IGC-MEDICAL ADVANCES INC.
QUADRATURE LOWER EXTREMITY COIL

472GE-64
472GE-42

Compatible with General Electric Signa®
1.5T, 1.0T MRI Systems

07/11/03
Rev.12

Federal Law restricts this device to sale, distribution, and use by or on the order of a physician.

Proper performance of this coil is guaranteed only while the coil is being used on the MR system (hardware/software level) specified at the time of purchase. Upgrades or other modifications to the system software and/or hardware may affect compatibility. Prior to upgrading your MR system, please contact IGC-Medical Advances Inc. Customer Service Department to discuss coil compatibility issues. Failure to do so may void your warranty.

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A subsidiary of
Intermagnetics General Corporation

Attention, Consult Accompanying Documents

Type BF Equipment

Class II Equipment

Conforms to European Medical Device Directive 93/42/EEC
0086

NOTICE:

TRANSPORT AND STORE THIS PRODUCT UNDER THE FOLLOWING ENVIRONMENTAL CONDITIONS ONLY, FOR A PERIOD NOT EXCEEDING 4 WEEKS:

AMBIENT TEMPERATURE OF -34°C TO + 60°C
RELATIVE HUMIDITY OF 15% TO 95%
(Non-Condensing)
ATMOSPHERIC PRESSURE OF 765hPa TO 1011hPa

CONTENTS i

TRAINING

This manual contains detailed information on the set-up, positioning and use of the IGC-Medical Advances Inc. (MAI) coil. The instructions should be read carefully and thoroughly before attempting to scan patients with the coil.

QUALITY ASSURANCE

The procedure described in the *Quality Assurance* Section of this manual should be performed upon receipt of the coil to establish a baseline for coil performance. The procedure should be repeated at regular intervals.

INDICATIONS

IGC-Medical Advances Inc. magnetic resonance coils are indicated for use as either receive-only or transmit and receive antennae of RF energy at a specific frequency. The signal received by the coils is dependent upon MRI parameters (T1 or Spin-lattice relaxation time, T2 or spin-spin relaxation time, density of nuclei, flow velocity, and chemical shift). The images produced by the imaging coil correspond to the distribution of nuclei exhibiting nuclear magnetic resonance.

The MR coil is tuned by MAI at the manufacturing site to the approximate resonant frequency of the magnetic resonance system.

CONTRAINDICATIONS

The operator should be aware of the following contraindications for use related to the strong magnetic field of the MR system:

- Scanning is contraindicated for patients who have electrically, magnetically or mechanically activated implants (for example, cardiac pacemakers), because the magnetic and electromagnetic fields produced by the MR device may interfere with the operation of these devices.
- Scanning patients with intracranial aneurysm clips is contraindicated.

PRECAUTIONS

Precautions should be taken when scanning patients with the following conditions:

- A greater than normal potential for cardiac arrest.
- An increased likelihood for developing seizures or claustrophobia.
- Unconscious, heavily sedated, confused patients or those with whom no reliable communications can be maintained.

CAUTIONS

The following general warning statements apply to scanning with a magnetic resonance system. For further details, review the warnings included in your MR system operations manual.

- Cables should not be looped or crossed. Arcing and patient burns could result.
- If a patient complains of burning, tingling, stinging, or other "burn"-type sensations, promptly stop the scan procedure, examine the patient, and contact the responsible physician before continuing the procedure. Pay special attention to very young, sedated, or other patients who may not be able to communicate effectively.
- Route all cables out of the magnet so that they do not contact the patient.
- Patients with ferromagnetic metal should not be scanned, because the magnetic field may interact with implanted surgical clips or other ferromagnetic materials.
- Persons with cardiac pacemakers or other implanted electronic devices should not enter the magnetic field zone delineated by the system's manufacturer.
- There is a risk to scanning feverish or decompensated cardiac patients.
- Facial makeup should be removed before scanning because many eye makeups contain metal flakes which can cause skin and eye irritation. Permanent eye-liner tattoos may cause eye irritation due to the presence of ferromagnetic particles.
- Patients who work in environments in which there is a risk of having embedded metallic fragments in or near the eye should be carefully screened before having an MR exam.

EMERGENCY PROCEDURES

In the unlikely event that a coil creates smoke, sparks or makes an unusually loud noise or if the patient requires emergency assistance:

1. Stop the scan if one is in progress.
2. Disconnect the coil.
3. Remove the coil from the patient.
4. Remove the patient from the scan room if medical treatment is needed.
5. Contact IGC-Medical Advances Inc. as soon as possible to inform us about the details of the incident.

SHIPPING LIST

Table 2-1 lists the Quadrature Lower Extremity Coil parts. Please note that only the coil and configuration ordered will be supplied. Check that all parts ordered have been shipped.

TABLE 2-1

SHIPPING LIST FOR THE QUADRATURE LOWER EXTREMITY COIL

QTY.	ITEM		PART NO.
1	Quadrature Lower Extremity Coil	1.0T	14600P1
		1.5T	14600
1	Cable Assembly	1.0T	14621P1
		1.5T	14621
1	Foot Support Pad		14626
1	Leg/Foot Support Pad		14627
1	Toe Pad		14628
1	Knee Pad		14629
1	Tips Sheet		14614
1	MSDS		10818
1	Bottle Phantom (contains NaCl & $CuSO_4 \cdot 5H_2O$)		14607
1	Operator's Manual		M472GE

Quadrature Lower Extremity Coil

The Quadrature Lower Extremity Coil is comprised of a coil, a positioning base, and a set of positioning pads.

Figure 2-1

COIL DESCRIPTION

The Quadrature Lower Extremity Coil is a **quadrature transmit and receive** imaging coil which means the RF is both sent and received from the imaging coil antenna. The unique "chimney" design of the upper half of the coil allows imaging of the foot and ankle in a comfortable, neutral position. Several features make patient positioning particularly easy:

1. The top half of the coil disconnects from the bottom half for ease of patient entry and exit.

2. The base allows you to move the coil left or right into alignment with the anatomy to be scanned.

3. A locking device on the support keeps the coil in place.

4. A numbering scale allows you to estimate the lateral offset.

PAD DESCRIPTION

Four pads are supplied with the Quadrature Lower Extremity Coil. One pad supports the knee during examinations of the knee, one pad supports the foot/ankle during foot/ankle examinations, one pad stabilizes the forefoot, and one pad supports the unaffected extremity. The pads are designed to raise the knee or ankle to isocenter in the coronal plane. If more padding is necessary to align the extremity with isocenter or to increase patient comfort, use additional pads from the department.

COIL POSITIONING

1. Attach the cable assembly to the Quadrature Lower Extremity Coil. Each cable is color coded to insure proper connection.

