MORRISON

CAIRNGORM FUNICULAR

6. OPERATION AND MAINTENANCE MANUALS.

Some of the smaller Operations and Maintenance Manuals are kept in this file with the larger manuals submitted separately and included with this documentation.

SEPARATE FILES

NG BAILEY – Mechanical and Electrical Installations

KEE – Sewage Treatment Plant

FERRIER PUMPS – Water Pumping Station

BARR and WRAY LTD – Water Treatment Plant

1 ROBINS & MYERS. SEWAGE GRINDER.

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ROBBINS MYERS

OPERATION AND MAINTENANCE MANUAL

MODEL 20000 MINI MONSTER

ELECTRIC DRIVE

CHANNEL CONFIGURATION

ROBBINS MYERS

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OPERATION AND MAINTENANCE MANUAL

MODEL 20002 MINI MONSTER

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SECTION 1

CHANNEL MINI MONSTER

GENERAL INFORMATION

1.1 EQUIPMENT DESCRIPTION

The Disposable Waste Systems Channel Mini Monster effectively treats solids in low flow, light duty, and sanitary waste applications (wastewater pre-treatment systems, small pump stations, treatment plants, or package treatment plant inlet applications). When used in conjunction with a centrifugal pump, the Mini Monster provides a cost effective system for treating and transporting liquid borne solids.

The Mini Monster is a low speed, high torque, dual-shafted device with a combination of standard and cam cutters.

1.2 SPECIFICATIONS

1.2.1 MINI MONSTER

Each Mini Monster is constructed from materials selected for strength, corrosion resistance, and long life.

A. Shafting: AISI 4140, BS970/Din, and 17200/ISO R 683 T.2 heat treated hexagonal steel stock. Supported on one end using a combination of spherical and cylindrical type roller bearings.
B. Bearings and gear housing: Protected by mechanical seals.
C. End/main housing castings: A395 ductile iron.
D. Cutters: AISI 4130, BS970/DIN, 17200/ISO R 683 T.2 heat treated alloy steel, surface ground for uniformity, and through-hardened to a minimum 45-50 Rockwell "C".
E. Seal faces: tungsten carbide. **NO** packing to adjust. Seal flushing is **NOT** required.
F. Maximum operating pressure: 60 PSI (4.2 kg/cm^2)
G. Flow Rate: 75 GPM (5 L/sec)
H. Weight: 225 U.S. Pounds (102 KG)
I. Dimensions: See Figure 1-1.

1.2.2 GEARBOX SPECIFICATION

Sumitomo gear unit type Cyclo Drive 4000
Reduction ratio 21:1
Driven by 1.5kw TEFC Motor, IP68 Eex de, 415/3/50, 1430 RPM

1.2.3 CONTROLLER

A Control panel is available as an option or a PLC and current sensor can be provided for the clients own control panel. It is imperative that the control philosophy is adhered to when operating the Mini Monster

1.3 STORAGE/HANDLING/CARE

The following paragraphs describes storage, handling, and care in a normal operational environment and, guidelines to be followed if the Mini Monster is being decommissioned.

1.3.1 OPERATIONAL ENVIRONMENT

The following operational environment storage, handling, and care requirements apply.

WARNING: NONCOMPLIANCE WITH THE CONDITION DEFINED IN THIS PARAGRAPH WILL INVALIDATE WARRANTIES.

A. Store indoors in an environment between -40°F (-40°C) and +115°F (+46°C).
B. Mini-Monster must remain in shipping container until time of installation.

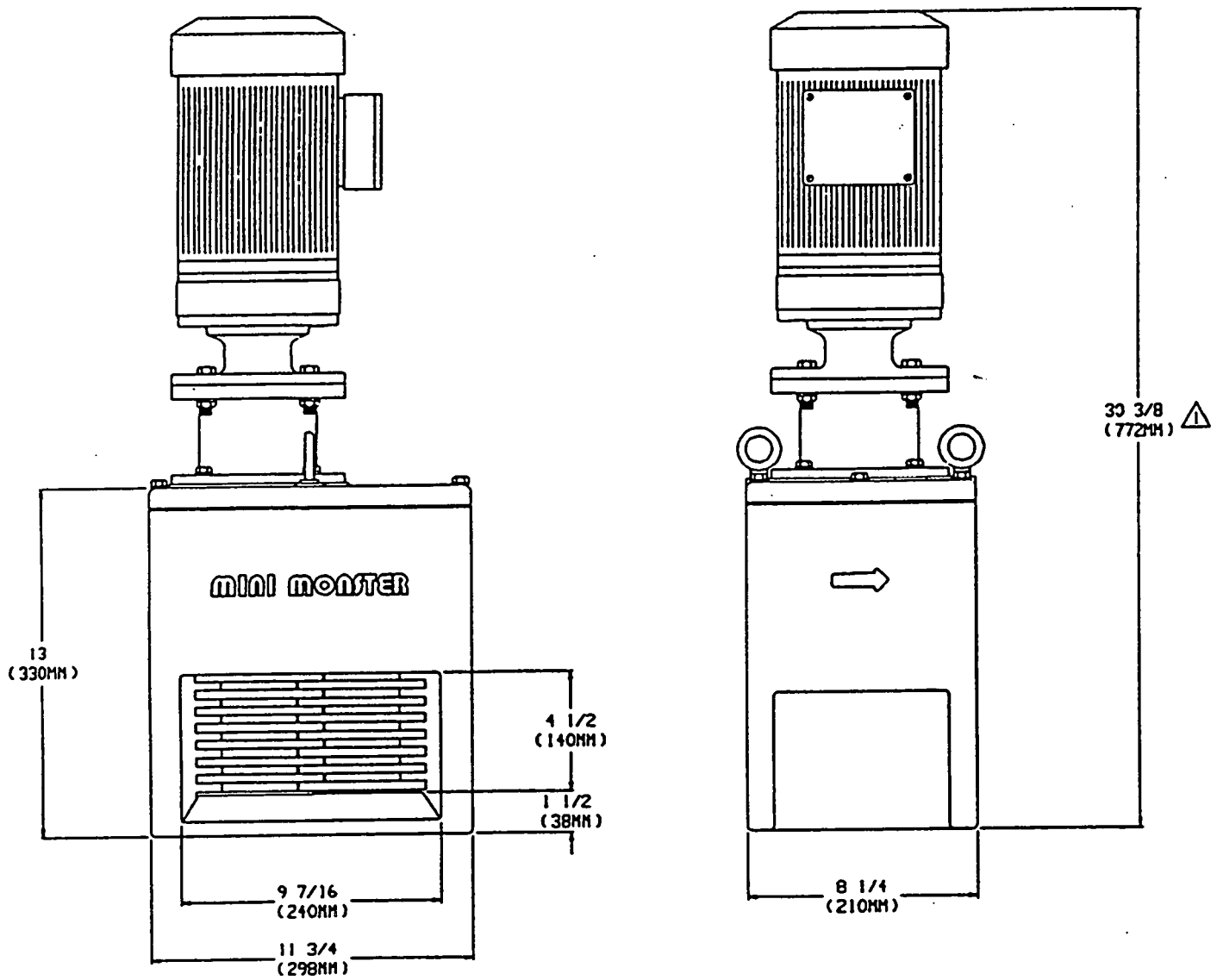
CAUTION: DO NOT OPEN SHIPPING CONTAINERS AFTER RECEIVING INSPECTION. SHIPPING CONTAINER SHOULD REMAIN CLOSED UNTIL TIME OF INSTALLATION.

C. Close **ALL** shipping containers after shortage/damage inspection. **DO NOT** open until time of installation.
D. Lubricants - Extended storage may cause grease to separate. A light oil **MAY** leak from greased areas. Unless this is excessive (more than 1 Tablespoon) this **WILL NOT** cause **ANY** problems. The grease will homogenize to its original consistency when the gears are run. **DO NOT LUBRICATE GEARMOTOR.**

1.3.2 DECOMMISSIONING GUIDELINES

The following guidelines should be adhered to if the Mini Monster is being taken out of and NOT scheduled to be returned to service.

A. Return to the manufacturer - clean and disinfect the unit thoroughly and return the unit as described in Paragraph 1.6, Repair Returns.
B. On-Site Disposal - Perform the following if the unit is to be disposed as scrap:
   1. Clean and disinfect the unit thoroughly.
   2. Disassemble the unit as described in Section 4.



Notes:
⚠ Minimal vertical height to remove cutter cartridge is 50-In. (1270-mm).
unless otherwise specified.

FIGURE 1-1. OUTLINE AND DIMENSION DRAWING

1.3.2 DECOMMISSIONING GUIDELINES (Cont'd)

B. On-Site Disposal - Perform the following if the unit is to be disposed as scrap:

1. Clean and disinfect the unit thoroughly.
2. Disassemble the unit as described in Section 4.
3. Clean and disinfect the individual parts of the unit.
4. Dispose of the gearmotor and individual parts in accordance with local, federal, and national safety and disposal regulations and standards. **APPLY REQUIRED WARNING AND CAUTION LABELS TO ALL SCRAP CONTAINERS.**

1.4 LIMITATION OF USE

The manufacturer considers that the buyers and users of this equipment will limit the use of the equipment to the purpose and intent defined at the time of sale. Applications of the equipment other than defined **MUST ASSURE COMPLIANCE WITH ALL APPLICABLE LOCAL, FEDERAL, AND AREA SAFETY RULES, REGULATIONS, AND GUIDELINES.**

1.5 DESIGN COMPLIANCE

The manufacturer considers that the equipment described in this manual satisfies the design criteria for same and/or similar types of equipment. The manufacturer also considers that buyers and users of this equipment **WILL COMPLY AND ASSURE COMPLIANCE WITH THE NOTES, CAUTIONS, AND WARNINGS INCLUDED THROUGHOUT THIS MANUAL AND SUMMARIZED IN TABLE 1-2 TO AVOID THE POTENTIAL FOR INJURY AND DAMAGE THAT COULD OCCUR WITH THIS TYPE OF EQUIPMENT.**

1.6 REPAIR RETURNS

If repairs are required, "Return Authorization" must be made by calling the factory. Be certain to give the model number and serial number to the representative. The item(s) to be returned should be properly packaged and shipped to the factory.

1.7 SERVICE QUESTIONS

For answers to your service questions please contact our Customer Service Department.

1.8 EMERGENCY OPERATION

In an emergency the Mini Monster is stopped by removing power to the electric gearmotor. The following methods can accomplish this power removal:

A. Operation of user defined and installed Main power circuit breaker disconnect and/or Remote Stop/Start switch.
B. Operation of the optional Controller Emergency Stop switch or panel disconnect.
C. Operation of Controller Stop function/switch.
D. Operation of a remotely installed panel Stop switch.

1.9 SAFETY INSTRUCTIONS

NOTE, CAUTION, and **WARNING** are used throughout the manual. **NOTE** highlights information considered important to the continued operation of the equipment. **CAUTION** highlights information that if **NOT** followed could result in damage to the equipment and might affect the safety of operating personnel. And, **WARNING** highlights areas of concern

1.9 SAFETY INSTRUCTIONS (Cont'd)

that will affect the safety of operating personnel. Customer/end user personnel are considered responsible for compliance to **ALL CAUTION's and WARNING's.** Table 1-2, Safety Instructions, is a summary of safety concerns, it is **NOT** intended as a substitute for the reading of each **CAUTION** and **WARNING** to assure compliance.

TABLE 1-2. SAFETY INSTRUCTIONS

WARNING:	KEEP PERSONNEL AND UNAUTHORIZED MATERIAL CLEAR OF CUTTING CHAMBER.
WARNING:	ELECTRICAL HAZARDS EXIST. VERIFY AND ASSURE POWER TO THE CONTROLLER IS OPEN, LOCKED OUT, AND TAGGED BEFORE PERFORMING ANY INSTALLATION, SERVICE, OR MAINTENANCE TASK.
WARNING:	KEEP PERSONNEL AND UNAUTHORIZED MATERIAL CLEAR OF CUTTING CHAMBER.
WARNING:	ELECTRICAL HAZARDS EXIST. VERIFY AND ASSURE POWER TO THE CONTROLLER IS OPEN, LOCKED OUT, AND TAGGED BEFORE PERFORMING ANY INSTALLATION, SERVICE, OR MAINTENANCE TASK.
WARNING:	ASSURE THAT ADEQUATE ASSISTANCE IS AVAILABLE AND UTILIZED WHEN LIFTING AND/OR TRANSPORTING THE EQUIPMENT, TOOLS, AND SUPPORT EQUIPMENT/MATERIALS. DO NOT LIFT HEAVY EQUIPMENT OVERHEAD OF PERSONNEL.
WARNING:	ELECTRICAL SHOCK HAZARDS EXIST. COMPLIANCE TO ALL OSHA AND APPLICABLE SAFETY REQUIREMENTS/ REGULATIONS IS MANDATORY TO ASSURE SAFETY OF PERSONNEL.
WARNING:	CONTROLLER INDICATORS UTILIZE LONG LIFE BULBS. IF AN INDICATOR BULB FAILURE IS SUSPECTED OPEN, LOCKOUT, AND TAG POWER TO THE CONTROLLER BEFORE TROUBLESHOOTING.
WARNING:	OPEN, LOCKOUT, AND TAG POWER TO THE CONTROLLER BEFORE MANUALLY REMOVING OR ATTEMPTING TO REMOVE ANY OBSTRUCTION(S).
WARNING:	CONTROLLER PANEL CONTROLS DO NOT DISCONNECT POWER WITHIN THE CONTROLLER. SERVICE CONTROLLERS AND CONNECTED DEVICES ONLY WHEN POWER TO THE CONTROLLER HAS BEEN OPENED, LOCKED OUT, AND TAGGED.
WARNING:	IF OPERATING FROM A REMOTE STATION DO NOT USE THE REMOTE START/STOP PUSHBUTTON AS A SYSTEM LOCKOUT DEVICE.
WARNING:	DISPOSABLE WASTE SYSTEMS, INC. SHALL NOT BE HELD LIABLE FOR ANY DAMAGES RESULTING FROM CONTROLLER FUNCTIONS THAT ARE TRIGGERED AS A RESULT OF WIRING MISCONNECTIONS, WIRING SHIELDING ERRORS, AND/OR OTHER WIRING ERRORS NOT IN COMPLIANCE WITH OSHA, FEDERAL, STATE, OR LOCAL REGULATIONS.

TABLE 1-2. SAFETY INSTRUCTIONS

WARNING:	AVOID INJURY. WEAR GLOVES WHEN REMOVING OR OTHERWISE HANDLING CUTTERS AND SPACERS.
WARNING:	PERSONAL AND MECHANICAL HAZARDS EXIST DURING THE PERFORMANCE OF THE GRIND TEST.
WARNING:	THE EQUIPMENT MAY START, STOP, REVERSE, OR RESTART AUTOMATICALLY AFTER POWER LOSS AND RECOVERY. DO NOT ATTEMPT ANY MAINTENANCE ON THE EQUIPMENT DURING A POWER LOSS. ELECTRICAL LOCKOUT PROCEDURES MUST BE PERFORMED PRIOR TO SERVICING ANY EQUIPMENT OR CONNECTED EQUIPMENT.

