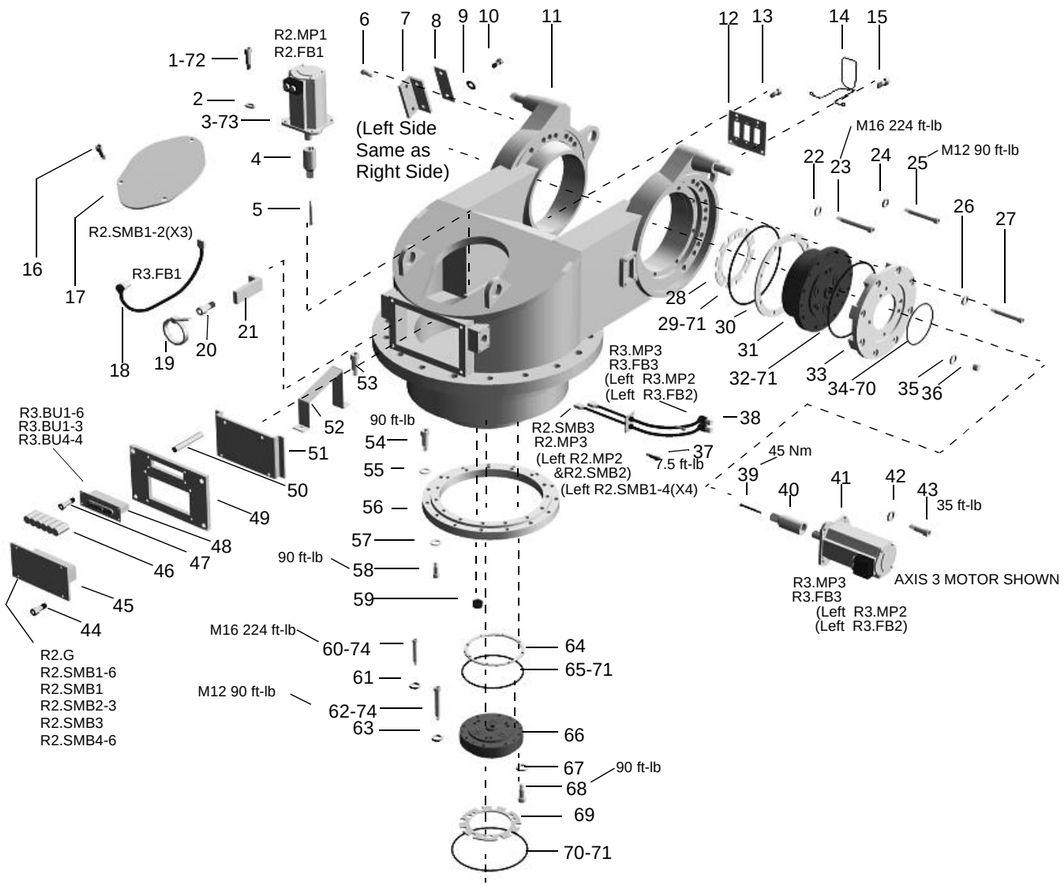
SM

ITEM	QTY.	DESCRIPTION	ABB PART NO .
1	4	Screw - M10x25	2121 2519-493
2	4	Washer - Plain 10.5x22x2	2151 2062-173
3	1	Motor - Axis 1	3HAA 4039-1
4	1	Pinion	(Incl. in item 64)
5	1	Screw - M10x100 12.9 Steel	3HAB 3409-62
6	4	Screw - M6x12	2321 2416-366
7	1	Bracket	3HAA 1001-104
8	1	Sync. Plate	3HAA 1001-79
9	2	Washer - Plain 4.3x19x0.8	2151 2062-136
10	2	Screw - M4x6	2121 2416-285
11	1	Frame Housing	3HAB 4084-1
12	1	Cover	3HAA 0001-ZK
13	2	Screw - M6x16 2.8	2121 2411-368
14	1	Cable Guide	3HAA 1001-721
15	2	Screw - M6x30	2121 2411-374
16	3	Screw M6x20	2121 2411-370
17	1	Cover	3HAA 0001-SZ
18	1	Cable - Axis 1 Signal	3HAB 4250-1
19	7	Strap	2166 2055-3
20	1	Screw M6x16	2121 2411-368
21	1	Holder	3HAA 1001-668
22	6*	Washer - Spring	3HAA 1001-181
23	6*	Screw- M16x140 12.9	3hab 3409-95
24	6*	Washer - 12.5x24x5.9	3HAA 1001-200
25	6*	Screw - M12x80 12.9	3HAB 3409-74
26	16*	Washer - Plain 13x21x2	3HAA 1001-632
27	16*	Screw - M12x80 12.9	3HAB 3409-74
28	2*	Friction Ring	3HAA 1001-613
29	2*	O-Ring - 234.54x3.53	2152 0431-17
30	2*	Friction Ring	3HAA 1001-616
31	2*	Reduction Gear RV-250A	3HAB 4080-1
32	2*	O-Ring 269.3x5.7	2152 2012-550
33	2*	Plate - Motor Socket	3HAB 4056-1
34	2*	O-Ring - 124.5x3	2151 2012-437
35	4*	Washer 13.5x18x1.5	2151 0441-1
36	4*	Magnetic Plug 1/4”	2522 122-1
37	4	Screw - M6x16	2121 2411-368
38	1	Cable - Axis 2	3HAB 4252-2
	1	Cable - Axis 3	3HAA 0001-YY
39	2*	Screw - M10x100 12.9 Steel	3HAB 3409-62
40	2*	Pinion	(Incl. in Item 35)
41	1	Motor - Axis 3	3HAB 4040-1