2. Place the Quadrature Lower Extremity Coil on the patient cradle towards the bore end of the cradle. The coil cables should exit toward the magnet. The coil base should be centered on the cradle side to side.

3. Release the coil centering lever(s) and slide the coil laterally to its desired position. Secure the coil in its desired position to ensure that the coil will not move during imaging.

   Always position the coil as close to magnet isocenter on the base as possible. Image quality decreases the further off-center the coil is positioned. This is especially important if fat saturation techniques will be employed.

4. Remove the top half of the coil. Apply downward pressure on the latches located on either side of the coil to release the latches and separate the two halves of the coil.

5. Position the Quality Assurance Phantom or the patient within the coil. Refer to either the QUALITY ASSURANCE or PATIENT PREPARATION & POSITIONING Sections for more detailed positioning information.

6. Put the top half of the coil back in place. Be sure to align the coil pins on the top half with the receiver holes on the coil bottom half (note that there is only one way in which it can connect). Secure the anterior portion of the coil.

NOTE: The anterior portion of the Quadrature Lower Extremity Coil ***must*** be clamped completely to the posterior portion. Failure to do so may cause severe anterior signal drop-off or coil damage!

7. Raise the patient table to "full up" position. Ensure that the RF cables do not get caught in the table or system while the table is being raised.

SYSTEM/COIL CONNECTION

1. Connect the Quadrature Lower Extremity Coil to the scanner by plugging the adapter box into the surface coil port.

2. Check the green LED on the adapter box to ensure that it is illuminated. This indicates that the fuses in the coil are functioning properly.

COIL ALIGNMENT

1. Turn on the alignment lights and align the axial plane to the alignment marks on the anterior portion of the coil.

2. If the coil is offset laterally, record the numerical amount from the numbered scale on the coil base. Enter the offset distance on the scan range page of your protocol.

3. Landmark the coil and Advance To Scan.

CAUTION: This is a transmit/receive coil. Use only [EXTREM] coil selection. Any other selection will damage the coil. DO NOT localize or scan using the body coil or COIL DAMAGE WILL OCCUR!

SYSTEM COIL SELECTION

If you have not had a specific soft key configured for the Quadrature Lower Extremity Coil, select the Coil Selection appropriate for your system:

4.X Systems:
(1.5T ONLY)

Select the **[OTHER COILS]** soft key on the patient parameters page.

Select the **[OTHER]** soft key on the **Transmit/Receive Coil** line or select the **[EXTREM]** soft key.

5.X Systems:
(1.5T ONLY)

Select the **[OTHER COILS]** soft key on the patient parameters page.

Select the **[EXTREM]** soft key on the **Transmit/Receive** line.

5.X Systems:
(1.0T ONLY)

Select the **[OTHER COILS]** soft key on the patient parameters page.

Select the **[QUADEXT]** soft key on the **Transmit/Receive** line.

LX Systems:
(1.5T, 1.0T)

At the "Patient Position" area, select **[...]** to the right of the Coil type-in field. A pop-up window of available coils will appear.

Click on **[Surface]** under coil types.

Click on **[EXTREM]** in the Surface Coil list.

Select **[Accept]**.

NOTE: For systems with 9.0 software or higher, the name for this coil is: QUADKNEE

Add the coil using the Configuration File Manager. Refer to: Service Methods CD; System Level Procedures; Software Utilities.

Choosing a coil selection that transmits with the body coil WILL damage the coil! If you are not confident that a coil selection is a Transmit/Receive selection, perform the following simple test to help confirm if the selection is correct.

1. Connect a receive-only coil (i.e., GP Flex, circular loop, Quad T/L etc.) to the system. Position a quality assurance phantom in or on the coil. Landmark and Advance To Scan.

2. Prescribe a scan using protocol such as the one outlined in the QUALITY ASSURANCE Section of this manual. For coil selection, **choose the system coil selection/s that you plan to use when scanning with the Quadrature Lower Extremity Coil**. Attempt to complete a scan with each selection and observe for one of the following results:

   - If a "TR Driver fault" error appears, most likely the selection is configured as a phased array coil. **DO NOT** use this selection with the **Quadrature Lower Extremity Coil**.

   - If the scan completes successfully, most likely the selection is configured as a body transmit, receive-only coil. **DO NOT** use this selection with the **Quadrature Lower Extremity Coil**.

   - If the scan does not complete, and a "TR Driver fault" **DOES NOT** appear, you most likely have chosen a Transmit/Receive selection appropriate for the **Quadrature Lower Extremity Coil**.

If any of the results from the previous tests raise concerns about using a particular system coil selection with the Quadrature Lower Extremity Coil, have your G.E. Service Engineer evaluate the situation further!

NOTE: If you wish, contact your G.E. Service Engineer to configure a coil selection specifically for the Quadrature Lower Extremity Coil. **The values entered should be identical to the default values for the 1.5T and 1.0T G.E. Transmit/Receive extremity coil. These values are included in Table 2-2.** It is not imperative for a specific coil selection to be created for the Quadrature Lower Extremity Coil to function properly so long as a **Transmit/Receive** Extremity Coil is selected.

TABLE 2-2

COIL CONFIGURATION PARAMETERS

	1.5T	1.0T
IGC-MAI Coil	**Quad Lower Extremity**	**Quad Lower Extremity**
Use same coil config as:	EXTREM	QUADEXT
CoilType	1	1
EXT Coil?	Yes	Yes
Cable Loss	1.3	1.45
Coil Loss	0.032	0.0173
Recon Scale Factor	1	1
Linear (1) vs. Quad (0)	Quad	Quad
Multi Receiver Coil?	No	No
# of Receivers	0	0
Starting Receiver ID	0	0
Ending Receiver ID	0	0
Multi-Coil Port Enable	0	0
Multi-Coil Port Error Enable	0	0
Additional Transmit Attenuation	0	30
# of Fast Receivers	1	1
Starting Fast Receiver ID	4	4
Ending Fast Receiver ID	4	4
Fast TG Start TA	190	190
Fast TG Start RA	12	12
Multicoil Recon Enable	0	0
Head Default Freq Direction	1	1
For Systems with 9.0 Software or higher, please use:		
CoilName	QUADKNEE	QUADKNEE
Fast TG Start TA	90	90

RECONSTITUTION INSTRUCTIONS FOR PHANTOM BOTTLE

1. Unscrew the cap from the phantom bottle.
2. Fill the phantom bottle approximately half full with distilled water. The proper amount of sodium chloride (NaCl) and copper sulfate ($CuSO_4 \cdot 5H_2O$) has been added to the bottle.
3. Securely screw the phantom bottle cap back on.
4. Shake the bottle vigorously to dissolve the sodium chloride and copper sulfate.
5. Unscrew the cap from the phantom bottle.
6. Fill the bottle completely with distilled water so that no air bubbles are present (all the way to the rim).
7. Securely screw the bottle cap back on.