SECTION 2

CHANNEL MINI MONSTER

INSTALLATION AND CHECKOUT

2.1 GENERAL

This section describes installation of the Mini Monster. See Section 1 for the Mini Monster outline and dimensions.

2.2 SUPPORT EQUIPMENT

NO special tools, test equipment, lifting equipment, or rigging is required to install the Mini Monster. Standard lifting and handling devices rated for a load capacity greater than the weight of the Mini Monster is the only handling equipment required.

2.3 INSTALLATION GUIDELINES

The following guidelines are to be observed:

A. **LIFTING EYEBOLT SIZE IS BASED ON QUANTITY OF TWO (2) STRAIGHT PULL. DO NOT SIDE LOAD AN EYEBOLT. DO NOT ATTEMPT TO LIFT THE MINI MONSTER USING ONE (1) EYE BOLT.**
B. Total system must be installed in compliance with **ALL** local codes and standards.
C. Gearmotor and control and power wiring must be installed as defined for the installation.

2.4 UNPACKING

The Mini Monster is carefully packed for shipment. **DO NOT** remove the Mini Monster from the shipping crate until it has been carefully checked for damage that may have occurred in transit. Report **ALL** damage immediately to the carrier and send a copy to the vendor. If **NO** transit damage is found perform the following:

A. Remove Mini Monster from shipping crate.
B. Inspect for missing or loose components. If parts are missing or loose call your factory representative as defined in Section 1.
C. If the Controller is installed on the Mini Monster inspect the Controller as described in the Controller manual.

2.5 PREPARATION FOR USE

The Mini Monster is shipped complete and ready for installation. **NO** preparation for use is required.

2.6 PROCEDURE

Install the Mini Monster as described in the following procedure.

A. Isolate the flow through the channel **TO AVOID INJURY AND/OR DAMAGE FROM FLOW PRESSURES AND/OR INFLUENT.**

2.6 PROCEDURE (Cont'd)

B. Attach lifting cables to **BOTH** lifting eyebolts.

WARNING: LIFTING EYEBOLT SIZE IS BASED ON QUANTITY OF TWO (2) STRAIGHT PULL. DO NOT SIDE LOAD AN EYEBOLT. DO NOT ATTEMPT TO LIFT THE MINI MONSTER USING ONE (1) EYE BOLT. DO NOT LIFT OVERHEAD OF PERSONNEL.

C. Lift (using a straight and even pull) and position the Mini Monster as defined for the installation.

WARNING: ASSURE THAT ADEQUATE ASSISTANCE IS AVAILABLE WHEN LIFTING THE MINI MONSTER. VERIFY AND ASSURE ALL PERSONNEL SAFETY REGULATIONS AND EQUIPMENT SAFE GUARDS ARE OBSERVED AND ENFORCED.

D. Verify arrow in the top cover points toward the discharge of the unit. (Figure 2-1 shows the direction of flow through the Mini Monster and, direction of motor rotation.)
E. Install the Mini Monster utilizing the supports defined for the installation.
F. Connect the Mini Monster gearmotor as defined for the installation and in compliance with all local, regional, and national codes and standards.
G. Verify and assure **ALL** mechanical connections are secure.
H. Verify and assure **ALL** electrical connections are connected properly and are secure.

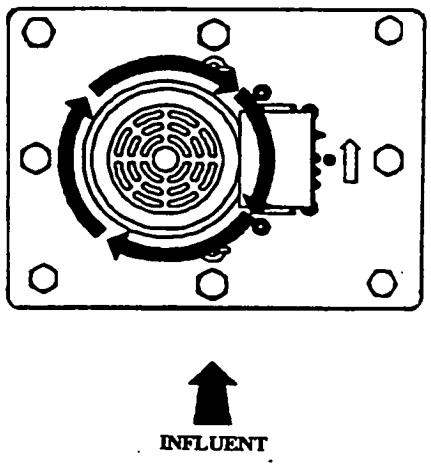


FIGURE 2-1. MOTOR ROTATION ARROW

2.7 STARTUP/CHECKOUT

Gearmotor jamming sensitivity is factory adjusted during final factory tests. Refer to the Controller manual for the controls, indicators, operation, and operational procedure to be followed when the Controller is connected to the Mini Monster.

SECTION 3

CHANNEL MINI MONSTER

REMOVAL/REPLACEMENT

3.1 GENERAL

This section describes the removal and replacement of the Mini Monster as a complete assembly and, the removal and replacement of the gearmotor and grinder spool. Refer to Section 4 for disassembly and assembly procedures and the Controller manual for the applicable Controller assembly methods/procedures.

3.2 PREPARATION FOR REMOVAL/REPLACEMENT

Perform the following before performing the removal/replacement procedures described in this section.

A. Isolate flow through the channel **TO AVOID INJURY AND/OR DAMAGE FROM FLOW PRESSURES AND/OR INFLUENT.**
B. Open, lockout, and tag power to the Controller.

WARNING: AVOID SERIOUS INJURY FROM ACCIDENTAL POWER APPLICATION. VERIFY AND ASSURE POWER TO THE CONTROLLER IS LOCKED OUT AND TAGGED.

C. Disconnect and tag the motor leads in the motor junction box.

3.3 MINI MONSTER

Removal and replacement of the Mini Monster can be accomplished without **ANY** disassembly.

3.3.1 REMOVAL

Remove the Mini Monster from the installation as described in the following procedure. Removal of the gearmotor and gearmotor spool from the grinder assembly is **NOT REQUIRED** prior to removal of the grinder assembly from the installation.

NOTE: Item reference numbers refer to item callouts on Figure 3-1.

A. Prepare Mini Monster for removal as described in Paragraph 3.2.
B. Unbolt Mini Monster from installation.
C. Attach lifting cables to **BOTH** lifting eyebolts (25) in the top cover (8).

WARNING: LIFTING EYEBOLT SIZE IS BASED ON QUANTITY OF TWO (2) STRAIGHT PULL. DO NOT SIDE LOAD AN EYEBOLT. DO NOT ATTEMPT TO LIFT MINI MONSTER USING ONE (1) EYE BOLT. DO NOT LIFT OVERHEAD OF PERSONNEL.

3.3.1 REMOVAL (Cont'd)

D. Lift, with a slow an even pull, Mini Monster clear of the installation.

WARNING:	USE CARE WHEN SLING LIFTING THE MUFFIN MONSTER. DO NOT LIFT HEAVY EQUIPMENT OVERHEAD OF PERSONNEL. VERIFY AND ASSURE ALL PERSONNEL SAFETY REGULATIONS AND EQUIPMENT SAFE GUARDS ARE OBSERVED AND ENFORCED.

E. Lay Mini Monster on a four-inch tall wooden block base or equivalent. **DO NOT** rest the Mini Monster on the mini chamber housing (17) side rails.

3.3.2 REPLACEMENT

Replace the Mini Monster after maintenance as described in Section 2.

3.4 GEARMOTOR

Removal and replacement of the gearmotor can be accomplished with the Mini Monster installed if the maintenance action **DOES NOT** require the Mini Monster to be removed from the installation.

3.4.1 REMOVAL

Remove the gearmotor from the Mini Monster as described in the following procedure. If the gearmotor (48) and the spool (5) are to be removed as an assembly perform the removal as described in Paragraph 3.5.1. If the gearmotor, spool, and cutter cartridge are to be removed as an assembly perform the removal as described in Paragraph 3.6.1.

NOTE: Item reference numbers refer to item callouts on Figure 3-1.

A. Proceed to Step B if gearmotor (48) removal is with the Mini Monster installed or, proceed to Step C if removal is to be accomplished after the Mini Monster has been removed from the installation.
B. Prepare the Mini Monster for gearmotor (48) removal as described in Paragraph 3.2. Proceed to Step C.
C. Remove hexhead capscrews (39), flat washers (40), split lock washers (41), and hex nuts (42) securing the gearmotor (48) to the spool (5).
D. Lift, with a slow and even pull, the gearmotor (48) from the spool (5).
E. Remove coupling half (10) and key from gearmotor (48) drive shaft. Coupling half (10) is an interlocking type of coupling half that should be easily removable from the gearmotor (48) drive shaft. If the coupling half **CAN NOT** be removed by hand a gear puller will be required.
F. Inspect coupling half (10) and gearmotor (48) drive shaft key. Replace damaged components and store undamaged components in a safe location until installed during the gearmotor (48) replacement process.
G. Remove coupling half (9) and key (18) from cutter cartridge drive shaft (11). Coupling half (9) is an interlocking type of coupling half that should be easily removable from cutter cartridge drive shaft (11). If the coupling half **CAN NOT** be removed by hand a gear puller will be required.

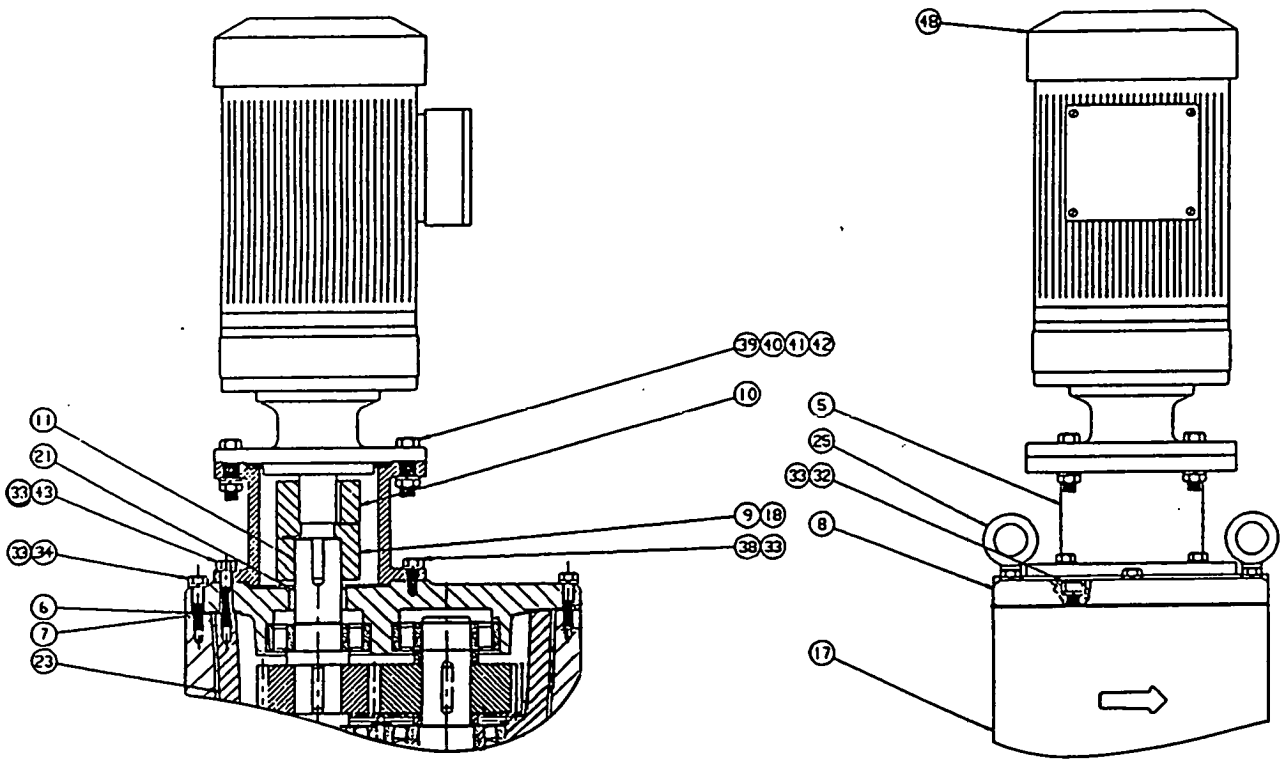


FIGURE 3-1. MOTOR, SPOOL, CUTTER CARTRIDGE REPLACEMENT

3.4.1 REMOVAL (Cont'd)

H. Inspect coupling half (9) and key (18). Replace damaged components and store undamaged components in a safe location until installed during the gearmotor (48) replacement process.

I. Inspect cutter cartridge drive shaft (11) and keyway. If damaged contact your local service representative or the factory as described in Section 1. If not damaged install key (18) and coupling half (9) on the cutter cartridge drive shaft (11).

3.4.2 REPLACEMENT

Replace the gearmotor (48) as described in the following procedure. If the gearmotor (48) and the spool are to be replaced as an assembly perform the replacement as described in Paragraph 3.5.2. If the gearmotor, spool, and cutter cartridge are replaced as an assembly perform the replacement as described in Paragraph 3.6.2.

NOTE: Item reference numbers refer to item callouts on Figure 3-1.

A. Install gearmotor (48) shaft key.

B. Install gearmotor (48) coupling half (10).

C. Install, if required, cutter cartridge drive shaft (11) coupling half (9) and key (18).

3.4.2 REPLACEMENT (Cont'd)

D. Position gearmotor (48) over the bolt circle on the spool (5). Slowly lower the gearmotor (48) into the spool (5) until cutter cartridge coupling half (9) and gearmotor coupling half (10) are mated and the gearmotor (48) is firmly seated on the spool (5).
E. Orient the gearmotor (48) to the desired operating position.
F. Secure the gearmotor (48) to the spool (5) with hexhead capscrews (39), flat washers (40), split lock washers (41), and hex nuts (42).
G. Connect all electrical connections to the gearmotor.
H. Perform Mini Monster startup and operational verification as described in the Controller manual.

3.5 SPOOL

The spool (5) provides adaptability from the gearmotor (48) to the cutter cartridge drive shaft (11). It is a one (1) piece assembly that houses the coupling which transitions the drive shaft to the gearmotor. Removal and replacement of the spool (5) can be accomplished with the cutter cartridge installed in the mini chamber housing (17) if the maintenance action **DOES NOT** require the cutter cartridge to be removed from the installation.

3.5.1 REMOVAL

Remove the spool (5) from Mini Monster as described in the following procedure. If the spool (5) and cutter cartridge are to be removed as an assembly perform the removal as described in Paragraph 3.6.1.

NOTE: Item reference numbers refer to item callouts on Figure 3-1.