	1	Motor - Axis 2	3HAB 4039-1
42	4	Washer - Plain 10.5x22.2	2151 2062-173
43	4	Screw - M10x25 8.8	2121 2419-493
44	4	Screw - M6x110 8.8	2121 2519-364
45	1	Signal Measuring Unit	3HAB 4259-1
-	1	Signal Measuring Board	3HAB 2213-1
46	1	Battery Pack	4944 026-4
47	4	Screw M6x16 8.8	2121 2411-368
48	1	Brake Release Unit	3HAA 0001-ADY
49	1	Rear Cover	3HAB 4136-1
50	4	Distance Screw L=140, M16	2125 2052-232
51	1	Protective Shield	3HAB 4138-1
52	1	Cable Bracked	3HAB 4147-1
53	2	Screw - M6x16	2121 2411-368
54	15	Screw - M12x70 12.9	3HAB 3409-13
55	15	Washer - Plain 13x24x2.5	3HAA 1001-632
56	1	Bearing	3HAA 1001-1
57	15	Washer - Plain 13x24x2.5	2551 2062-177
58	15	Screw - M12x70 12.9	3HAB 3409-73
59	1	Plug	2522 2021-113

ITEM	QTY.	DESCRIPTION	ABB PART NO .
60	3	Screw - M16x140 12.9	3HAB 3409-95
61	3	Washer - Spring	3HAB 1001-181
62	3	Screw - M12x140	3HAB 3409-200
63	3	Washer - Support	3HAA 1001-200
64	1	Friction Ring	3HAA 1001-614
65	1	O-Ring 245.0x3.0	2152 0431-15
66	1	Gear Reduction Unit	3HAB 4079-1
67	8	Washer - Plain 13x24x2.5	2551 2062-177
68	8	Screw - M12x90 12.9	3HAB 3409-75
69	1	Friction Ring	3HAA 1001-613
70	1	O-Ring 234.54x3.53	2152 0431-17
71	-	Lubricating Grease	1171 4012-201
72	-	Loctite 242	1269 0014-410
73	-	Permatex 3	1236 0012-202
74	-	Loctite 577	1269 1907-1
75	Ref	Installation Aid Tool	3HAB 1067-6

* The left side drive components for Axis 3 are the same as the same as the right side drive components for Axis 2. Quantities shown are for both sides combined, Axis 2 plus Axis 3.