INITIAL SNR MEASUREMENT

1. Follow the reconstitution instructions above to prepare the bottle phantom.
2. Position the coil on the cradle, raise the table and connect the coil according to the steps outlined on Pages 2-2 and 2-3 of the COIL INSTRUCTIONS Section of this manual.
3. Insert the phantom into the coil (with the top half of the coil connected) so that the length of the phantom runs along the axis of the coil. Use the knee pad, supplied with the coil, to position the phantom in the coil center. Make sure that the coil is centered on the coil positioning support. (Figure 3-1)

Figure 3-1

4. Align the coil, landmark and advance the cradle to scan as previously described in the COIL INSTRUCTIONS Section.

5. Prescribe and scan the protocol found on the next page. Be sure to choose the proper system coil selection as detailed on Page 2-5.

CAUTION: This is a transmit/receive coil. Use only [EXTREM] coil selection. Any other coil selection will damage the coil. To prevent damage to coil **DO NOT** scan using the body coil!

SCAN PROTOCOL	
Scan Plane	Axial
Field of View	20 cm
Pulse Sequence	SE
TR	600
TE	20
Start Location	0
# of Slices	1
Slice Thickness	3 mm
Nex	1
Matrix Size	256 x 128

6. Display the image and check for artifacts. If no artifacts are visible, go to Step 7. If artifacts are present, eliminate them by checking for the following:

   - Check for metal on the phantom, padding, coil, and patient table.

   - Check that the color coded cables are correctly attached and that the top half of the coil is fully closed.

7. Display a circular cursor approximately 2 cm in diameter. Position the cursor at the phantom center.

8. Generate an ROI from the display menu and record the Signal Mean Value in Table 3-1 on Page 3-4.

9. Move the cursor to the background, to the top right of the screen, out of the phantom image.

10. Generate another ROI from the display menu on the touch screen and record the Noise Standard Deviation value of the cursor area in Table 3-1 on Page 3-4.

11. Calculate the Signal-to-Noise ratio from the following equation and record in Table 3-1 below:

- $\frac{\text{Value from Step 8}}{\text{Value from Step 10}}$

Table 3-1			
Original SNR Data Obtained at Initial Coil Installation			
Date	Signal Mean Value of Phantom (Step 8)	Standard Deviation of Noise (Step 10)	SNR Value (Step 11)

NOTE: THE ABOVE SNR DATA PROVIDES IMPORTANT BASELINE DATA USED IN CALCULATING FUTURE COIL PERFORMANCE.

Once the *Initial SNR Measurement* has been completed and the values recorded in Table 3-1, the Quadrature Lower Extremity Coil is ready to be used for clinical imaging.

PERIODIC QUALITY ASSURANCE CHECK

On a periodic basis, such as during Preventative Maintenance, perform the quality assurance check outlined below to ensure that the Quadrature Lower Extremity Coil is operating properly with no appreciable degradation of image quality.

To maintain consistent image quality, the Periodic Quality Assurance procedure should also be performed in the event of major system software and/or hardware changes or upgrades.

1. Follow the steps previously described in this section for *Initial SNR Measurement* to obtain a phantom image from the coil.

2. Generate ROI's of the phantom and the background noise as described in the *Initial SNR Measurement* Section.

3. Record the Signal Mean Value from the phantom ROI in Table 3-2, *Periodic SNR Data* on Page 3-6.

4. Record the Standard Deviation value of the noise ROI in Table 3-2, *Periodic SNR Data* on Page 3-6.

5. Calculate the Signal-to-Noise ratio from the following equation and record in Table 3-2 on Page 3-6:

   - $\frac{\text{Mean Value from phantom ROI}}{\text{Standard Deviation from noise ROI}}$

6. Divide the SNR value obtained in the periodic QA check (recorded in column 4) by the original SNR value. The original SNR value can be found in Table 3-1 on Page 3-4.

7. Multiply the value from Step 10 by 100, and record this percentage in column 5 of Table 3-2 on Page 3-6.

8. If this percentage is not greater than 85%, then the coil may be damaged or there may be a problem with your system. Follow the troubleshooting instructions in the *Troubleshooting/Maintenance* Section of the manual.

CAUTION: This is a transmit/receive coil. Use only [EXTREM] coil selection. Any other coil selection will damage the coil. To prevent damage to coil **DO NOT** scan using the body coil!

TABLE 3-2

PERIODIC SNR DATA

1 DATE	2 SIGNAL MEAN VALUE	3 NOISE STANDARD DEVIATION VALUE	4 SNR VALUE	5 VALUE IN COLUMN 4 DIVIDED BY ORIGINAL VALUE X 100
				> 85%
				> 85%
				> 85%
				> 85%
				> 85%
				> 85%
				> 85%
				> 85%
				> 85%
				> 85%
				> 85%
				> 85%
				> 85%
				> 85%
				> 85%
				> 85%
				> 85%
				> 85%
				> 85%

PATIENT PREPARATION

The following are some patient preparation considerations to be aware of before positioning for the exam.

1. Have the patient remove any deodorant, jewelry or clothing that may interfere with the study.

2. Be aware of skin tattoos that may contraindicate scanning.

3. Apply skin markers as requested by your Radiologist.

GENERAL PATIENT POSITIONING GUIDELINES

Here are some general positioning guidelines to keep in mind.

1. Position the coil at the end of the table closest to the bore. Check to see that the cable from the coil is not too far away to plug in. Place the table mat on the cradle superior to the coil to provide a more even positioning surface.

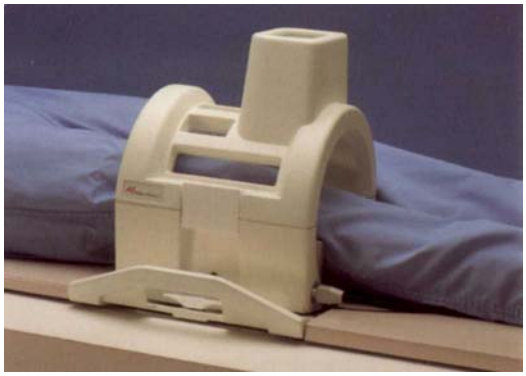
2. Keep the base of the coil centered on the cradle. Offset the coil within the base to adjust for patient size and comfort. Lock the coil down when in position and record the offset distance for use during the exam.

3. Be sure not to pinch any gowns or bedding material between the coil halves when attaching the top half of the coil. This would cause poor image quality and possibly result in damage to the coil.

4. Padding is provided that is designed for either knee imaging or for specific ankle and foot imaging. Additional padding or towels from the department may be required for patient comfort and immobilization depending on the anatomy to be imaged and patient size.

5. Position the patient’s arms in a comfortable position either over their chest or at the sides. Utilize additional pillows or sponges to support the patient and make them comfortable.