A. Proceed to Step B if spool (5) removal is with the Mini Monster installed or, to Step C if removal is to be accomplished after the Mini Monster has been removed from the installation.
B. Prepare the Mini Monster for spool (5) removal as described in Paragraph 3.2.
C. Remove, if required, the gearmotor (48) as described in Paragraph 4.3.1.
E. Remove hexhead capscrews (38) and split lock washers (33).
F. Remove hexhead capscrews (43) and split lock washers (33).
G. Lift, with a slow even pull, the spool (5) from the top cover (8).
H. Inspect the spool (5) for **ANY** obvious signs of damage. If damaged the spool is replaced as a complete assembly. **DO NOT** attempt to repair the spool. Contact your local service representative or the factory as described in Section 1 with any questions regarding spool (5) serviceability.
I. Remove coupling half (9) and key (18) from cutter cartridge drive shaft (11). Coupling half (9) is an interlocking type of coupling half that should be easily removable from cutter cartridge drive shaft (11). If the coupling half **CAN NOT** be removed by hand a gear puller will be required.
J. Inspect coupling half (9) and key (18). Replace damaged components and store undamaged components in a safe location until installed during the gearmotor (48) replacement process.
K. Inspect cutter cartridge drive shaft (11) and keyway. If damaged contact your local service representative or the factory as described in Section 1.
L. Inspect oil seal (21) in the top cover (8). If evidence of leakage is observed replace oil seal (21). If no evidence of damage or leakage is observed install key (18) and coupling half (9) on the cutter cartridge drive shaft (11).

3.5.2 REPLACEMENT

The following procedure describes spool (5) replacement after removal. If the spool (5) and cutter cartridge are replaced as an assembly perform the replacement as described in Paragraph 3.6.2.

NOTE: Item reference numbers refer to item callouts on Figure 3-1.

A. Install, if required, cutter cartridge drive shaft (11) key (18) and coupling half (9).
B. Proceed to Step C if the spool (5) is replaced as an individual item or, Step F if the spool (5) is replaced as part of a gearmotor (48)/spool (5) assembly.
C. Position spool (5) over the bolt circle on the top cover (8). **NO** special spool orientation is required.
D. Install hexhead capscrews (38) and (43) with split lock washers (33).
E. Install the gearmotor as described in Paragraph 3.4.2. Proceed to Step J.
F. Position spool (5) over the bolt circle on the top cover (8).
G. Slowly lower the gearmotor (48)/spool (5) assembly until cutter cartridge coupling half (9) and gearmotor coupling half (10) are mated and the gearmotor (48)/spool (5) assembly is firmly seated on the top cover (8).
H. Orient the gearmotor (48)/spool (5) assembly to the desired operating position.
I. Install hexhead capscrews (38) and (43) with split lock washers (33).
J. Connect all electrical connections to the gearmotor.
K. Perform Mini Monster startup and operational verification as described in the Controller manual.

3.6 CUTTER CARTRIDGE

The cutter cartridge is an assembly consisting of the cutters, spacers, bearings, and drive gears. The assembly is removed and replaced as a complete assembly. Once removed the cutters and spacers can be inspected and, if necessary, replaced without requiring the shutdown of the flow line while the maintenance is performed. The factory recommends that the user contact the factory Customer Service Department as defined in Section 1 for alternative(s) and/or other component replacement options if detail maintenance is considered necessary.

3.6.1 REMOVAL

Remove the cutter cartridge from mini chamber housing (17) as described in the following procedure. Removal can be accomplished with the gearmotor (48) and spool (5) attached if the maintenance action **DOES NOT** require removal of either the gearmotor (48) and/or spool (5).

NOTE: Item reference numbers refer to item callouts Figure 3-1.

A. Remove the Mini Monster from the channel as described in Paragraph 3.3.1 and stand on the bottom the mini chamber housing (17).
B. Hose out and disinfect the cutters. **DO NOT** steam clean and disinfect the gearmotor, seals, and/or bearings.
C. Proceed to Step D if gearmotor (48) and/or spool (5) removal is required prior to removing the cutter cartridge from the mini chamber housing (17) or, to Step F if removal is **NOT** required prior to cutter cartridge removal.
D. Remove gearmotor (48) as described in Paragraph 3.4.1. If the gearmotor (48) and spool (5) are to be removed as an assembly proceed to Step E.

3.6.1 REMOVAL (Cont'd)

E. Remove spool (5) as described in Paragraph 3.5.1.
F. Remove hexhead capscrews (34) and split lock washers (33) securing the cutter cartridge to the Mini chamber housing (17).
G. Attach lifting cables to **BOTH** lifting eyebolts (25) in the top cover (8).

WARNING: LIFTING EYEBOLT SIZE IS BASED ON QUANTITY OF TWO (2) STRAIGHT PULL. DO NOT SIDE LOAD AN EYEBOLT. DO NOT ATTEMPT TO LIFT THE CUTTER CARTRIDGE USING ONE (1) EYE BOLT. DO NOT LIFT OVERHEAD OF PERSONNEL.

H. Lift, with a slow an even pull, the cutter cartridge clear of the mini chamber housing (17).

WARNING: USE CARE WHEN LIFTING THE CUTTER CARTRIDGE. DO NOT LIFT HEAVY EQUIPMENT OVERHEAD OF PERSONNEL. VERIFY AND ASSURE ALL PERSONNEL SAFETY REGULATIONS AND EQUIPMENT SAFE GUARDS ARE OBSERVED AND ENFORCED.

I. Lay the cutter cartridge on a four-inch tall wooden block base or equivalent. Verify cutter cartridge **DOES NOT** rest on the Controller (if installed on the gearmotor).
J. Remove **ALL** mini chamber gasket (6) material from the top cover (8) and mini chamber housing (17) mating surfaces.
K. Steam clean and disinfect the mini chamber housing (17).

3.6.2 REPLACEMENT

Replace the cutter cartridge as described in the following procedure. Replacement can be accomplished with the gearmotor (48) and spool (5) attached if the maintenance action **DOES NOT** require their removal.

NOTE: Item reference numbers refer to item callouts on Figure 3-1.

A. Stand the mini chamber housing (17) on the bottom of the housing (17).
B. Install a **NEW** mini chamber gasket (6) on the mini chamber housing (17)-to-top cover (8) mating surface.
C. Attach lifting cables to both Mini Monster eyebolts (25).

CAUTION: USE BOTH EYEBOLTS TO LIFT THE CUTTER CARTRIDGE.

D. Verify the orientation of the cutter cartridge as described in Paragraph 2.6.
E. Lift, using a straight even pull, the cutter cartridge and install in the mini chamber housing (17).

WARNING: OBSERVE AND ENFORCE ALL PERSONNEL SAFETY REGULATIONS AND EQUIPMENT SAFE GUARDS WHEN LIFTING THE CUTTER CARTRIDGE. DO NOT LIFT OVERHEAD OF PERSONNEL.

3.6.2 REPLACEMENT (Cont'd)

F. Install hexhead capscrews (34) with attached flat washer (35), lock washer (36), and hex nut (37) to secure the cutter cartridge to the mini chamber housing (17).

G. Proceed to Step H if the gearmotor (48) and/or spool (5) were removed from the cutter cartridge. If the gearmotor (48) and spool (5) are installed on the cutter cartridge proceed to Step J.

H. Install the spool (5) and/or gearmotor (48)/spool (5) assembly as described in Paragraph 3.5.2 and proceed to Step J. If, however, the gearmotor (48) was removed as an individual assembly proceed to Step I.

I. Install the gearmotor (48) as described in Paragraph 3.4.2.

J. Connect **ALL** electrical connections at the gearmotor.

K. Verify **ALL** mechanical and electrical connections are secure.

L. Perform the Mini Monster startup procedure as described in the Controller manual.

3.7 CONTROLLER

If the Mini Monster is supplied with the Controller attached the manufacturer **DOES NOT** recommend the removal of the Controller from the gearmotor. If a Controller problem is detected or suspected the manufacturer recommends the user contact our Customer Service Department as defined in Section 1.

SECTION 4

CHANNEL MINI MONSTER

DISASSEMBLY AND ASSEMBLY

4.1 GENERAL

This section describes Mini Monster disassembly and reassembly after disassembly. Refer to the Controller manual for Controller related disassembly/assembly information.

4.2 GUIDELINES

Observe the following guidelines during disassembly and assembly.

A. Steam clean and disinfect **ALL** parts except the gearmotor, seal assemblies, and bearings.
B. Clean end housing bores with solvent (MEK, Acetone or equivalent). Replace the housing if the bores are scored, pitted, or other damage is identified.
C. Replace **ALL** bushings that exhibit excessive wear.
D. Replace **ALL** cracked parts or parts that exhibit excessive wear.
E. Replace complete seal assembly if the mating surfaces of **ANY** seal component is **NOT** clean and polished.
F. Clean **ALL** shaft assembly bearings. Replace if wear is exhibited.

4.3 DISASSEMBLY

The following paragraphs describe disassembly of the Mini Monster.

4.3.1 GEARMOTOR

The gearmotor utilized in the Mini Monster is a one (1) piece assembly consisting of an electric motor and speed reducer. The motor is a heavy duty three (3) phase, electric motor selected by the user for their specific environmental and usage requirements; and, the speed reducer increases the torque of the electric motor while at the same time reducing the motor shaft speed. Disposable Waste Systems, Inc. **DOES NOT** recommend disassembly of the gearmotors since each gearmotor is covered by a gearmotor manufacturers service policy and limited warranty . If service is required Disposable Waste System, Inc. recommends that the user remove the suspected gearmotor and, as defined in the gearmotor manufacturer's warranty statement, return the gearmotor to the authorized repair center.

4.3.2 SPOOL

The spool provides adaptability from the gearmotor to the cutter cartridge drive shaft. The spool is a one piece assembly and disassembly is **NOT APPLICABLE**. If damaged the spool is replaced as a complete assembly.

4.3.3 CONTROLLER

The Controller provides the electrical control for the Mini Monster. The Controller, based on user preference, is supplied as a separate unit or attached to the gearmotor. In either case, refer to the Controller manual for unit disassembly guidelines and recommendations.

4.3.4 MINI CHAMBER HOUSING

The cutter cartridge is housed in the mini chamber housing. The mini chamber housing is a one piece assembly and disassembly is **NOT APPLICABLE**. If damaged it is replaced as a complete assembly.

4.3.5 CUTTER CARTRIDGE

Cutter cartridge disassembly consists of the removal and inspection of: cutters, spacers, drive gear, driven gear, end housing assemblies, bearings, and seal assemblies. The following procedure describes the removal and inspection of these components and assumes that the gearmotor and spool have been removed from the cutter cartridge.

NOTE: Item reference numbers refer to item callouts on Figure 4-1 and 4-2.

CAUTION: DO NOT REST THE CUTTER CARTRIDGE ON THE DRIVE SHAFT (11) DURING THE DISASSEMBLY PROCEDURE.

A. Turn grinder upside down and support on top cover (8).
B. Observe spacer/cutter stacking configuration. Close attention to stacking configuration (the helical stack and ratio of cutters to spacers) prior to disassembly will ease the restacking of the cutters and spacers.
C. Remove shaft stack hexhead capscrews (26) from drive (11) and driven (12) shafts.
D. Remove shaft stack washers (16) from the drive (11) and driven (12) shafts.
E. Remove **ALL** cutters (45) and (46), and spacers (44) from drive (11) and driven (12) shafts. **AVOID INJURY. WEAR GLOVES WHEN REMOVING AND HANDLING CUTTERS AND SPACERS.**