FORK LIFT BRACKETS (not shown on drawing)		
	S/2.9-120:	
	Lifting Device Set Comp.	3HAB 0463-1
2	Lifting Bracket	3HAB 4139-1
8	Screw - M16x40 8.8	2121 2519-628
8	Washer - 17x30x3	2151 2062-185
-	Axis 1 Complete	3HAB 4161-3 3HAB 4651-3



NOTE: S/2.9-120 SHOULDER item numbers not referenced in guidelines

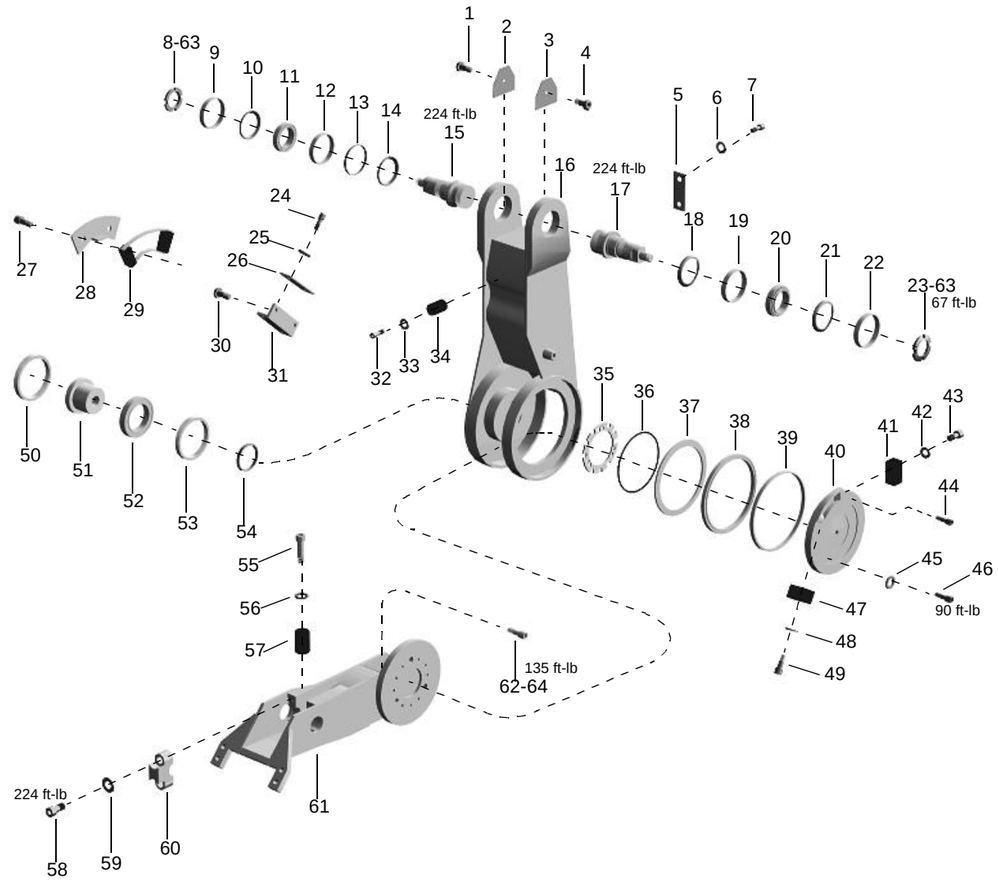
LOWER ARM . . .
for serial numbers IRB 6400 0000-0048