Refer to the images below for the two most common applications using the Quadrature Lower Extremity Coil, knee imaging (Figure 4-1) and ankle/foot imaging (Figure 4-2).

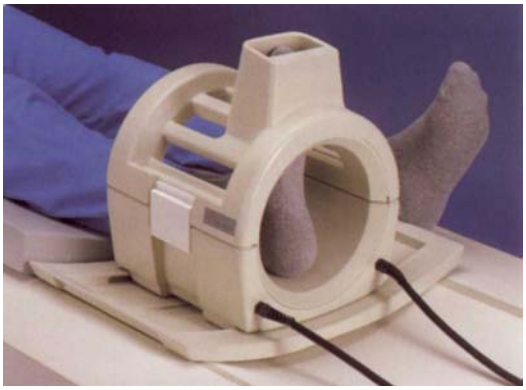


Position the knee within the Quadrature Lower Extremity Coil.

Figure 4-1

For knee imaging, place the knee in the coil so that the apex of the patella is located in the center of the coil. Adjust the rotation of the leg so that the patient is comfortable and positioned according to department protocol. Support the leg above and below the coil. Immobilize the knee as needed.

For ankle or foot imaging, place the ankle in the coil with the foot flexed so that it will extend up into the foot extension of the coil and position with the ankle/foot pad. Utilize additional padding to immobilize the toes and foot within the "chimney" portion of the coil. Support the leg as needed. Immobilize the ankle and foot as needed.



Position the foot and ankle within the coil. *(Note: Ankle/foot pads not shown for detail.)*

Figure 4-2

GENERAL PROTOCOL CONSIDERATIONS

Proceed to scan using your designated protocols and/or the ones included in the following section. You may use the protocols supplied as is or modify them to suit your needs keeping in mind the inherent tradeoffs involved in MR parameter selection. The parameters achievable on your scanner may vary slightly from those supplied here due to differences in system software.

Listed below are a few applications considerations to keep in mind when scanning:

- A coronal or axial localizer will be easier to prescribe and scan than a sagittal localizer that would require a more precise entry of scan locations.

- Always try to keep the coil positioned as close to isocenter as possible. This is especially important if fat suppression techniques will be used.

- When performing **fat saturation**, be sure to check the CFA Fine setting in manual pre-scan and adjust the center frequency of water if needed. This should be done for **each** scan using fat saturation and is very important if homogeneous fat suppression is desired!

- To optimize fat saturation further, after centering the water peak, utilize the commands "**mrsp**", "**cstun**" and "**1**" to view the prescan spectrum with the fat saturation in affect. Type "**csa**" to visualize the default setting for the amplitude of the fat saturation pulse. Enter higher or lower numbers (usually higher) to minimize the fat peak as much as possible. Refer to your system operator's manual for detailed information on the procedure.

- When performing Inversion Recovery techniques for fat suppression, check that selected TI time is correct. From the CFA Fine screen in manual pre-scan, type "**mrsp**", then "**titime**". The presently selected TI time appears. At this point, different inversion times can be entered to see their affect on the fat peak. If a time other than the initially prescribed TI time is found to produce improved fat suppression, go back to the SCAN TIMING page and change the selected TI time and proceed with completing the scan. Refer to your system operator's manual for detailed information on the procedure.

PARAMETERS	Axial Gradient Localizer	Sagittal Oblique FSE PD w/ Fat Sat	Sagittal Oblique FSE T2 w/ Fat Sat	Sagittal Oblique Routine SE w/ Fat Sat	Coronal Oblique FSE PD w/ Fat Sat	Coronal Oblique T1	Sagittal 3D GRE
IMAGE MODE	2D	2D	2D	2D	2D	2D	3D
PULSE SEQUENCE	Gre,FC	Spin Echo	Spin Echo	Spin Echo	Spin Echo	Spin Echo	Gre
IMAGING OPTIONS	FC	Fast,NPW, TRF	Fast,NPW	NPW	Fast,TRF	-	Fast,Gx,FC
PSD TYPE IN	-	-	-	-	-	-	-
FLIP ANGLE (or # ECHOS)	20	1	1	1	1	1	30
TE (ms)	Min	30	102	Min Full	30	Min Full	15
TR (ms)	200	2000	4000	650	2000	600	Min
INVERSION TIME (ms)	-	-	-	-	-	-	-
ECHO TRAIN LENGTH	-	4	8	-	4	-	-
AUTOSHIM	On	On	On	On	On	On	On
PHASE CORRECTION	Off	On	On	-	On	-	-
RECEIVE BANDWIDTH (KHz)	16	16	16	16	16	16	16
FLOW COMP. DIRECTION	Slice	-	-	-	-	-	Freq
FOV (cm)	16	14	14	14	14	14	14
SCAN THICKNESS (mm)	5	4	4	4	4	4	1.5
INTERSCAN SPACE (mm)	1	0	0	0	0	0	0
EXPLICIT / GRAPHIC Rx.	I55 - S55	Gx	Gx	Gx	Gx	Gx	Gx
EXPLICIT SATS	SI	SI	SI	SI	SI	SI	SI
FAT / WATER SAT (Y/N)	-	Fat	Fat	Fat	Fat	-	-
MATRIX (Freq X Phase)	256 x 160	256 x 224	256 x 224	256 x 224	256 x 224	256 x 224	256 x 224
FREQUENCY DIRECTION	RL	AP	AP	AP	SI	SI	SI
PHASE FOV	1	1	1	1	1	1	1
NEX	1	2	2	2	2	2	1