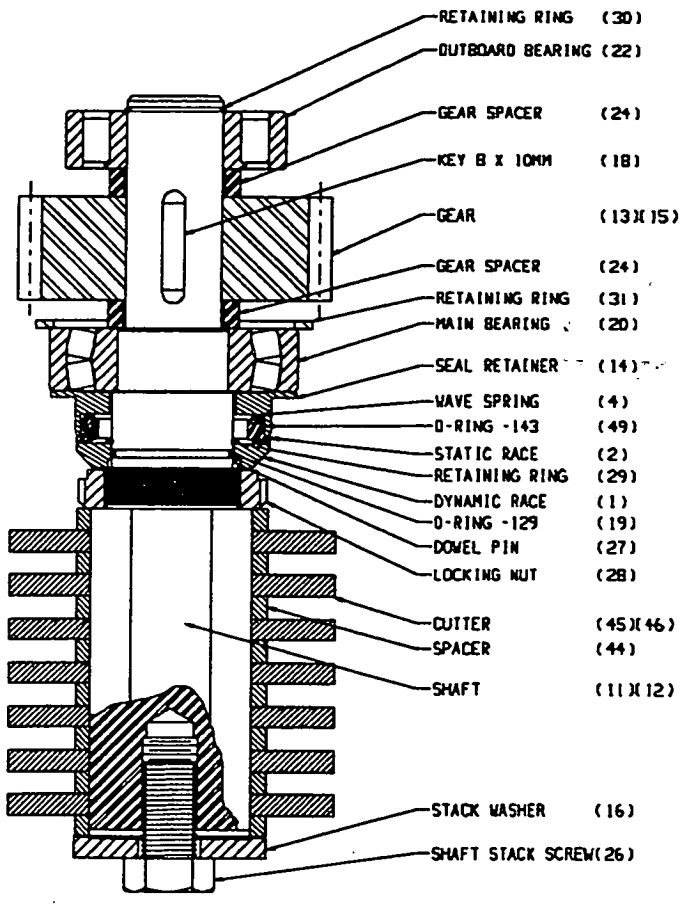


FIGURE 4-1. CUTTER CARTRIDGE SHAFT ASSEMBLY

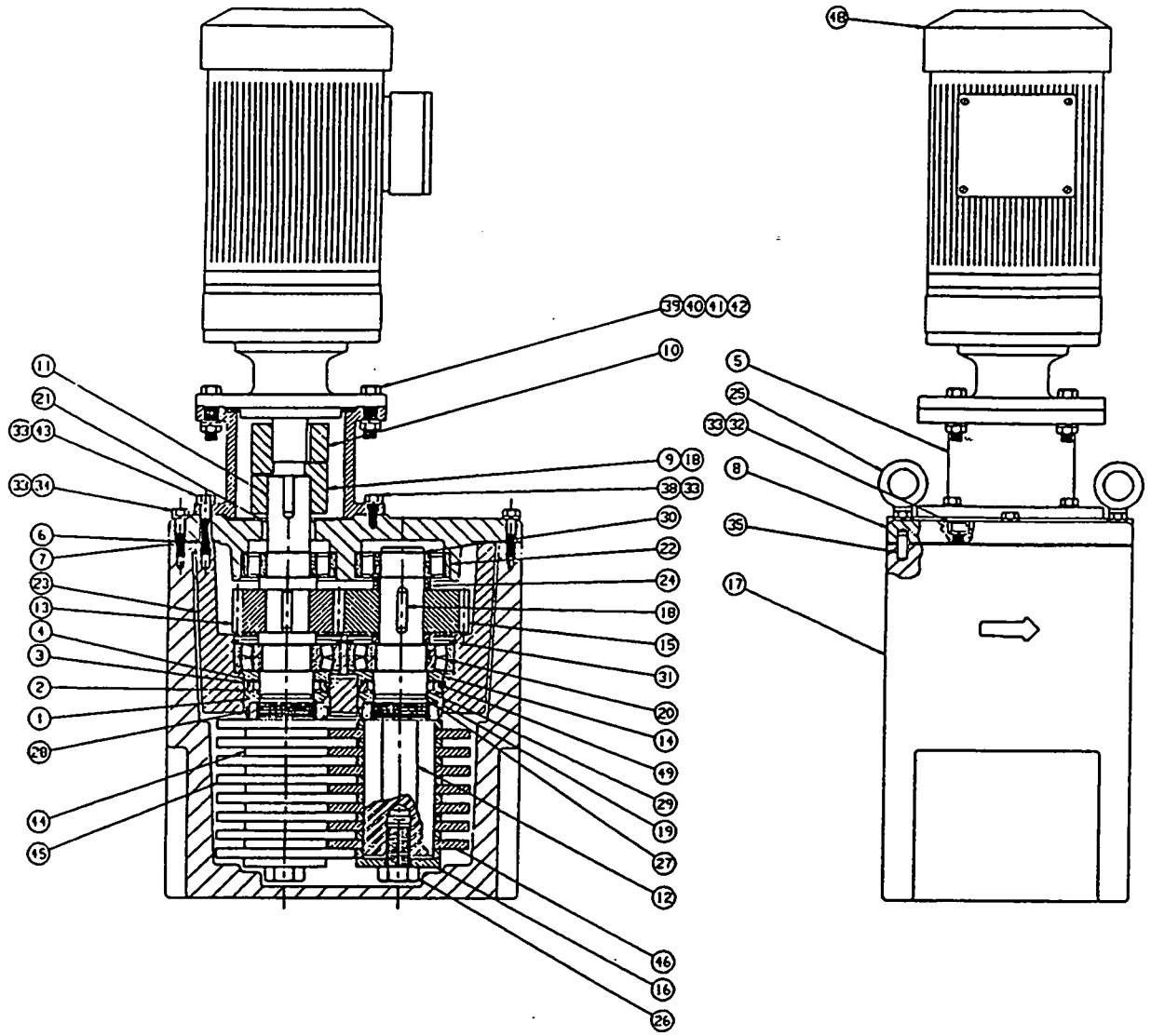


FIGURE 4-2. MINI MONSTER ASSEMBLY DRAWING

4.3.5 CUTTER CARTRIDGE (Cont'd)

F. Turn assembly over and clamp both shafts in a vise. **BOTH SHAFTS MUST BE CLAMPED IN A VISE BEFORE PROCEEDING. IF NOT CLAMPED THE SHAFTS WILL DROP FREE AND BE DAMAGED WHEN THE DRIVE SHAFT SNAP RING RETAINER (30) OF STEP K IS REMOVED.**

G. Remove sockethead capscrews (32) from top cover (8).

H. Remove top cover (8) with oil seal (21), outboard roller bearing (22) outer race, and end housing gasket (7).

I. Remove **ALL** end housing gasket (7) material from top cover (8) and end housing (23) mating surfaces.

J. Inspect drive and driven outboard roller bearing (22) outer races for evidence of wear and, cleaned and polished mating surfaces. If signs of excessive wear or mating surface dullness is observed install **NEW** outboard roller bearings (22) as described in Paragraphs 4.3.5.1 and 4.4.3. The outer race is press fit into the top cover (8) bores and, the inner race is retained as part of the shaft and held in place by snap ring retainer (30).

4.3.5 CUTTER CARTRIDGE (Cont'd)

K. Remove snap ring retainer (30) from drive (11) and driven (12) shafts.
L. Slide outboard roller bearing (22) inner races off the shafts.
M. Inspect drive (11) and driven (12) shaft outboard roller bearing (22) inner races for evidence of wear and, cleaned and polished mating surfaces. If excessive wear or mating surface dullness is observed install a **NEW** outboard roller bearing (22) as described in Paragraphs 4.3.5.1 and 4.4.3.
N. Store outboard roller bearing (22) inner races with the top cover (8) until a final disposition of the complete outboard roller bearing (22) is made.
O. Remove gear spacer (24) from drive (11) and driven (12) shafts.
P. Remove drive gear (13) and driven gear (15).
Q. Remove gear keys (18) from drive (11) and driven (12) shafts.

NOTE: If gears **CAN NOT** be removed by hand a gear puller will be required.

R. Clean and inspect drive (13) and driven (15) gears. Replace if signs of wear, cracks, or obvious damage are observed.
S. Remove gear spacer (24) from drive (11) and driven (12) shafts.
T. Remove retaining ring (31) from end housing (23).
U. Remove drive (11) and driven (12) shafts from end housing (23). The shaft assemblies should slide free from the end housing (23) when the end housing retaining ring (31) is removed.

NOTE: Lower Bearing and Seal Assembly consists of main roller bearing (20), seal retainer (14), O-Ring (49), retaining ring (29), wave spring (4), static race (2), dynamic race (1), and bearing lock nut (28). It will remain as an assembly on the drive (11) and driven (12) shafts.

CAUTION: HANDLE SHAFT ASSEMBLIES WITH CARE. LOWER BEARING AND SEAL ASSEMBLY COMPONENTS ARE EASILY DAMAGED.

V. Inspect drive (11) and driven (12) shaft Lower Bearing and Seal Assemblies of Step U for obvious signs of damage, wear, or signs that the mating surfaces are **NOT** cleaned and polished. If damage, wear, or the mating surfaces show signs of dullness disassemble each Lower Bearing and Seal Assembly as described in Paragraph 4.3.5.2.

4.3.5.1 OUTBOARD BEARING

The manufacturer **DOES NOT** recommend removal of the outboard roller bearing (22) in the top cover (8)). Inspect each bearing for obvious signs of damage, excessive wear, or outboard roller bearing (22) mating surfaces show signs of dullness. If **ANY** of these conditions are observed remove and inspect the outboard roller bearings (22) as follows:

NOTE: Item reference numbers refer to item callouts on Figure 4-1 and 4-2.

A. Press bearings (22) out of top cover (8) bearing bores.
B. Clean bearings (22) and inspect for wear or pitting. Replace if necessary.
C. Clean the top cover (8) bores with solvent (MEK, Acetone or equivalent).
D. Inspect top cover (8) bores for signs of damage, scoring, pitting, or wear. If signs of damage or wear are observed contact the manufacturer as defined in Section 1.

4.3.5.2. LOWER BEARING AND SEAL ASSEMBLY

The manufacturer recommends disassembly of the Lower Bearing and Seal Assembly for inspection. If obvious signs of damage, excessive wear, or mating surface show signs of dullness replacement of defective components will be required. Disassemble and inspect the drive (11) or driven (12) shaft Lower Bearing and Seal Assembly as follows:

NOTE: Item reference numbers refer to item callouts on Figure 4-1.

CAUTION:	**HANDLE SHAFT ASSEMBLIES WITH CARE. LOWER BEARING SEAL ASSEMBLY COMPONENTS ARE EASILY DAMAGED.**

A. Remove main roller bearing (20) from the shaft. A bearing puller may be required to remove the main roller bearing (20) from the shaft.
B. Slide seal retainer (14) off the shaft.
C. Slide wave spring (4) off the shaft.
D. Slide static race (2), with O-Ring (49), off the shaft.
E. Remove and discard O-Ring (49).
F. Remove and discard Spiralock retaining (snap) ring (29).
G. Slide dynamic race (1) off the shaft. It may be necessary to use a rocking motion when removing the dynamic race since it is held in position by shaft dowel pin (27). **DO NOT** remove shaft dowel pin (27).
H. Remove O-Ring (19) from the shaft. Discard O-Ring (19).
I. Clean Lower Bearing and Seal Assembly components with solvent (MEK, Acetone or equivalent).
J. Inspect Step I components for damage and/or wear. Replace if necessary.
K. Inspect shaft and shaft keyway for damage. If a shaft or shaft keyway problem is detected or suspected contact the your local service representative or our Customer Service Department as defined in Section 1. **DO NOT ATTEMPT TO REPAIR THE SHAFT OR SHAFT KEYWAY.**

4.4 ASSEMBLY

The following paragraphs describe the assembly of the cutter cartridge after disassembly. Assembly of the other major components of the Mini Monster is **NOT APPLICABLE.**

4.4.1 GUIDELINES

Observe the following guidelines during the assembly of the cutter cartridge.

A. Verify gasket surfaces are clean of **ALL** gasket material before installing a new gasket.
B. Assure **ALL** gaskets are **NEW**, properly installed, and of the material specified.
C. Inspect **ALL** parts for damage, cracks or excessive wear during the assembly process. Replace if necessary.
D. Verify **ALL** parts/components being assembled are clean and free of dirt, excess lubricants, and gasket material.
E. Verify **ALL** attaching hardware (nuts, bolts, screws, washers, etc.) are free of defects and are the size/quantity required for the assembly.
F. Verify **ALL** required tools and support equipment are available and in good condition.

4.4.2 PREPARATION FOR ASSEMBLY

Specific procedures required to prepare the cutter cartridge components are defined as part of the assembly sequence. **NO** special preparation for assembly of the cutter cartridge is required.

4.4.3 OUTBOARD BEARING

Outboard roller bearing (22) consists of an inner and an outer race. The outer race is press fit into the top cover (8) bores and, the inner race is installed on the shaft and held in place by retainer (snap) ring (30). This procedure describes the installation of **NEW** outer races in the top cover (8). If the outer races **WERE NOT REMOVED** from the top cover (8) proceed to Paragraph 4.4.4. See Paragraph 4.4.5 for the installation of new inner races.

NOTE: Item reference numbers refer to item callouts on Figure 4-1 and 4-2.

A. Clean top cover (8) bores of **ALL** foreign matter.
B. Inspect top cover (8) bores. Replace top cover (8) if the bores have **ANY** signs of scoring, pitting, or obvious signs of damage.
C. Coat top cover (8) bores with a thin film of grease (Petrolon SLICK 50 MPG).
D. Coat outside diameter of a **NEW** outboard roller bearing (22) outer race with a thin film of grease (Petrolon SLICK 50 MPG).
E. Press lubricated outer race into one of the top cover (8) bores. Continue to press on the bearing until it seats against the inside shoulder of the top cover bore.
F. Repeat Steps D and E for the second bearing.
G. Store top cover (8) in a safe location until the top cover (8) is installed.

4.4.4 LOWER BEARING AND SEAL ASSEMBLY

Lower Bearing and Seal Assembly consists of the main roller bearing (20), seal retainer (14), static race (2), dynamic race (1), and attaching components. This procedure describes the installation of the complete Lower Bearing and Seal Assembly. If the assembly was disassembled and its components were **NOT REMOVED** from the drive (11) or the driven (12) shaft proceed to Paragraph 4.4.5. Install the components of the Lower Bearing and Seal Assembly as follows:

NOTE: Item reference numbers refer to item callouts on Figure 4-1 and 4-2.

CAUTION:	**CLEAN COMPONENT SURFACES OF DUST AND FOREIGN PARTICLES AND, COAT COMPONENT MATING SURFACES WITH AN EVEN FILM OF SLICK 50 TEFLON GREASE BEFORE JOINING.**

A. Clamp shaft in a vise, hex end down.
B. Lightly coat O-Ring (19) with grease (Petrolon SLICK 50 MPG).
C. Install O-Ring (19) in shaft groove. Verify O-Ring (19) is completely seated in the groove.
D. Slide dynamic race (1) down the shaft, rocking the dynamic race (1) until it engages dowel pin (27). Verify dynamic race (1) is: against shaft's thread shoulder and above the lock nut (28), held firmly in position on the shaft by dowel pin (27), and is **NOT** in contact with the locknut (28).

4.4.4 LOWER BEARING AND SEAL ASSEMBLY (Cont'd)

E. Slide Spiralock retaining (snap) ring (29) down the shaft and install in the shaft groove above the dynamic race (1).
F. Lightly coat face of dynamic race (1) with grease (Petrolon SLICK 50 MPG).
G. Lightly coat O-Ring (3) with grease (Petrolon SLICK 50 MPG).
H. Install O-Ring (3) in outer groove of static race (2). Verify O-Ring (3) is completely seated in the groove.
I. Lay seal retainer (14) on a flat surface.
J. Install wave spring (4) in seal retainer (14).
K. Place static race (2) on top of the wave spring (4). With the flat of your hand press the static race (2) into the seal retainer (14) assuring that the O-Ring (3) on the static race (2) is seated in the seal retainer (14).
L. Slide seal retainer (14), wave spring (4), and static race (19) assembly down the shaft until it seats on top of the dynamic race (1).
M. Move the assembled components about the shaft. The assembled components should move as a single assembly. This verifies that the components are aligned and properly seated.
N. Place main bearing (20) between your palms and press down on the bearing to seat the bearing components. There should be **NO** evidence of bearing component "cocking" and the components should be seated fully within the bearing shell.
O. Slide main roller bearing (20) down the shaft. When it is as far as it will go then press down on the main roller bearing (20) until it seats on the step in the shaft.
P. Inspect the assembly. Verify components are locked into position when the main roller bearing (20) is pressed into position.
Q. Coat the components of the assembly, including main roller bearing (20), with an even film of Slick 50 Teflon grease.

4.4.5 END HOUSING/SHAFTS ASSEMBLY

The end housing and shafts are assembled as follows:

NOTE: Item reference numbers refer to item callouts Figure 4-1 and 4-2.

A. Verify drive (11) and driven (12) shaft Lower Bearing and Seal Assemblies have been assembled, inspected, coated with an even film of Slick 50 Teflon grease, and are ready for installation in end housing (23).
B. Slide end housing (23) over the hex end of drive shaft (11), moving into position over the Lower Bearing and Seal Assembly. While holding the end housing (23) stationary slide retaining (snap) ring (31) down the drive shaft (11) and seat the retaining ring in the groove above the top of main roller bearing (20). Verify and assure that the end housing (23) is held in place.
C. Repeat Step B, sliding the driven shaft (12) into end housing (23).
D. Verify both shafts are secured in the end housing (23).
E. Clamp both shafts, hex end down, in a vise.
F. Slide a gear spacer (24) down the drive (11) and driven (12) shafts. Position the spacers on top of the main roller bearing (20) on each shaft.
G. Place key (18) in the drive (40) and driven (39) shaft keyways.
H. Slide pinion gear (13), smaller gear of the two gears, into position on the drive shaft (11).
I. Slide spur gear (15) into position on the driven shaft (12).
J. Slide gear spacer (24) down drive (11) and driven (12) shaft on top of the drive (13) and driven (15) gears.