LA

ITEM	QTY.	DESCRIPTION	ABB PART NO .
1	1	Screw - M6x10	2121 2763-364
2	1	Protective Plate	3HAA 1001-164
3	1	Protective Plate	3HAA 1001-164
4	1	Screw - M6x10	2121 2763-364
5	1	Sync. Plate	3HAA 1001-79
6	2	Washer - 4.3x9x0.8	2151 2062-136
7	2	Screw - M4x6	2121 2416-285
8	1	Lock Nut - M6x2	2126 2851-112
9	1	Spacer	3HAA 1001-126
10	1	NILOS Ring	2216 0085-5
11	1	Bearing - 32013X	2213 3802-8
12	1	Sealing Ring 6.4x15x3	3HAA 1001-173
13	1	Spacer (left side only)	3HAA 1001-125
14	1	V-Ring	2216 264-16
15	1	Shaft	3HAA 1001-127
	1	Shaft - S/2.9-120	3HAA 1001-317
16	1	Lower Arm Frame	3HAA 1001-621
17	1	Shaft	3HAA 1001-127
	1	Shaft - S/2.9-120	3HAA 1001-317
18	1	V-Ring	2216 264-16
19	1	Sealing Ring	3HAA 1001-173
20	1	Bearing - 32013X	2213 3802-8
21	1	NILOS Ring	2216 0085-5
22	1	Spacer	3HAA 1001-126
23	1	Lock Nut - M6x2	2126 2851-112
24	2	Screw - M4x6	2121 2416-285
25	2	Plain Washer - 4.3x9x0.8	2151 2062-136
26	1	Sync. Plate - Axis 2	3HAA 1001-74
27	2	Screw - M6x10	2121 2763-364
28	1	Plate	3HAA 1001-282
29	1	Damper	3HAA 1001-90
30	2	Screw - M6x12	2121 2416-366
31	1	Bracket	3HAA 1001-346
32	2	Screw - M8x25	2121 2519-453
33	2	Washer - 8.4x16x1.5	2151 2062-165
34	2	Damper	3HAA 1001.123
35	1	Friction Ring	3HAA 1001-613
36	1	O-Ring - 215.49x3.53	2152 0431-18
37	1	Sealing Ring	3HAA 1001-83
38	1	Ball Bearing - 61856	2213 253-10
39	1	X-Ring - JF4 84	3HAA 1001-193
40	1	Middle Ring	3HAA 1001-633
41	1	Damper	3HAA 1001-622
42	2	Washer - 6.4x12x1.6	2151 2062-153
43	2	Screw - M6x16	2121 2416-368
44	3	Set Screw - M16x16	3HAA 1001-198
45	9	Washer - 13x19x1.5	3HAA 1001-632
46	9	Screw - M12x50	2121 2518-542
47	1	Damper	3HAA 1001-622
48	2	Washer - 6.4x12x1.6	2151 2062-153
49	2	Screw - M6x16	2121 2416-368
50	1	Sealing Ring	3HAA 1001-197

ITEM	QTY.	DESCRIPTION	ABB PART NO .
51	1	Support Bearing Shaft	3HAA 1001-85
52	1	Bearing - 22210E	3HAA 1001-194
53	1	NILOS Ring	3HAA 1001-195
54	1	Spacing Sleeve	3HAA 1001-82
55	2	Screw - M8x25	2121 2519-453
56	2	Washer	2151 2062-165
57	2	Damper	3HAA 1001-81
58	4	Screw - M16x17	2121 2518-634
59	4	Washer - 17x30x3	2151 2062-185
60	2	Clamp	3HAA 1001-13
61	1	Parallel Arm Frame	3HAA 0001-EH
62	1	Screw - M16x30	3HAA 1001-196
63	-	Loctite 242	1269 0014-410
64	-	Locktite 577	1269 1907-1

		Lower Arm System	3HAA 0001-EN
		Material Set - Axes 2 & 3	3HAA 0001-ZP
		Material Set - Robot Compl.	3HAA 0001-ZS
		Matl. Set - Sync. Plate Axis 2 2.4-120, 2.4-150, 2.8-120, & 3.0-75	3HAA 0001-SU
		Matl. Set - Sync. Plate Axis 2 S /2.9-120	3HAA 0001-SV