Protocol: **KNEE** ***For:*** **G.E. Signa® 1.5T**

Patient Entry: **Feet First/Supine** ***Landmark:*** **Apex Of Patella**

PARAMETERS	Axial Gradient Localizer	Sagittal Oblique FSE PD w/ Fat Sat	Sagittal Oblique FSE T2 w/ Fat Sat	Sagittal Oblique Routine SE w/ Fat Sat	Coronal Oblique FSE PD w/ Fat Sat	Coronal Oblique T1	Sagittal 3D GRE
IMAGE MODE	2D	2D	2D	2D	2D	2D	3D
PULSE SEQUENCE	Gre	Spin Echo	Spin Echo	Spin Echo	Spin Echo	Spin Echo	Gre
IMAGING OPTIONS	FC,ED	Fast,NPW, TRF,VB ED	Fast,NPW, VB,ED	NPW,VB, EDR	Fast,TRF, EDR	EDR	Fast,Gx, VB,EDR
PSD TYPE IN	-	-	-	-	-	-	-
FLIP ANGLE (or # ECHOS)	20	1	1	1	1	1	30
TE (ms)	Min	30	102	Min Full	30	Min Full	Min
TR (ms)	200	2000	4000	650	2000	600	Auto
INVERSION TIME (ms)	-	-	-	-	-	-	-
ECHO TRAIN LENGTH	-	6	8	-	6	-	-
AUTOSHIM	On	On	On	On	On	On	On
PHASE CORRECTION	-	On	On	-	On	-	-
RECEIVE BANDWIDTH (KHz)	16	8	8	16	8	16	6
FLOW COMP. DIRECTION	16	16	16	16	16	16	16
FOV (cm)	Slice	-	-	-	-	-	-
SCAN THICKNESS (mm)	5	4	4	4	4	4	1.5
INTERSCAN SPACE (mm)	1	0	0	0	0	0	0
EXPLICIT / GRAPHIC Rx.	I50 - S50	Gx	Gx	Gx	Gx	Gx	Gx
EXPLICIT SATS	-	SI	SI	SI	SI	SI	SI
FAT / WATER SAT (Y/N)	-	Fat	Fat	Fat	Fat	-	-
MATRIX (Freq X Phase)	256 x 160	256 x 224	256 x 224	256 x 224	256 x 224	256 x 224	256 x 224
FREQUENCY DIRECTION	RL	AP	AP	AP	SI	SI	SI
PHASE FOV	1	1	1	1	1	1	1
NEX	1	2	2	2	2	2	1

Protocol: **KNEE** ***For:*** **G.E. Signa® 1.0T**

Patient Entry: **Feet First/Supine** ***Landmark:*** **Apex of Patella**

PARAMETERS	Sagittal T1 Localizer	Coronal T1	Sagittal FSE PD w/ Fat Sat	Sagittal Fast IR	Coronal Oblique FSE PD w/ Fat Sat	Axial Oblique T1	Sagittal 3D GRE
IMAGE MODE	2D	2D	2D	2D	2D	2D	3D
PULSE SEQUENCE	Spin Echo	Spin Echo	Spin Echo	IR	Spin Echo	Spin Echo	Gre
IMAGING OPTIONS	-	-	Fast,TRF	Fast,TRF	Fast,TRF	-	-
PSD TYPE IN	-	-	-	-	-	-	-
FLIP ANGLE (or # ECHOS)	1	1	1	1	1	1	30
TE (ms)	Min	Min Full	30	30	30	Min Full	15
TR (ms)	500	600	2000	5000	2000	600	25
INVERSION TIME (ms)	-	-	-	150	-	-	-
ECHO TRAIN LENGTH	-	-	6	8	6	-	-
AUTOSHIM	On	On	On	On	On	-	On
PHASE CORRECTION	-	-	On	On	On	-	-
RECEIVE BANDWIDTH (KHz)	16	16	16	16	16	16	16
FLOW COMP. DIRECTION	-	-	-	-	-	-	-
FOV (cm)	16	14	14	14	14	10	18
SCAN THICKNESS (mm)	5	3	3	4	3	4	1.5
INTERSCAN SPACE (mm)	1	0	1	0	1	0	0
EXPLICIT / GRAPHIC Rx.	Offset	Gx	Gx	Gx	Gx	Gx	Gx
EXPLICIT SATS	-	SI	SI	SI	SI	SI	-
FAT / WATER SAT (Y/N)	-	-	Fat	-	Fat	-	-
MATRIX (Freq X Phase)	256 x 160	256 x 224	256 x 224	256 x 192	256 x 224	256 x 224	256 x 192
FREQUENCY DIRECTION	SI	SI	SI	SI	SI	RL	SI
PHASE FOV	1	1	1	1	1	1	1
NEX	1	2	2	2	2	2	1

Protocol: **ANKLE** ***For:*** **G.E. Signa® 1.5T**

Patient Entry: **Feet First/Supine** ***Landmark:*** **Tibiotalar Jt.**

PARAMETERS	Sagittal T1 Localizer	Coronal T1	Sagittal FSE PD w/ Fat Sat	Sagittal Fast IR	Coronal Oblique FSE PD w/ Fat Sat	Axial Oblique T1	Sagittal 3D GRE
IMAGE MODE	2D	2D	2D	2D	2D	2D	3D
PULSE SEQUENCE	Spin Echo	Spin Echo	Spin Echo	IR	Spin Echo	Spin Echo	Gre
IMAGING OPTIONS	EDR	EDR,VB	Fast,EDR, VB,TRF	Fast,EDR, VB,TRF	Fast,EDR, VB,TRF	EDR,VB	EDR,VB
PSD TYPE IN	-	-	-	-	-	-	-
FLIP ANGLE (or # ECHOS)	1	1	1	1	1	1	30
TE (ms)	Min	Min Full	30	30	30	Min Full	15
TR (ms)	500	600	2000	3000	2000	650	25
INVERSION TIME (ms)	-	-	-	100	-	-	-
ECHO TRAIN LENGTH	-	-	6	6	6	-	-
AUTOSHIM	On	On	On	On	On	-	On
PHASE CORRECTION	-	-	On	On	On	-	-
RECEIVE BANDWIDTH (KHz)	16	12	12	12	12	12	10
FLOW COMP. DIRECTION	-	-	-	-	-	-	-
FOV (cm)	16	14	14	14	14	14	18
SCAN THICKNESS (mm)	5	3	3	4	4	4	1.5
INTERSCAN SPACE (mm)	1	0	0	0	0	0	0
EXPLICIT / GRAPHIC Rx.	Offset	Gx	Gx	Gx	Gx	Gx	Gx
EXPLICIT SATS	-	SI	SI	-	SI	SI	-
FAT / WATER SAT (Y/N)	-	-	Fat	-	Fat	-	-
MATRIX (Freq X Phase)	256 x 160	256 x 224	256 x 224	256 x 192	256 x 224	245 x 224	245 x 192
FREQUENCY DIRECTION	SI	SI	SI	SI	SI	RL	SI
PHASE FOV	1	1	1	1	1	1	1
NEX	1	2	2	2	2	2	1