K. Slide an outboard roller bearing (22) inner race down each shaft. Secure the inner races in place with retaining (snap) ring (30).
L. Grease gears with approximately one US pound (0.45 Kg) of Cato-Mystik JT-6 or equivalent.
M. Inspect top cover (8). Verify top cover (8) is clean and free of ANY old oil seal (21) material.
N. Press in new top cover (8) oil seal (21).
O. Install end housing gasket (7) on rim of end housing (23).
P. Verify outboard roller bearing (22) outer races installed in the top cover (8) are coated with an even film of Slick 50 Teflon grease.
Q. Slide top cover (8) over drive shaft (11) and, align holes in the top cover (8) with the holes in end housing (23).
R. Secure top cover (8) to end housing (23) with sockethead capscrews (32).

CAUTION: DO NOT REST THE ASSEMBLY ON THE DRIVE SHAFT (11) WHEN POSITIONING THE ASSEMBLY IN STEP S.

S. Remove shafts, with attached end housing (23), from the vise and support the assembly on the top cover (8). Proceed to paragraph 4.4.6 and restack the cutters and spacers.

4.4.6 RESTACKING CUTTER AND SPACERS

The meshed, helical stack consists of cutters and spacers alternately placed on the drive and driven shafts to complete and assure a balanced stack. The standard Mini Monster stack consists of 5-tooth standard cutters and spacers on the drive shaft and, 11-tooth cam cutters and spacers on the driven shaft.

The following procedure describes the installation of the standard cutters and spacers.

NOTE: Item reference numbers refer to item callouts Figure 4-1 and 4-2.

A. Clean **ALL** cutters and spacers. **FOREIGN MATERIAL TRAPPED BETWEEN THE COMPONENTS OF THE STACK WILL AFFECT THE STACK HEIGHT AND CUTTER MESHING TOLERANCE.**
B. Inspect **ALL** cutters and spacers. Replace cutters and spacers that are cracked, show signs of excessive wear, and/or other obvious signs of damage.
C. Inspect drive (11) and driven (12) shafts for burrs. File and clean off **ANY** burrs for easier stacking.
D. Inspect each cutter (45) and (46) to assure that one (1) cutter tooth on each cutter is marked with a referenced dimple. This referenced dimple is necessary to assure the proper orientation of the cutters (45) and (46) as they are stacked on the drive (11) and driven (12) shafts.
E. Verify eight of the 5-tooth standard cutters (45), seven of the 11-tooth cam cutters (46), and 15 spacers (44) are on hand.
F. See Figure 4-3 for the drive (11) and driven (12) shaft orientation diagram. This shaft orientation must be maintained during the stacking process to assure correct cutter installation.

NOTE: Drive shaft (Shaft A) is numbered counter-clockwise and Driven shaft (Shaft B) is numbered clockwise.

G. Orient a 5-tooth standard cutter (45) on the drive (11) shaft (Figure 4-3, Shaft A) with the reference dimple at position 1 of the drive shaft (11). Install the cutter (45).
H. Install a spacer (44) on the driven (12) shaft (Figure 4-3, Shaft B).
I. Install a spacer (44) on the drive (11) shaft (Figure 4-3, Shaft A).
J. Orient an 11-tooth cam cutter (46) on the driven (12) shaft (Figure 4-3, Shaft B) with the reference dimple at position 1 of the driven (12) shaft. Install the cutter (46).

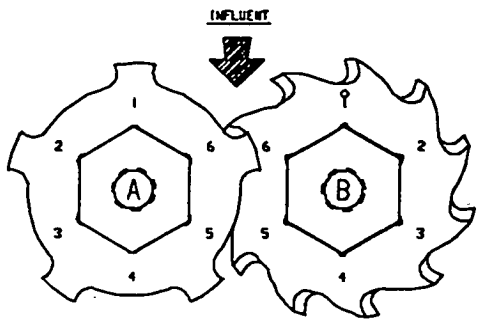


FIGURE 4-3. DRIVE AND DRIVEN SHAFT ORIENTATION

K. Orient a 5-tooth standard cutter (45) on the drive (11) shaft (Figure 4-3, Shaft A) with the reference dimple at position 2 of the drive (11) shaft. Install the cutter (45).
L. Install a spacer (44) on the driven (12) shaft (Figure 4-3, Shaft B).
M. Orient an 11-tooth cam cutter (46) on the driven (12) shaft (Figure 4-3, Shaft B) with the reference dimple at position 2 of the driven (12) shaft. Install the cutter (46).
N. Install a spacer (44) on the drive (11) shaft (Figure 4-3, Shaft A).
O. Continue the installation of the 5-tooth standard (45) cutters, 11-tooth cam (46) cutters, and spacers (44), rotating the cutter's reference dimple one (1) position at a time, until **ALL** the 5-tooth standard cutters (45) and spacers (44) are installed on the drive (11) shaft and, **ALL** the 11-tooth cam cutters (46) are installed on the driven (12) shaft.
P. Inspect stack for the correct quantity and installation of required cutters (45) and (46) and spacers (44) on the drive (11) and driven (12) shafts.
Q. Install a stack washer (16) on the drive (11) and driven (12) shafts.
R. Apply Loctite adhesive to drive (11) and driven (12) shaft stack screw (26) threads.
S. Install drive (11) and driven (12) shaft stack screws (26).
T. Torque drive (11) and driven (12) shaft stack screws (26) to 135 Ft. Lbs (184 Nm).
U. Perform cutter stack tightness as described in Section 5.
V. Replace the cutter cartridge in the mini chamber housing (17) as described in Section 3.

SECTION 5

CHANNEL MINI MONSTER

MAINTENANCE INFORMATION

5.1 GENERAL

This section defines maintenance guidelines, problem analysis, and identifies the tools, lubricants, parts, and drawings required to support the Mini Monster. Please contact our Customer Service Department as defined in Section 1 or, contact your local service representative if you have **ANY** questions or require maintenance information clarification. (Refer to the Controller manual for maintenance information applicable to the Controller.)

5.2 MAINTENANCE REQUIREMENTS

The following paragraphs describe maintenance activities. (See Table 5-1 for a summary of these tasks.)

TABLE 5-1. MAINTENANCE REQUIREMENTS

MAINTENANCE OPERATION [A]	FREQUENCY [BC]	LUBRICANT [D]	COMMENTS
Inspect for cutter wear	[E]	Not Applicable	See Paragraph 5.3.4
Inspect cutter stack tightness	6 Months	Not Applicable	See Paragraph 5.3.5
Tighten fasteners	12 Months	Not Applicable	See Paragraph 5.3.6
Inspect bearings and seals	[F]	Not Applicable	See Paragraph 5.3.7
Grease gears	[G]	Cato-Mystic JT-6 HI Temp	See Paragraph 5.3.8

[A] Tasks are based on use of personnel experienced in same and/or similar equipment and, are familiar with the basic operation, safety, emergency procedures, general plant safety, and use of plant tools/maintenance equipment.
[B] Task to be performed on a regular basis. Scheduling is established by the user based on the users own unique resources and operating/installation environment.
[C] Time periods are based on normal operation usage and should be adjusted by the individual users based on their usage and operational environment. More frequent inspections are encouraged if operating in a harsh environment.
[D] See this section for a listing of lubricants and alternates.
[E] Inspect when solids can not be reduced without excessive jamming.
[F] Inspect every 12 months or 8760 operating hours whichever occurs first.
[G] Gears are greased once a year or during reassembly whichever occurs first.

5.3 INSPECTION/MAINTENANCE

The following paragraphs describe the inspection/maintenance guidelines, preparation for inspection/maintenance, and the inspections and maintenance defined for the Mini Monster.

5.3.1 PARTS/TOOLS/MATERIALS

NO special parts, tools, and/or materials are required in the performance of the maintenance and inspection tasks.

5.3.2 MAINTENANCE GUIDELINES

Observe the following guidelines during Mini Monster inspection and maintenance.

A. **AVOID SERIOUS INJURY. ALWAYS OPEN, TAG, AND LOCK OUT MAIN POWER TO THE CONTROLLER BEFORE SERVICING THE MINI MONSTER.**
B. **DO NOT LUBRICATE THE GEARMOTOR. BEARINGS ARE LIFETIME LUBRICATED. ALL GREASE FITTINGS ARE REPLACED WITH PLUGS.**
C. **DO NOT** steam clean and disinfect the gearmotor, seal assemblies, and bearings.
D. Verify gasket surfaces are clean of **ALL** gasket material before installing a new gasket.
E. Clean housing bores thoroughly with solvent (MEK, Acetone or equivalent). Replace the housing if the bores are scored, pitted or other damage is identified.
F. Replace **ALL** bushings that exhibit excessive wear.
G. Replace **ALL** cracked parts or parts that exhibit excessive wear.
H. Clean **ALL** shaft assembly bearings. Replace if wear is exhibited.
I. Inspect and replace **ALL** bearings that exhibit excessive wear or **ANY** pitting in the races or rollers.

5.3.3 PREPARATION FOR MAINTENANCE

Perform the following prior to the Mini Monster inspection and maintenance tasks described in this section.

A. Disconnect, tag, and lockout power to the Controller.
B. Disconnect electrical connections to the motor.
C. Remove the Mini Monster from the installation as described in Section 3.

5.3.4 CUTTER WEAR

Cutter wear is determined when the Mini Monster can **NO** longer reduce solids without excessive jamming.

5.3.5 CUTTER STACK TIGHTNESS INSPECTION

Inspect the cutter stack assemblies for tightness every six (6) months.

WARNING:	**AVOID SERIOUS INJURY FROM ACCIDENTAL STARTUP. VERIFY AND ASSURE POWER TO THE CONTROLLER IS LOCKED OUT AND TAGGED BEFORE SERVICING THE MINI MONSTER.**

A. Prepare Mini Monster for inspection as defined in Paragraph 5.3.3.
B. Remove cutter cartridge from mini chamber housing as described in Section 3.
C. Insert long, heavy duty screwdriver firmly between a pair of adjacent cutters on the same shaft and apply vertical pressure (parallel to shaft). If **ANY** play or movement is detected proceed to step D. If **NO** play or movement is detected proceed to step G.
D. Torque the shaft stack screws (26) to 135 Ft.Lbs (184 Nm).

5.3.5 CUTTER STACK TIGHTNESS INSPECTION (Cont'd)

E. Repeat step C to verify tightness of stack. If the stack is still loose refer to Section 4 for Mini Monster cutter removal/replacement.
F. Perform Step C for second shaft cutters, taking the corrective action identified if **ANY** play or movement is detected. If **NO** play or movement is detected proceed to step G.
G. Install the Mini Monster as described in Section 2.
H. Complete **ALL** inspection/maintenance forms and/or log entries.

5.3.6 FASTENERS

Although the Mini Monster has a minimum of vibration, inspect the fasteners approximately every twelve (12) months. Tighten as necessary.

5.3.7 BEARING AND SEAL INSPECTION

Inspect the drive and driven shaft bearings and seals every twelve (12) months, or 8760 operating hours whichever occurs first as described in the following procedure.

NOTE: Item reference numbers refer to item callouts on Figure 4-1.

A. Prepare Mini Monster for inspection as defined in Paragraph 5.3.3.
B. Remove the spool (5) as described in Section 3.
C. Remove hexhead capscrews (34) and split lock washers (33) securing the top cover (8) to the mini chamber housing (17).
D. Remove top cover (8) and end housing gasket (7).
E. Inspect inside of end housing (23) for contaminants. If **NO** contaminates are found proceed to Step F. If **ANY** contaminates are found the bearings and seals have worn and must be removed and replaced as described in Section 4.
F. Clean the end housing (23), mini chamber housing (17), and the top cover (8) end housing gasket (7) mating surfaces of **ALL** old gasket material.
G. Install a **NEW** end housing gasket (7).
H. Install top cover (8) and secure to mini chamber housing (17) with hexhead capscrews (34) and split lock washers (33).
I. Install spool (5) and gearmotor (48) as described in Section 3.
J. Install the Mini Monster as described in Section 2.
K. Complete **ALL** inspection/maintenance forms and/or log entries.

5.3.8 GREASE GEARS

The drive and driven gears (Item 13 and 14, Figure 4-1) are greased as part of the Mini Monster assembly process described in Section 4.

5.3.9 GEARMOTOR

Gearmotor scheduled maintenance and/or lubrication is **NOT APPLICABLE.**

5.4 PROBLEM ANALYSIS

The Mini Monster is designed to operate smoothly and quietly. If **ANY** excessive noise or temperature rise is noted, stop operation and inspect the unit. Table 5-2 identifies potential problems and possible solutions. Refer to the Controller manual for potential Controller related problems and possible solutions.

TABLE 5-2. PROBLEM ANALYSIS

Potential Problems	Possible Solutions
Gearmotor Making Noise	Speed reduction mechanism damaged. Repair and/or replace as required.
Grinder making noise	Inspect cutters for burrs.
	Check cutters for evidence of off-center cutter.
	Check for broken cutter or spacer.
	Check cutter stack tightness. If loose tighten as necessary.
	Inspect bearing. Contamination found in bearing areas indicates that seals and bearings have worn and must be replaced.
	Check drive and driven shaft for **ANY** indication of a bent or broken shaft.
	Inspect retaining rings. If broken replace. If **NOT** in groove inspect the ring for damage. Replace if ring is damaged.
Driven shaft **NOT** turning	Check gear key. Replace gear key if broken or missing.
	Check for broken shaft.
	Check for broken gear.
Drive shaft **NOT** turning	Check for broken shaft below the gear.
Drive and driven shaft **NOT** turning	Check coupling key. Replace if broken or missing.
	Check gear key. Replace gear key if broken or missing.
	Check for broken shaft.
	Check for broken shaft below the gear.
Seal failure	Inspect seals for wear. Replace parts indicating wear (i.e. Races, Seal Wedge, o-rings).
	Inspect end housing. Replace if obvious signs of wear are observed.
	Inspect cutters and spacers for wear. If worn thin replace.
	Inspect cutters or spacers for obvious signs of damage. Replace as required.

5.5 TOOLS

Table 5-3 identifies the tools required to support Mini Monster maintenance, assembly, and disassembly of the Mini Monster. **NO** special tools are required.