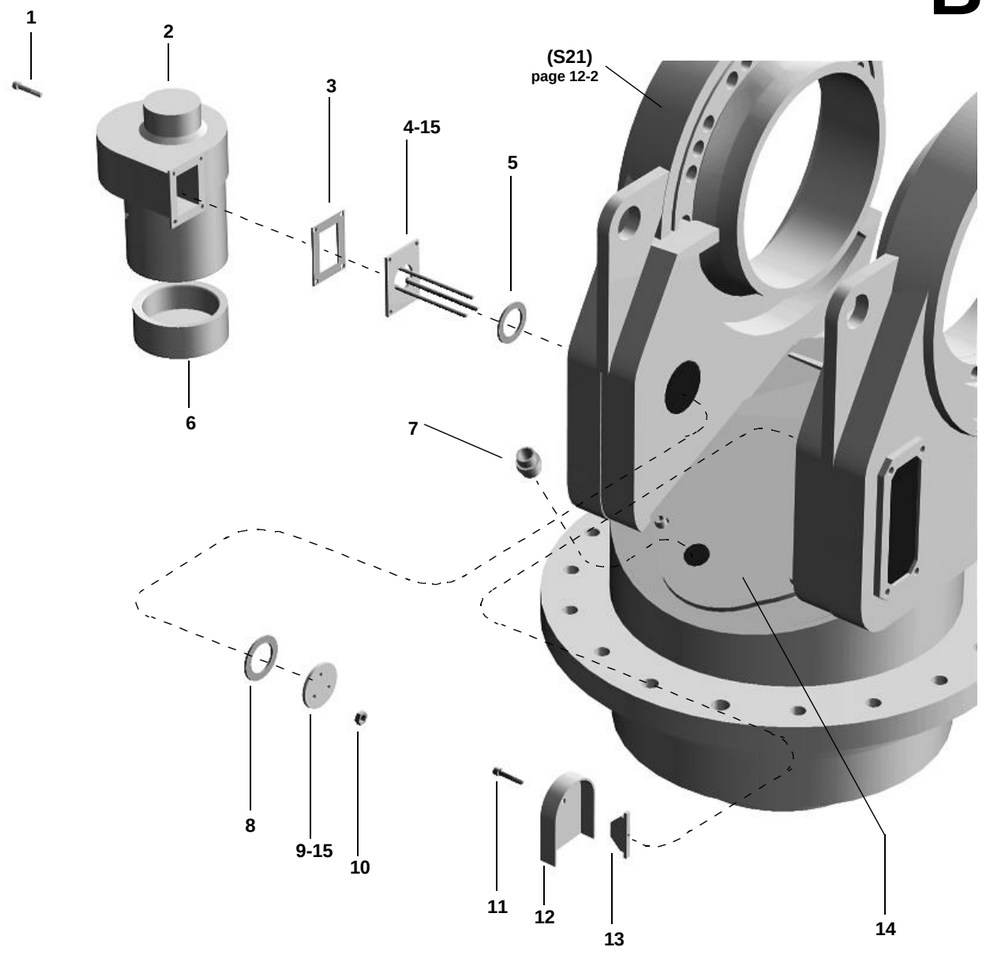
NOTE: LOWER ARM item numbers not referenced in guidelines

BASE FAN

ITEM	QTY.	DESCRIPTION	ABB PART NO .
1	4	Screw - M6x12	2121 2416-366
2	1	Fan	3HAA 0001-UL
	1	Fan Cable	3HAA 0001-ACE
	1	Fan Cable Clamp	2166 2018-1
3	1	Gasket	3HAA 1001-607
4	1	Holder	3HAA 1001-606
5	1	Gasket	3HAA 1001-608
6	1	Filter	3HAA 1001-612
7	1	Cable Gland	3HAA 1001-243
	1	Cable Gland Nut	2126 0023-2
8	1	Gasket	3HAA 1001-608
9	1	Flange	3HAA 1001-605
10	3	Nut	2126 2011-116
11	1	Screw - M6x40	2121 2416-378
12	1	Cover	3HAA 1001-604
13	1	Holder	3HAA 1001-603
14	1	Cover	3HAA 0001-VH
15	-	Sealing Paste	3HAB 3172-1

		Cooling Axis 1	3HAA 0001-AAB

BF



NOTE: BASE FAN item numbers not referenced in guidelines

SECTION 13

Reference Mechanical Layouts

REFERENCE MECHANICAL LAYOUTS

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SECTION 14

Reference
Cable Layouts

REFERENCE CABLE LAYOUTS

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