Protocol: **ANKLE** ***For:*** **G.E. Signa® 1.0T**

Patient Entry: **Feet First/Supine** ***Landmark:*** **Tibiotalar Jt.**

PARAMETERS	Axial T1 Localizer	Sagittal FSE PD w/ Fat Sat	Sagittal FSE T2 w/ Fat Sat	Coronal Routine SE w/ Fat Sat	Axial FSE T2
IMAGE MODE	2D	2D	2D	2D	3D
PULSE SEQUENCE	Spin Echo	Spin Echo	Spin Echo	Spin Echo	Spin Echo
IMAGING OPTIONS	-	Fast,TRF	Fast,VB	VB	Fast,VB
PSD TYPE IN	-	-	-	-	-
FLIP ANGLE (or # ECHOS)	1	1	1	1	1
TE (ms)	Min	30	102	Min Full	102
TR (ms)	400	2000	5000	600	5000
INVERSION TIME (ms)	-	-	-	-	-
ECHO TRAIN LENGTH	-	6	8	-	8
AUTOSHIM	On	On	On	On	On
PHASE CORRECTION	-	On	On	-	On
RECEIVE BANDWIDTH (KHz)	16	16	10	10	10
FLOW COMP. DIRECTION	-	-	-	-	-
FOV (cm)	18	Pt Size	Pt Size	Pt Size	Pt Size
SCAN THICKNESS (mm)	4	4	3	3	3
INTERSCAN SPACE (mm)	1	1	1	0	0
EXPLICIT / GRAPHIC Rx.	I50 - S50	Gx	Gx	Gx	Gx
EXPLICIT SATS	SI	SI	SI	SI	SI
FAT / WATER SAT (Y/N)	-	Fat	Fat	Fat	-
MATRIX (Freq X Phase)	256 x 160	256 x 224	256 x 224	256 x 224	256 x 224
FREQUENCY DIRECTION	RL	SI	SI	SI	RL
PHASE FOV	1	1	1	1	1
NEX	1	2	2	2	2

Protocol: **FOOT** ***For:*** **G.E. Signa® 1.5T**

Patient Entry: **Feet First/Supine** ***Landmark:*** **Mid Foot**

PARAMETERS	Axial T1 Localizer	Sagittal FSE PD w/ Fat Sat	Sagittal FSE T2 w/ Fat Sat	Coronal Routine SE w/ Fat Sat	Axial FSE T2
IMAGE MODE	2D	2D	2D	2D	2D
PULSE SEQUENCE	Spin Echo	Spin Echo	Spin Echo	Spin Echo	Spin Echo
IMAGING OPTIONS	EDR	Fast,TRF, EDR,VB	Fast,TRF, EDR,VB	EDR	Fast,EDR, VB
PSD TYPE IN	-	-	-	-	-
FLIP ANGLE (or # ECHOS)	1	1	1	1	1
TE (ms)	Min	30	102	Min Full	102
TR (ms)	500	2000	5000	600	5000
INVERSION TIME (ms)	-	-	-	-	-
ECHO TRAIN LENGTH	-	6	8	-	8
AUTOSHIM	On	On	On	On	-
PHASE CORRECTION	-	On	On	-	On
RECEIVE BANDWIDTH (KHz)	16	12	10	10	10
FLOW COMP. DIRECTION	-	-	-	-	-
FOV (cm)	18	Pt Size	Pt Size	Pt Size	Pt Size
SCAN THICKNESS (mm)	4	4	4	4	4
INTERSCAN SPACE (mm)	1	1	1	0	0
EXPLICIT / GRAPHIC Rx.	I50 - S50	Gx	Gx	Gx	Gx
EXPLICIT SATS	SI	SI	SI	SI	SI
FAT / WATER SAT (Y/N)	-	Fat	Fat	Fat	-
MATRIX (Freq X Phase)	256 x 160	256 x 224	256 x 224	256 x 224	256 x 224
FREQUENCY DIRECTION	RL	SI	SI	SI	SI
PHASE FOV	1	1	1	1	1
NEX	1	2	2	2	2

Protocol: **FOOT** ***For:*** **G.E. Signa® 1.0T**

Patient Entry: **Feet First/Supine** ***Landmark:*** **Mid Foot**

TROUBLESHOOTING

The following is a list of common problems and solutions for those problems. If you cannot solve a problem by following the procedures in the manual, contact IGC-Medical Advances Inc. Customer Service at **1-800-657-0891** between the hours of 7:30 AM and 5:30 PM, (United States Central Standard Time) Monday through Friday to arrange for service/repair or to speak with an Applications Specialist.

Further correspondence can be sent to the following address:

Customer Service
IGC-Medical Advances Inc.
10437 Innovation Drive
Milwaukee, WI 53226-4815 USA
Tel: 1 (414) 258-3808
Fax: 1 (414) 258-4931

RECEIVING NO SIGNAL

PROBLEM: You are unable to pre-scan **or** are scanning and yet receiving no signal.

POSSIBLE SOLUTION: Verify that you have selected the appropriate system coil selection. Refer to Page 2-5 for additional information.

Verify that the cable is correctly connected to the system and that it is completely plugged in.

Verify that the landmark is correct and that the cradle has not unlatched.

Verify that the scan locations and any FOV offsets are correct.

Perform a Continuity Check on the external cable (to be performed by a G.E. authorized Service Engineer only).

If you still cannot get a signal, try to scan (transmit and receive) with the body coil. **For this test, be sure to remove the imaging coil from the magnet bore before you scan with the body coil**. If you still receive no signal the problem probably lies with your MR system. If the body coil scan is satisfactory, attempt a scan using **both** another coil of the **exact same type** (receive-only, phased array or transmit/receive, whichever applies) and the same system coil selection. If the scan completes successfully, there is probably a problem with the IGC-Medical Advances Inc. coil. Contact IGC-Medical Advances Inc. for further assistance. If you are unable to scan with the substitute coil, there may be a system problem related to this particular coil type.

IMAGE QUALITY

PROBLEM: The ratio obtained in the periodic quality assurance check is not greater than 85%, or the image quality is not what you expect it should be, given the parameters selected.

POSSIBLE SOLUTION: Review the selected protocol. If you are performing the Periodic Quality Assurance, be sure your protocol is **identical** to the protocol provided on Page 3-3 of this manual. If you are performing diagnostic images, you may need to increase NEX or FOV.

Perform a Continuity Check on the external cable (to be performed by a G.E. authorized Service Engineer only).

Verify that there are no loops in the cables.

Verify that there are no metal or ferromagnetic objects close to the coil, patient or magnet (i.e., safety pin, hair pin).

Verify that the coil is properly positioned.

Verify that your center frequency is within the frequency adjustment range for your system.

Verify that the R1, R2 and TG values from the pre-scan are within normally expected ranges.

Cleaning the electrical contacts that connect the upper and lower halves with Isopropyl Alcohol and a cotton swab has been demonstrated to improve the coil's SNR on occasion.

If you have not done so already, perform a system Quality Assurance phantom test, as outlined in Section 3 of this manual. If the values you obtain do not fall within normal operating parameters, investigate this further by performing a phantom scan with the body coil. **For this test, be sure to remove the imaging coil from the magnet bore before you scan with the body coil**. If you still have the same problems, there is probably an MR system problem. If the body coil scan is satisfactory, acquire a scan using **both** another coil of the **exact same type** (receive-only, phased array or transmit/receive, whichever applies) and the same system coil selection. If the image quality is visibly improved, there may be a problem with the IGC-Medical Advances Inc. coil. Contact IGC-Medical Advances Inc. for further assistance. If the image quality still suffers, there may be a system problem related to imaging with this type of coil.