TABLE 5-3. TOOL LIST (Sheet 1 of 2)

SIZE	DESCRIPTION	QTY	SIZE	DESCRIPTION	QTY
0.125-Inch Hole Diameter	Snap Ring Plier	1	8-Inch	Adjustable Wrench, 1-1/4-Inch Opening	1
7-Inch Spread	Gear Puller, 6-Ton Capacity	1	Standard	Ratchet, 3/8-Inch Square Drive	1

TABLE 5-3. TOOL LIST (Sheet 2 of 2)

SIZE	DESCRIPTION	QTY	SIZE	DESCRIPTION	QTY
Standard	Torque Wrench, 1/2-Inch Square Drive (0 to 150 Ft. Lbs.)	1	13-MM	3/8-Inch Square Drive Socket	1
2-1/2-Inch	Spanner Wrench	1	14-MM	3/8-Inch Square Drive Socket, Hexkey	1
1-1/2-Inch	Gasket Scraper	1	17-MM	3/8-Inch Square Drive Socket	1
6-MM	3/8-Inch Square Drive Socket, Hexkey	1	30-MM	1/2-Inch Square Drive Socket	1

5.6 LUBRICANTS

Table 5-4 lists the lubricants recommended for the Mini Monster. Please contact your local service representative or our Customer Service Department, as defined in Section 1, if you have any questions on the lubricants recommended. **AVOID MIXING BRANDS AND/OR TYPES OF LUBRICANTS. IF THE LUBRICANTS IDENTIFIED DO NOT MEET YOUR REQUIREMENTS, CONTACT THE FACTORY.**

TABLE 5-4. RECOMMENDED LUBRICANTS (Sheet 1 of 2)

MANUFACTURER	GREASE
RECOMMENDED GREASES FOR GEARS [A] N.L.G.I. GRADE NUMBER: 1 (Approx. 1.0 Pounds/0.45 Kg)	
Cato Oil and Grease Co.	Cato-Mystic JT-6 Hi-Temp [B]
Chevron Oil Co.	Industrial Grease
Fiske Brothers Refining Co. Lubrication Division	Lubriplate 930-AA
Gulf Oil Co.	Gulfgem
Mobil Oil Co.	Mobil Temp No. 1
RECOMMENDED GREASES FOR SEALS [A] N.L.G.I. GRADE NUMBER: 1 (Light Coating)	
Petrolon, INC.	Slick 50 MPG [B]
RECOMMENDED GREASES FOR REDUCTION MECHANISM [A] N.L.G.I. GRADE NUMBER: 2 (Approx. 0.5 Pounds/0.2 Kg)	
Shell	Alvania II [B]
Shell	Darina EP2
Mobil Oil Co.	Mobilux EP2

TABLE 5-4. RECOMMENDED LUBRICANTS (Sheet 2 of 2)

MANUFACTURER	GREASE
RECOMMENDED LUBRICANT/PROTECTANT FOR GENERAL ASSEMBLY	
Zep 45 [B]	
Liquid Wrench No. 2	
Starrett Rust Preventive Lubricant	

[A] Mixtures of different soap base greases vary in properties such as dropping point, consistency and leakiness. For this reason avoid using mixtures of different greases. When standard grease types **DO NOT** meet your requirements, consult your grease manufacturer.
[B] O.E.M. (Original Equipment Manufacturer)

5.7 PARTS INFORMATION

The parts list included as part of this manual lists the parts applicable to the basic Channel Mini Monster and identifies Mini Monster replaceable parts. See Figure 4-1 and 4-2 for the specific location and identification of the parts utilized. Factory **DOES NOT** recommend the stocking of parts for the Mini Monster, but does recommend the user refer to our "FREE LABOR POLICY" for an alternative to the stocking of parts which **MAY or MAY NOT** be used. Please contact your local service representative or our Customer Service Department as defined in Section 1 when inquiring about parts information. Be certain to give the Mini Monster nameplate serial number to the Customer Service Representative. (The nameplate is located on the Mini Monster top cover.)

5.8 DRAWINGS

Drawings applicable to Mini Monster operation and maintenance are included as an integral part of this manual. Refer to the Controller manual for the drawings related to the Controller.

Disposable Waste Systems, Inc.
Parts List for Model 20002 Channel Mini Monster (Sheet 1 of 2)

ITEM NO.[A]	PART NO. [B]	DESCRIPTION	QTY
1 [C D]	04002-TC	Race, Dynamic, Tungsten Carbide	2
2 [C D]	04004-TC	Race, Static, Tungsten Carbide	2
3 [C]	04005-B	O-Ring, No.149, Buna	2
4 [C D]	03014-0001	Spring, Wave, 17-4 PH, Steel	2
5	20013-AL	Spool, Motor Adapter, Aluminum 6061-T6	1
6 [C]	20114	Gasket, Mini Chamber, 1/16, Tan Fiber	1
7 [C]	20014-0002	Gasket, End Housing, 1/16, Tan Fiber	1
8	20215-DI	Cover, Top, Ductile Iron	1
9	20017-0001	Coupling, Half, Interlocking, 35-mm Bore, 1018 CD/ Ledloy (Used with Item 18)	1
10	20017-0003	Coupling, Half, Interlocking, 1-1/8 Inch Bore, 1018 CD/Ledloy (Used with Item 48)	1
11 [D]	20018-0001	Shaft, Drive, 4140	1
12 [D]	20018-0002	Shaft, Driven, 4140	1
13 [D]	20019	Gear, Pinion, 27-Teeth, 4340 (Used with Item 18)	1
14 [D]	20020	Retainer, Seal, 1018 CD	2
15 [D]	20021	Gear, Spur, 34-Teeth, 4340 (Used with Item 18)	1
16 [D]	20034	Washer, Stack, 4130	2
17	20136-DI	Housing, Mini Chamber, Ductile Iron	1
18 [C D]	20045-0001	Key, 8 X 10-mm, Steel (Used with Items 9, 13, and 15)	3
19 [C D]	20046-B	O-Ring, 568-129, Buna	2
20 [C D]	20047	Bearing, Main Roller, Steel	2
21 [C]	20048	Seal, Oil, 1-3/8 X 1-3/4 X 1/4, Steel/Buna	1
22 [C D]	20049	Bearing, Outboard Roller, 35 X 80 X 21mm, Steel	2
23	20077-DI	Housing, End, Ductile Iron	1
24 [D]	20083	Spacer, Gear, 1018 CD	4
25	21147	Eyebolt, 8M X 1.25 X 31.7mm, Steel	2
26 [D]	21001	HHCS, M20, 1.5-Inch X 40-mm, Steel	2
27 [D]	21002	Pin, Dowel, 0.6-Inch Dia. X 3/16-Inch, Steel	2
28 [D]	21003	Nut, Lock, Bearing, Steel	2

Disposable Waste Systems, Inc.
Parts List for Model 20002 Channel Mini Monster (Sheet 2 of 2)

ITEM NO.[A]	PART NO. [B]	DESCRIPTION	QTY
29 [C D]	21004	Ring, Retaining, Spiralock, Steel, WS-175	2
30 [C D]	21005	Retaining Ring, 5100-137, Steel	2
31 [C D]	21006	Retaining Ring, N5000-354, Steel	2
32	21007	SHCS, M8 X 1.25-Inch X 20-mm, Steel	8
33	21008	Washer, Lock, M8, Steel	20
34	21146	HHCS, M8 X 1.25-Inch X 35-mm, Steel	8
35	21148	Pin, Dowel, M8 Dia. X 20mm (Used with Item 8)	2
38	21013	HHCS, M8 X 1.25-Inch, 20-mm, Steel	2
39	21025	HHCS, M10 X 1.5-Inch, 40-mm, Steel	4
40	21016	Washer, Flat, M10, Steel	4
41	21017	Washer, Split Lock, M10, Steel	4
42	21018	Nut, Hex, M10 X 1.5-Inch, Steel	4
43	21019	HHCS, M8 X 1.25-Inch, 45-mm, Steel	2
44 [C D]	30024-FB/E	Spacer, Fine Blanked, 0.319, 4130/17-4, SS	15
45 [C D]	31001-0005-FB	Cutter, Fine Blanked, 5-Tooth, 0.310, 4130/17-4, SS	8
46 [C D]	31017-0011-FB	Cutter, Cam, 11-Tooth, 0.310, 4130/17-4, SS	7
48	20010-0001	Gearmotor, 1HP, 29:1, TEFC, 1725RPM, Sumitomo	1
49 [C D]	04006-B	O-Ring, 568-143, Buna	2

[A] See Figure 4-1 unless otherwise specified.
[B] Part numbers **DO NOT** include reprocurement level identification such as leading zero's. (GSA and NSN part numbers are **NOT APPLICABLE.**)
[C] Replaceable part.
[D] See Figure 4-2.

Information for the installation and operation of CYCLO DRIVE 4000

GREASE LUBRICATED UNITS

0. Sections

1. General safety instructions

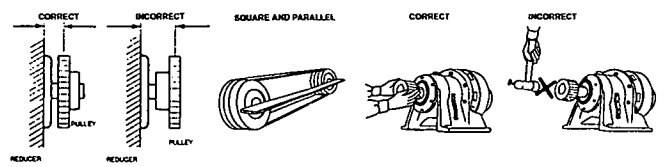
Study these instructions carefully before installing and operating the drive. Make sure that this information is readily available to all persons involved in the operation and maintenance of the drive. All appropriate safety regulations must be observed when installing a drive. Suitable safety covers must be provided for all rotating shafts. The drive is designed exclusively for use as specified in the order confirmation and/or catalogue. Any other usage is considered improper. The manufacturer accepts no liability for any damage as a result thereof. Before switching on or starting up the machine, make sure that nobody can be endangered by the machine/system startup. Own modifications and/or alterations which affect the safety of the drive are not permitted. Spare parts must comply with the technical requirements specified by SUMITOMO CYCLO EUROPE. This is always ensured with original spare parts. Safety regulations for people and the environment in compliance with safety regulation data sheets to DIN 52 900 are to be observed when handling lubricants and anti-corrosive agents. The anti-corrosive agent (Valvoline Tectyl 846/K19) used for transportation and storage on the shaft-ends or hollow shafts and on the central seats must be removed before startup. The anti-corrosive agent can be removed using an alkaline detergent; under no circumstances is it to be removed mechanically (abrasive etc.). The alkaline detergent must not come into contact with the seals.

2. Transportation

Cable loops of suitable and adequate size are to be used; these are to be hooked into the ring screws or laid round the flange connections. The following applies for all drive units: do not use the central bores in the shaft-ends for lifting the drive with hooked bolts etc. This could result in damage to the bearings.

3. Connection of reduction elements

Clutches, discs, gear wheels, chains etc. which are connected to the reduction shaft must not be pressed on by force or struck on as this could cause damage to the bearings.



Assembly is carried out using the central bores in the ends of the shaft or by heating the parts to be mounted to a maximum of 100°C. The shafts have been fitted with a slot for keys and keyways to DIN 6885, sheet 1. Shafts should be manufactured in accordance with the tolerances stated in the selection catalogue. A locking screw or similar is to be used to prevent any axial displacement. Chainwheels, discs or gear wheels must be located as close to the bearing as possible (see illus. above left) to keep radial loads as small as possible. If pinions or chains etc., are used, the drive should be installed so that the unit's housing is pressed onto the foundation. In the case of speed reducers with hollow high speed shafts, MoS2 paste or spray (e.g. Molykote) is to be applied to the motor shaft before the counterpiece is connected.

4. Installation

The drive is to be installed so that it is easily accessible for any future lubrication or grease top-up. First establish a perfectly level, non-distorting and vibration-absorbing base for the complete mounting area and align the drive before tightening the fastening screws. Check all fastening screws for correct torque after about 4 weeks. Positive connections (e.g. DIN 6325 cylinder pins) are to be used in addition to the base fastening with screws of property class 8.8 or greater if the drive is being driven to max. output torque or max. cross-load. Units to be installed outdoors or in very unfavourable ambient conditions, e.g. dirt, dust, spray water or heat, should be protected by casing. Free air access to the housing surface must not be impaired under these circumstances.

5. Lubrication

Grease lubricated DRIVE units are filled with grease at our factory and are ready for use without refilling. The grease being used must not be mixed with other types of grease. The standard types of grease Shell Alvania RA and Shell Alvania R2 are suitable for ambient temperatures of -10° C to +50° C, whereby self-heating of the units up to a max. +60° C can be achieved during constant operation. Please contact us if considering use of standard grease outside this temperature range as well as the use of other lubricants.

Lifetime grease lubrication

All DRIVE 4000 units type CN ... are grease lubricated for life and can be mounted in any position required. The units are filled with Shell Alvania RA at the factory and do not require any refilling. The service life can be increased if the grease is replaced after 20,000 hours or 4 to 5 years.

Shell Alvania RA grease filling quantities for grease replacement:

Size	4075G	4085G	4090G 4095G	4100G 4105G	4110G 4115G 4125G	4075DAG
Grease quantitiy (g)	30	45	125	210	380	50

Size	4085DAG	4090DAG 4095DAG	4100DAG 4105DAG	4110DAG 4115DAG	4110DBG 4115DBG
Grease quantity (g)	65	145	230	400	440

Grease lubrication

If the unit is filled with Shell Alvania R2 as lubricant, it must be topped up after 500 operating hours, however no later than 2 months. The grease may no longer be in perfect condition if the unit has not been used for longer than 1 year. In this case, the DRIVE unit should be disassembled and the old grease replaced by new.

Shell Alvania R2 grease filling quantities for grease top-up/replacement:

Size	4130DB 4135DB	4130 DC 4135 DC	4145DC	4150DB 4165DB
Grease quantity for top-up (g)	10	10	20	25
and grease replacement (g)	790	815	815	1115

Regreasing intervals

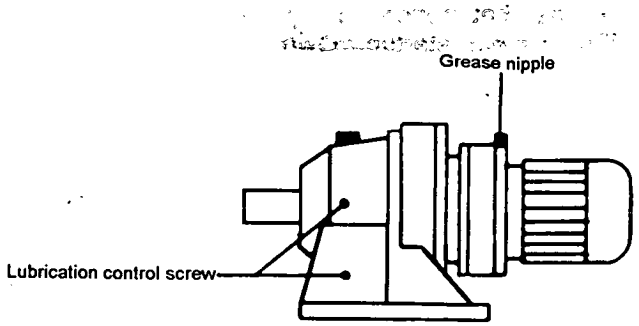
Operating conditions	Regreasing interval	Comments
Up to 10 hours per day	Every 3-6 months	Regreasing intervals must be shortened in the case of larger units or units used under difficult operating conditions
10 - 24 hours per day	Every 500 - 1.000 hours	

Grease change intervals

Section	Grease change-intervals	Comments
Reduction & speed reducer section High speed shaft bearings	every 2-3 years	Regreasing intervals must be shortened in the case of larger units or units used under difficult operating conditions.
Slow speed shaft section	every 3-5 years	

Filling and changing lubricants

DRIVE units from size 4135 are fitted with grease nipples and filters for regular regreasing.



The DRIVE unit should be lubricated during operation in order to ensure a circulation of the grease. To grease, first remove the lubrication control screw on the housing. Then apply grease using a grease gun at the grease nipple on the flange on the drive side or on the motor connection flange.
If too much grease is applied, the operating heat can lead to a rise in the lubricant temperature or grease escaping through the seals.

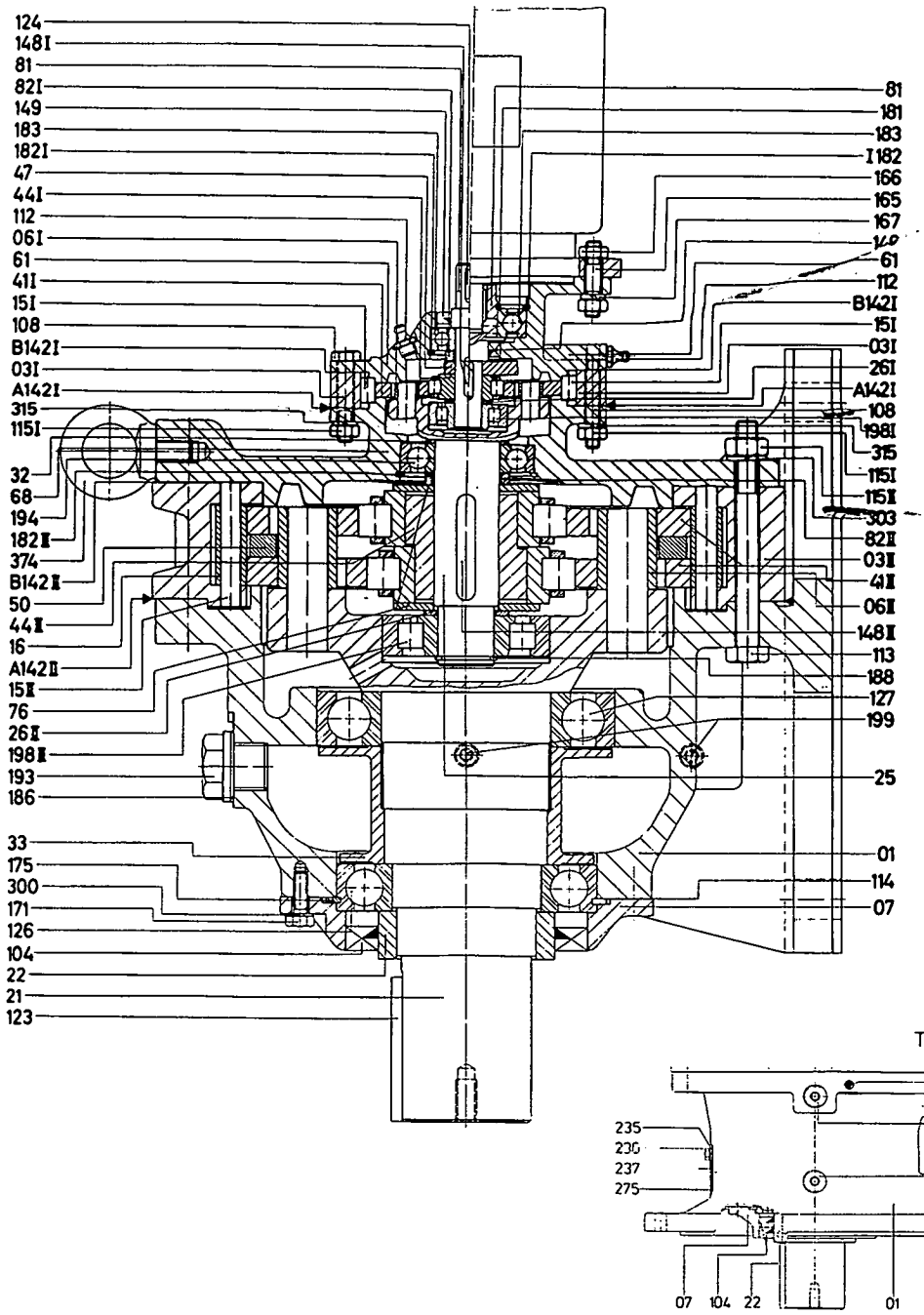
6. General design

Explanation of terminology on the rating plate can be found in the valid DRIVE 4000 catalogue (990341).

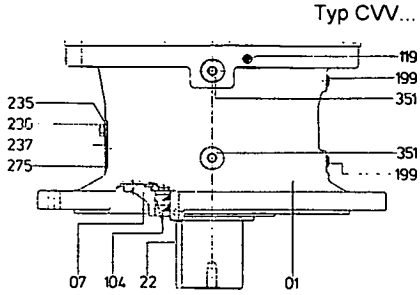
Spare parts (example)

01 Casing
03 I+II Ring gear housing
06 I Roller
06 II Roller
07 Seal cover
15 I+II Outer pin
16 Outer roller
21 Slow speed shaft
22 Ring
25 Intermediate shaft
26 I Spacer
26 II Spacer
32 Spacer
33 Grease tank
41 I Cycloid disc
41 II Cycloid disc
44 I+II Eccentric
47 Counterweight
50 Spacer ring
61 Flange
69 Intermediate flange
76 Thrust washer
81 High speed shaft
82 I+II Spacer
104 Shaft seal
108 Screws
112 Grease nippel
113 Screws
114 Paper gasket
115 I nuts
115 II nuts
119 Plug screw
123 Key
124 Key
126 Bearing
127 Bearing A
142 I+II Paper gasket B
142 I+II Paper gasket
148 I+II Keys
149 Shaft seal
171 Screws
175 Circlip
181 Circlip
182 I+II Circlip
183 Bearing
186 FR-Seal
188 Circlip
193 Plug screw
194 Bearing
198 I+II Bearing
199 Lubrication control screw
235 Filler panel
236 Screws
237 Spring washer
275 Gasket
300 Spring washer
303 Spring washer
315 Spring washer
351 Plug screw
374 Ring screw - only with complete gearmotors
(165) Screws
(166) Nuts
(167) Spring washers

CVH-4135DBGH3-195/G **CVHM1-4135DBGH3-195/GF80M**



Typ CVV...



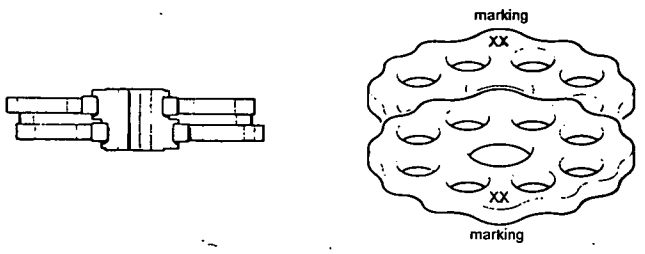
8. Disassembly / assembly

Disassembly

a. .Place the DRIVE unit so that the high speed shaft is facing upwards. No pressure may be applied to the high speed shaft.
b. Undo screws (113) and (108) and open the speed reducer at the separating joint (x symbol, see cross section).
c. Remove parts in the following order for each reduction stage: circlip (188), cycloid disc (41II), spacer ring (50), cycloid disc (41II), eccentric (44II). For speed reducers with only one cycloid disc: spacer (26I), cycloid disc (41I), ring gear housing (031), eccentric (44I), counterweight (47).
d. To disassemble the output side bearing case, remove the parts in the following order: screws (171), seal cover (07) and circlip (175). Then remove the slow speed shaft (21) with the help of a wooden or rubber hammer. Then remove the following parts using a press: ring (22), bearing (126) and bearing (127).
e. To disassemble the bearing (183), first remove the circlip (182), then remove the high speed shaft (81) and the bearing (183).

Assembly

Assembly is in the reverse order of disassembly. The following points, however, should be observed: In the case of speed reducer sizes 4105 to 4275, the cycloid disc (41 II) must be inserted so that the marking shows towards the output shaft. At the same time, the markings on the two cycloid disc (41 II) must be at 180° to each other.



Tightening torque in Nm for screw quality 8.8

M 4	M 5	M 6	M 8	M 10	M 12	M 14
2.8	5.5	9.5	23	46	79	125

M 16	M 18	M 20	M 22	M 24	M 27	M 30
195	280	390	530	670	1000	1350

R_{EL} = 640 N / mm^2

The following must also be observed:

Check the surfaces of the ring (22) and the shaft 81). If necessary, they should be replaced!

Replace paper gaskets and rotary shaft seals!

If replacing the bearing and seals, make sure that only undamaged original parts are used!

Apply some grease to the lip of the rotary shaft seal!

Only use the specified grease in the specified quantity to the bearing and inner periphery!

Heat up the bearing and rings and place on the shaft (21) without tension!

If you have any questions, please don't hesitate to contact us.

SUMITOMO CYCLO EUROPE

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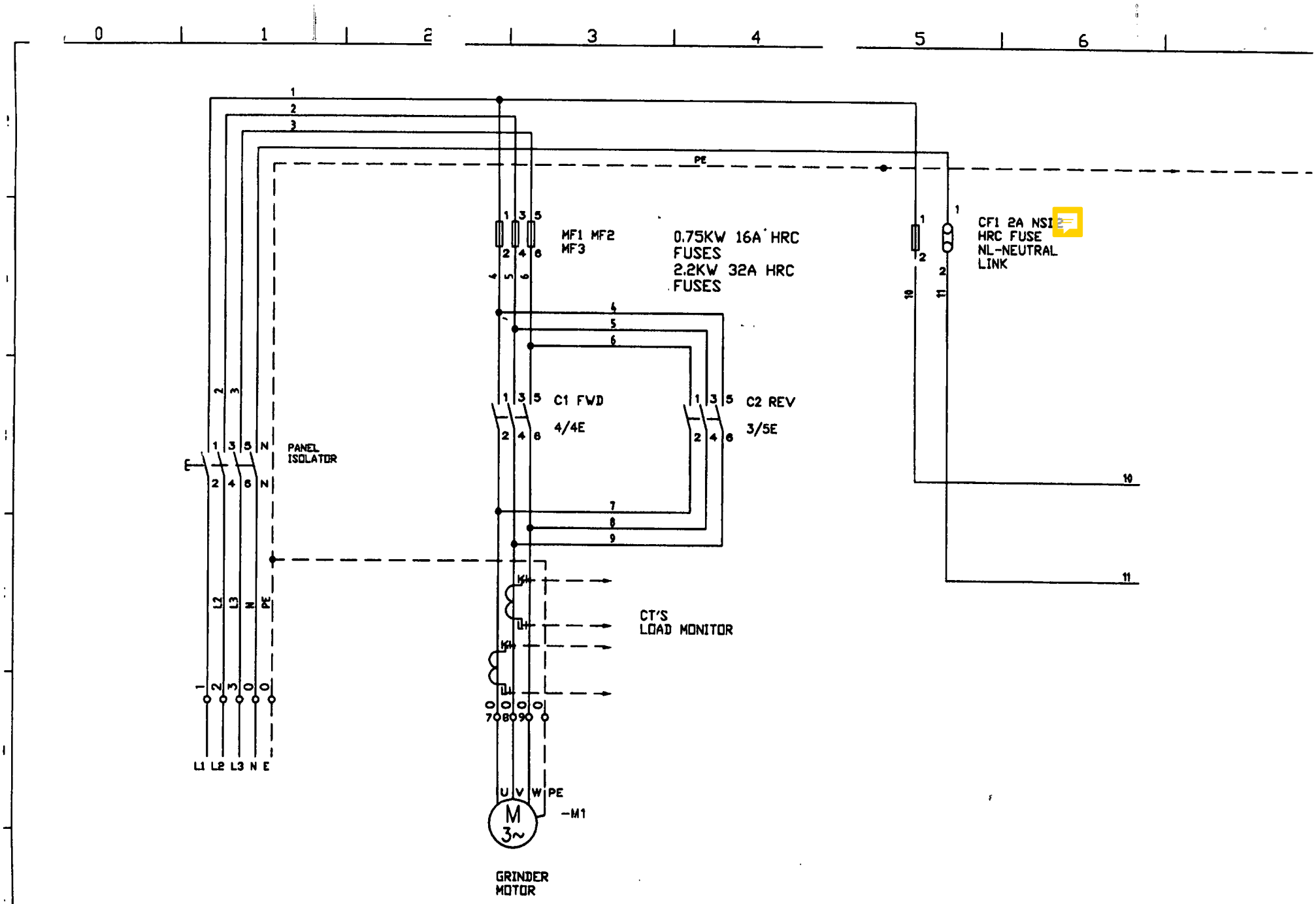
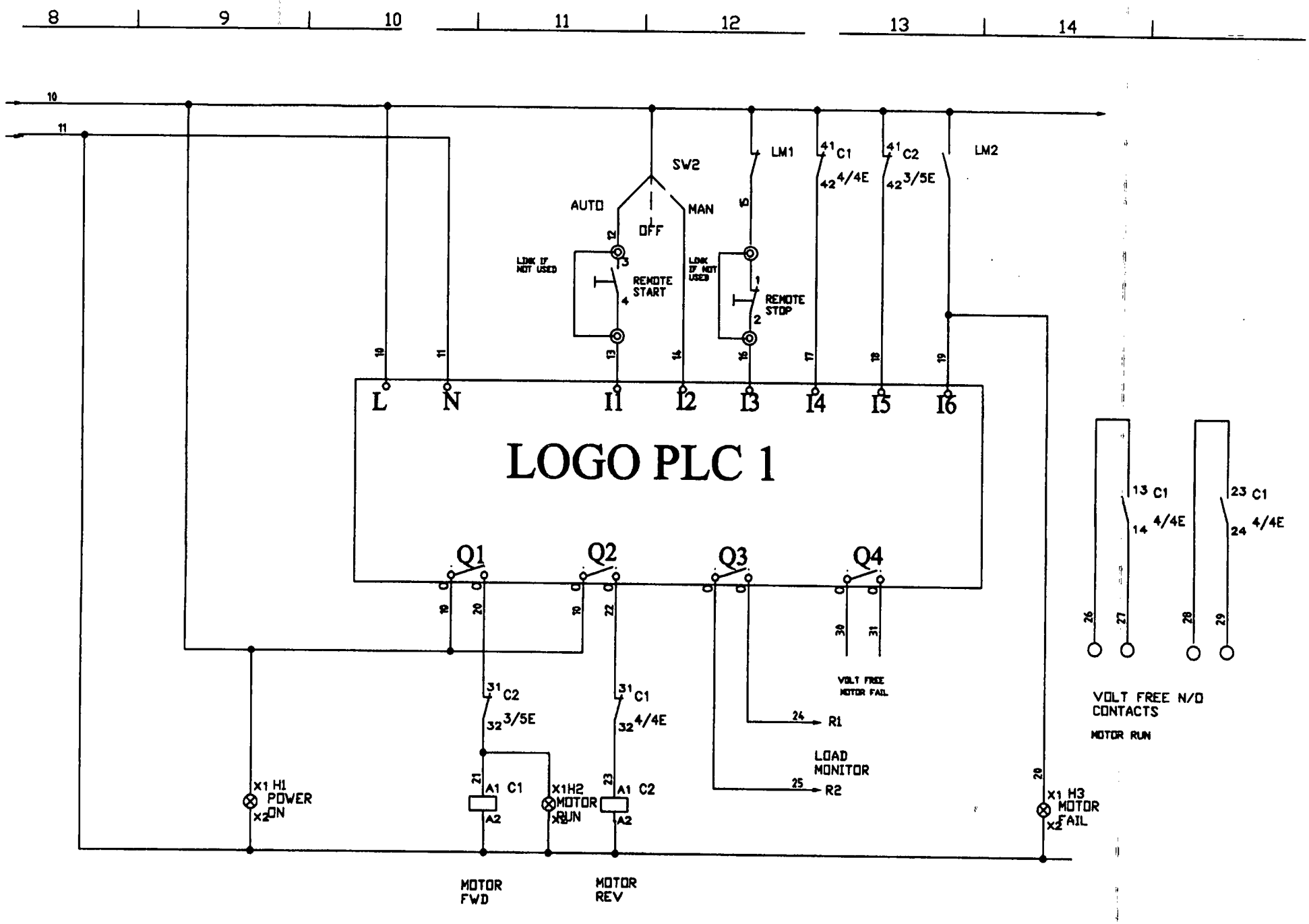
ROBBINS & MYERS LTD
GRINDER CONTROLLER
M-RC01 20000/30000