ARTIFACTS

PROBLEM: There is a black line or signal void on the image.

POSSIBLE SOLUTION: Verify that there is no metal present in the area being scanned in or on the patient.

PROBLEM: Some or all of the images appear shaded or exhibit uneven signal or banding.

POSSIBLE SOLUTION: Confirm that no metallic objects are located nearby, outside the FOV. This is especially important on images utilizing Fat Saturation.

If Fat Saturation is being used, verify that the CFA fine adjustment has been optimized.

For quadrature coils: Verify that the coil is positioned with the cable exiting towards the bore and that the system and coil polarity match.

For phased array coils: Confirm that all phased array channels are functioning properly. Sites that have a Research Key may perform the following procedure themselves. Those sites without a Research Key will need to have their G.E. Field Engineer carry out the procedure utilizing a Service Key.

- Position a phantom on a phased array coil. Prescribe a midline slice using a sequence such as the one included in the QA Section of this manual. Use an FOV large enough to visualize the entire coil.
- Perform **Auto Prescan**, then select **Manual Prescan**.
- On the bottom most "Enter Command" line of the Manual Prescan screen, type "**saveinter**" (lower case). Select "**Backup**" and "**Scan**".
- An image from each channel will be reconstructed along with the conventional image generated from the combination of all coils. Review the image to check for missing signal from one of the channels.

If the above checks out, it is possible the coil has failed. Contact IGC-Medical Advances Inc. for assistance.

MAINTENANCE

STORAGE

Coils should be stored and used at the same room temperature as your MR system.

INSPECTION

Inspect the coil weekly for mechanical breakage/damage. DO NOT USE A COIL WHICH HAS SUSTAINED MECHANICAL DAMAGE. Return the coil to IGC-Medical Advances Inc. for service/repair. This coil contains no user serviceable parts. All repairs must be performed by factory trained personnel.

CLEANING

The cleaning solutions listed below have been tested and are recommended (with comments noted) for cleaning the coil(s) and strap(s). Spray or pour the cleaning liquid onto a soft cotton cloth and proceed to clean.

Solution	Comments
1. Warm water	Safe for all areas of the coil(s) or strap(s)
2. Commercial dishwashing liquid/water combination (1 oz. per gallon of water)	Safe for all areas of the coil(s) or strap(s)
3. Alcohol mixture (70% isopropyl alcohol/ 30% water)	**Do not apply** to adhesive backed materials such as labels, decals or Velcro® fasteners
4. "Break Thru" all purpose cleaner (25 oz. per gallon of water)	**Do not apply** to adhesive backed materials such as labels, decals or Velcro® fasteners

IMPORTANT: **Do not spray or pour cleaning liquid directly onto the coil or cables. Apply to a soft cotton cloth and proceed to clean.**

FUSE/CABLE CONTINUITY CHECK PROCEDURE

To Be Performed by Authorized Service Engineer Only

Checking the Fuse/External Cable

1. Remove four (4) nylon screws from the cover of the interface box assembly. (Figure 6-1)

2. Select the OHMMETER function on the Digital Multi-meter (DMM).

3. Using the DMM, verify if the fuse is blown. If the fuse is blown, replace the fuse.

4. Using the DMM, verify continuity of the cable by performing the following operations: (Figure 6-2)

    a) A continuity check for Receive should be measured from J1 to the center pin on the Black BNC connector.

    b) A continuity check for Transmit should be measured from J3 to the center pin of the Grey BNC connector.

    c) A continuity check for Receive should be measured from J2 to the coaxial shield on the Black BNC connector.

    d) A continuity check for Transmit should be measured from J4 to the coaxial shield on the Grey BNC connector.

5. Verify open (No short circuit) using DMM between J1 and J2.

6. Verify open (No short circuit) using DMM between J3 and J4.

7. Flex the cable while checking to test for intermittent shorting in the cable.

8. If the cable fails either test, replace the cable assembly. Affix the cover to the interface box using four (4) nylon screws and return for repair.

9. If the cable passes the tests, affix the cover to the interface box using four (4) nylon screws.

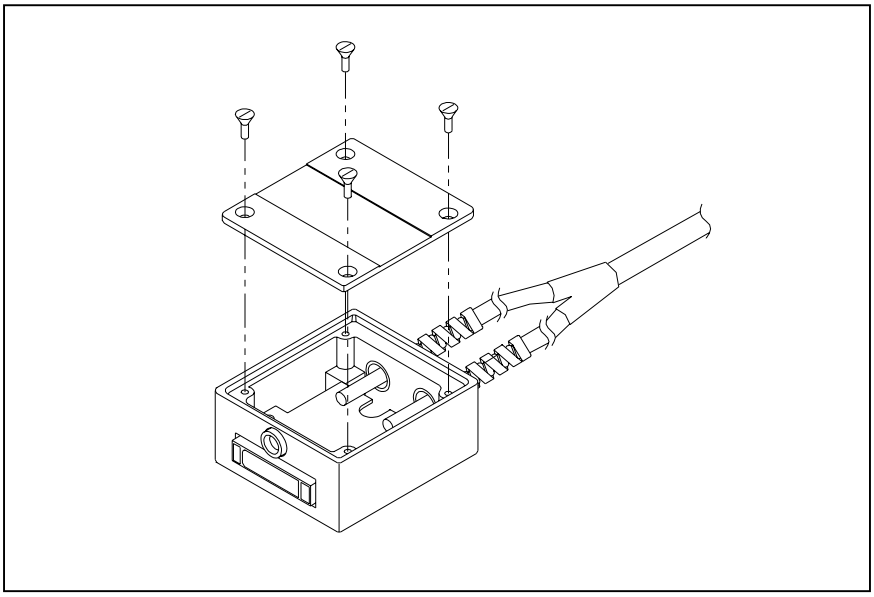


Figure 6-1

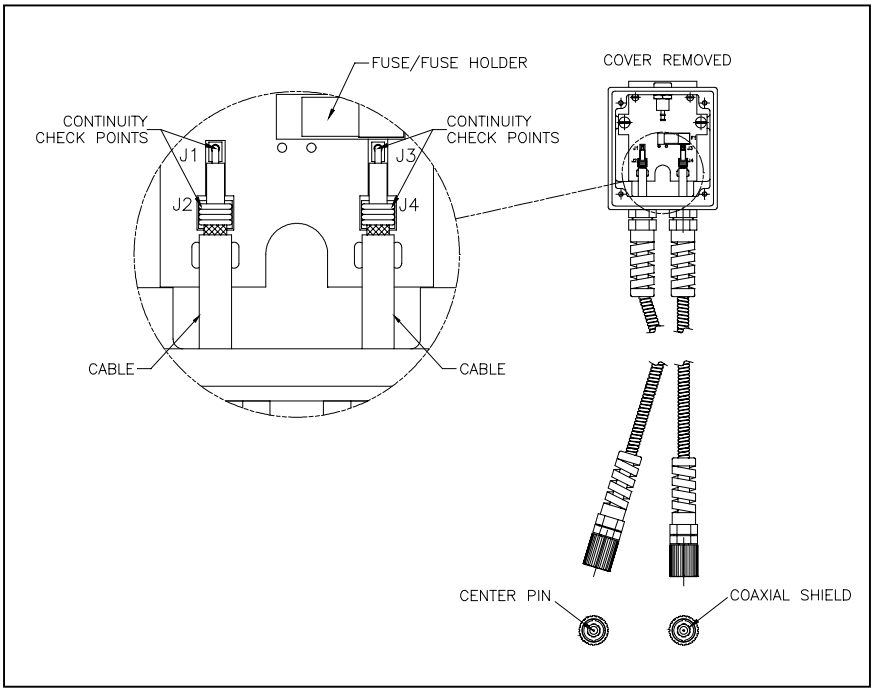


Figure 6-2

SPARE PARTS LISTING

Quadrature Knee/Foot Coil Assembly

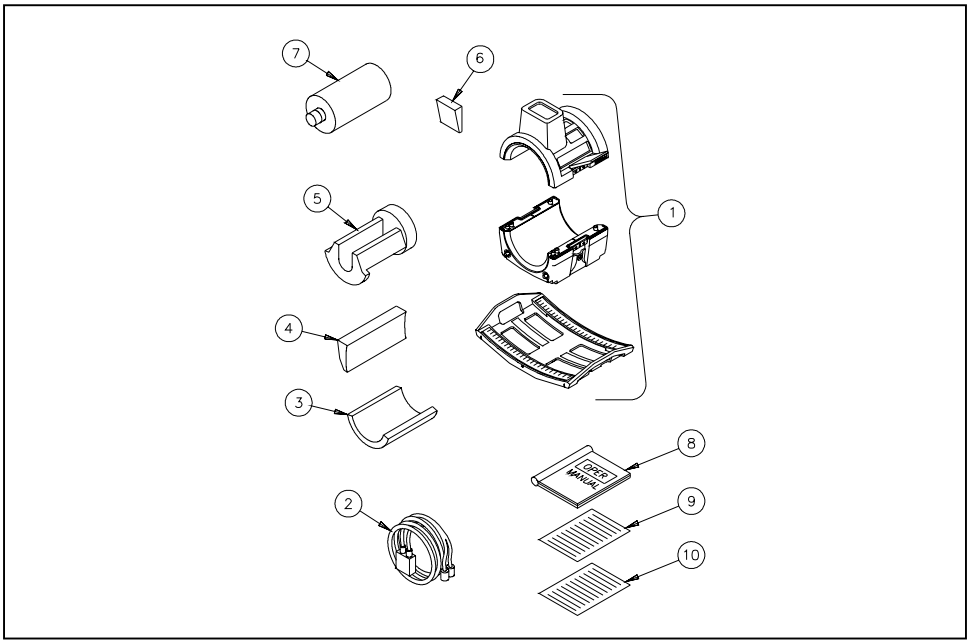


Figure 6-3

SPARE PARTS LISTING			
Item	GE Part #	MAI Part #	Description
1	2225478-8 2225479-8	14600 14600P1	GE Signa® 1.5T Foot/Knee Assembly GE Signa® 1.0T Foot/Knee Assembly
2	2225478-9 2225479-9	14621 14621P1	1.5T Cable Assembly 1.0T Cable Assembly
3	E8800TD	14629	Knee Pad
4	E8800TE	14627	Leg/Foot Support Pad
5	E8800TF	14626	Foot Support Pad
6	E8800TG	14628	Toe Pad
7	2225478-10	14607	Phantom Assembly
8	2225478-11	M472GE	Operator's Manual
9	2225478-12	10818	Material Safety Data Sheet
10	2225478-13	14614	Tips Sheet
11	2225478-7	14680	Spare Parts Repair Kit (Not Shown)

SPARE PARTS LISTING

Latch and Dual-Lock Assemblies

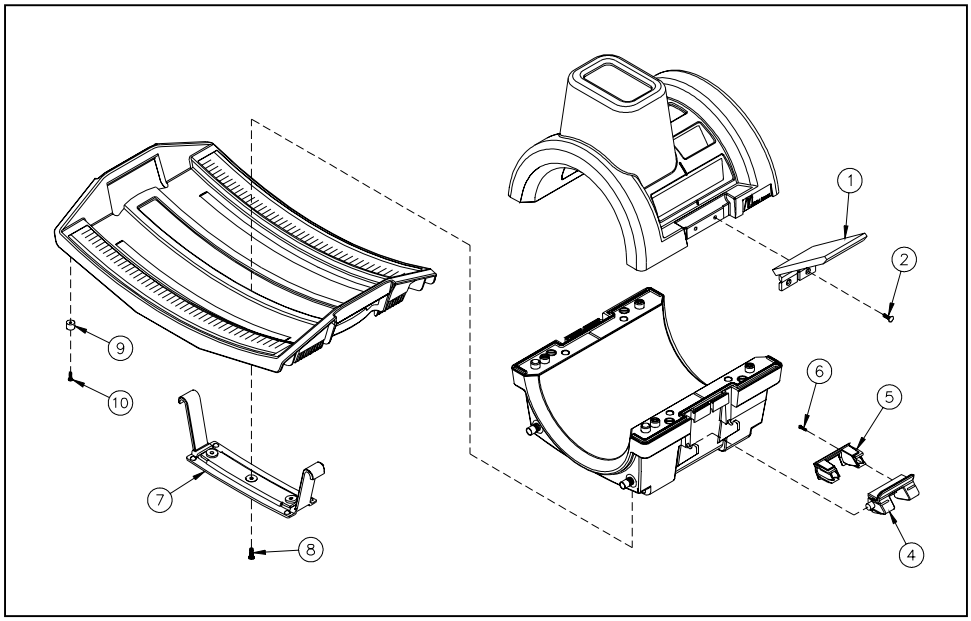


Figure 6-4

SPARE PARTS LISTING		
Item	Part No.	Description
1	20074P2	Draw Latch
2	20117P25	#6-32 x 0.438 FHMS, Brass
3	20146P5	Fuse (Not Shown) (GEMS #2225478-14)
4	14643	Handle, Coil Lock
5	14684	Cover, Lock Handle
6	20271P4	#4-40 x 0.50 RHMS, Brass
7	14644	T-Bracket
8	20136P14	#10-32 x 0.375 PHMS, Brass
9	20287	Rubber Bumper
10	20271P8	#6-32 x 0.50 RHMS, Brass