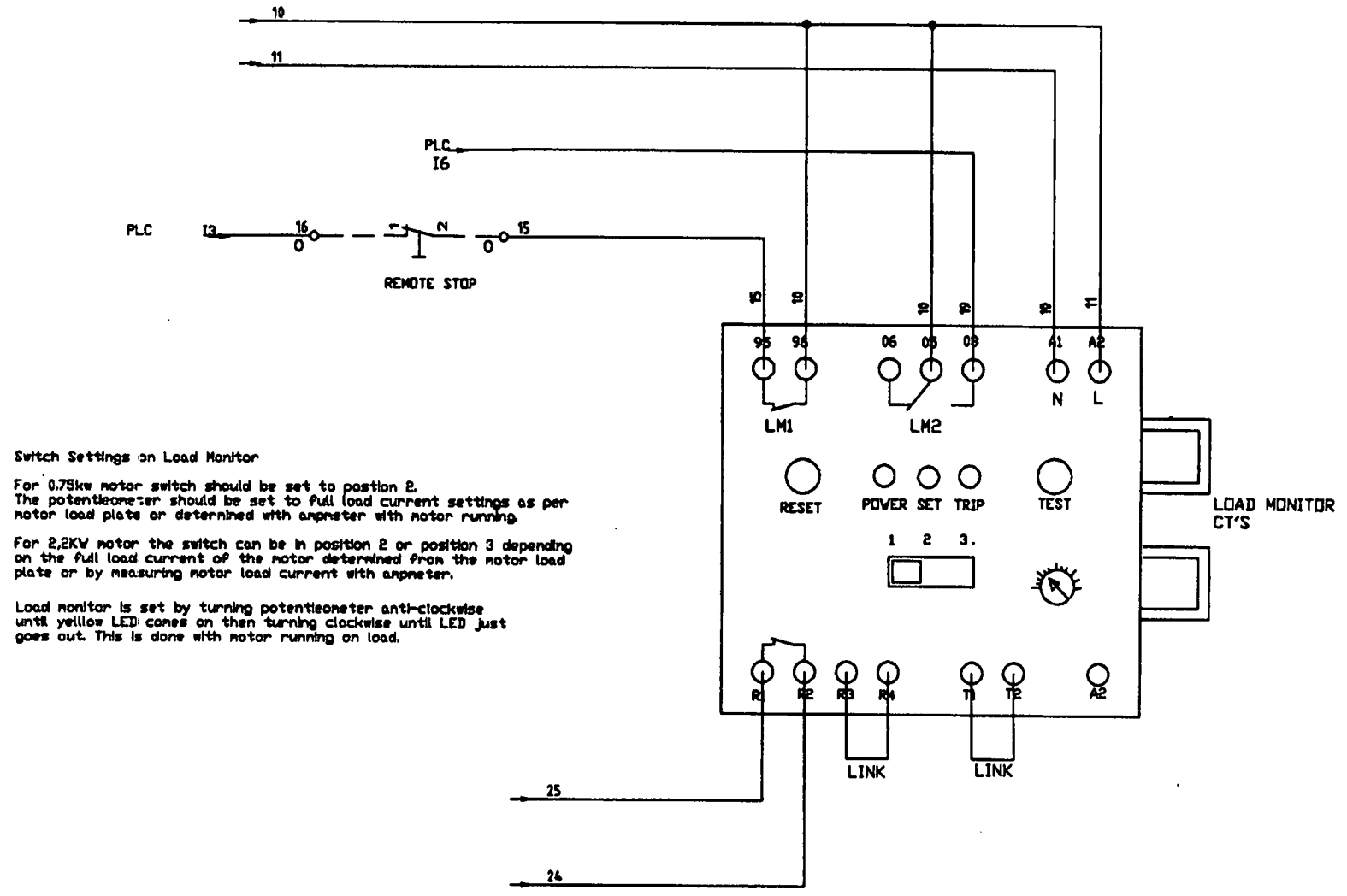
	/ /		L. Mod	08/03/2000	ROBBINS & MYERS GRINDER CONTROL PANEL	1/5	Previous:	Next: 2
	/ /		In Cha.			RLM00/13959		• DFS
	/ /		Verif.	Date				• DFZ
Issue Code	Date	Name	Std.	BS	[redacted]	13959/1	RLM00/13959	



	/ /		L. Mod	10/09/1998	ROBBINS & MYERS GRINDER CONTROL PANEL	GRINDER CONTROL DISTRIBUTION SCHEMATIC	2/5	Previous:1 / Next:3
	/ /		In Cha.	RLM			RLM00/13959	=DFS
	/ /		Verif.	Date				+DFZ
Issue Code	Date	Name	Std.	BS	Personal Data Re		13959/2	RLM00/13959



	/ /		L. Mod	08/03/2000	ROBBINS & MYERS GRINDER CONTROL PANEL		GRINDER CONTROL CIRCUIT SIEMENS LOGO PLC SCHEMETIC	3/5	Previous:2	Next:4
	/ /		In Cha.					RLM00/13959		=DFS
	/ /		Verif.	Date						+DFZ
Issue Code	Date	Name	Std.	BS				13959/3	RLM00/13959	



Switch Settings on Load Monitor

For 0.75kw motor switch should be set to postion 2.
The potentiometer should be set to full load current settings as per motor load plate or determined with ampmeter with motor running.

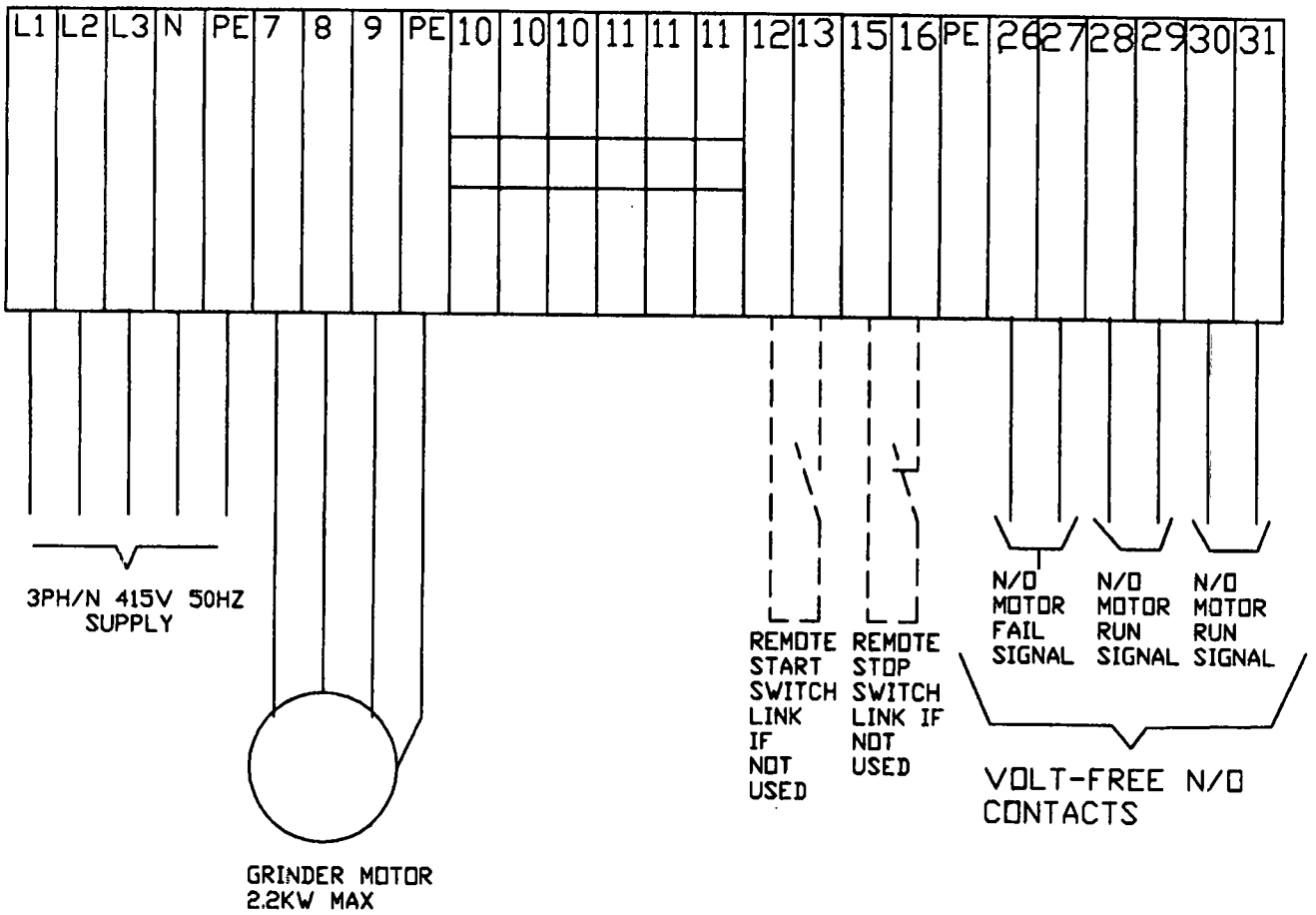
For 2.2KW motor the switch can be in position 2 or position 3 depending on the full load current of the motor determined from the motor load plate or by measuring motor load current with ampmeter.

Load monitor is set by turning potentiometer anti-clockwise until yellow LED comes on then turning clockwise until LED just goes out. This is done with motor running on load.

LOAD MONITOR LM

TITLEBOX	/ /	Personal Di	L. Mod	28/09/1998	ROBBINS & MYERS GRINDER CONTROL PANEL		Load Monitor Connections MTE DMPO Monitor 110vac	4/5 Previous:3 Next:5
	/ /		In Cha.					RLM00/13959
	/ /		Verif.	Date				▪DFS ▪DFZ
Issue Code	Date	Name	Std.	BS	PePerso	Perso		13959/4 RLM00/13959

TB1 - TERMINAL CONNECTION BLOCK



DESIGN & MANUFACTURE BY:
RLM ELECTRICAL SERVICES
LAWBROOK, MARTLEY ROAD
LOWER BROADHEATH
WORCESTR WR2 6QG
TEL 01905 640055 FAX.01905 641451

Issue Code	Date	Name	Std.	BS
	/ /		L. Mod	/ /
	/ /		In Cha.	
	/ /		Verif.	Date

ROBBINS & MYERS
GRINDER CONTROL PANEL

5/5
GRINDER CONTROLLER TERMINALS

5/5 | Previous:4 | Next:
RLM00/13959
=DFS
+DFZ

13959/5 | RLM00/13959

Macerator Motor Control Panel

Set-up Instructions.

1. Panel requires 415v 3ph/n AC supply + earth and should be fused at a max. 10A.
2. Motor maximum load should not exceed 2.2kw. Motor direction must be correct for application.
3. The remote start terminals 12 – 13 on TB1 should be linked out if not used.
4. The remote stop terminals 15 – 16 should be linked out if not used.
5. There are three sets of normally open volt –free terminals no. 26/27, 28/29, 30/31. N/O set 30/31 are the motor fail signal terminals.

Load Monitor set-up. MTE DMPO 230S

a) The load monitor switch on the front of the unit must be set for the correct current range for load current of motor. 1) 0.2 – 1.2A. 2) 1.0 – 6.5A. 3) 6.0 – 32.0A.
b) Ensure switch is in position 2.
c) Turn potentieometer fully up (clockwise).
d) Start motor up by turning front panel selector to auto or manual.
e) Turn potentieometer on load monitor anti-clockwise until set LED comes on, then turn slightly clockwise until set LED goes out. Monitor is now set.
f) Test load monitor trip by pressing **TEST** button on monitor.

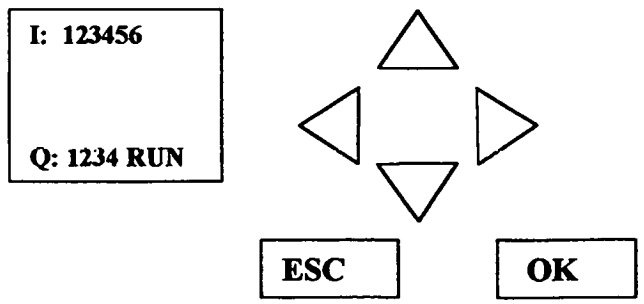
Siemens Logo PLC Unit Set- up.

There are 4 parameters that can be changed with-in the Logo programme. These are as follows:-

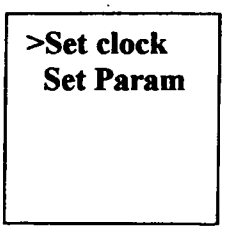
1) The start time for forward contactor operation on start and after failure, (normally set at 1.5secs). **Parameter Block B:05**
2) The length of time the motor reverse contactor is on, (normally set at 5 secs). **Parameter Block B:11**
3) The number of times the unit switches into motor reverse before tripping out on fail (currently set at 3). **Parameter Block B:17**
4) Time delay for motor start in forward after motor reverse operation, (normally set at 2 secs). **Parameter Block B:16**

Switching to Parameterization Mode.

(a)To switch to parameterization mode, press **ESC** and **OK** simultaneously.

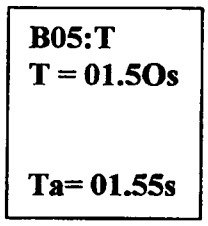


LOGO!switches to to parameterization mode and displays the menu.



Move cursor to the **Set Param** by using the down button and then press **OK.**

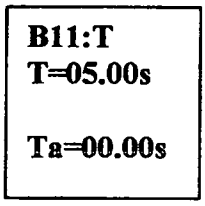
LOGO! Displays the first parameter which in the set programme is **Block 05.**



Press **OK.** Cursor will flash on 1st number of the Time set line.
To move cursor to next position press right button, to move back to 1st number press left button. Move cursor to number you wish to change then then press up or down buttons to change number. When complete press **OK.**

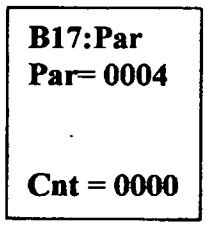
00

To move to the next parameter press the down button, which will bring on screen **Block B11:T.** Which is the time that the motor is in the reverse mode.



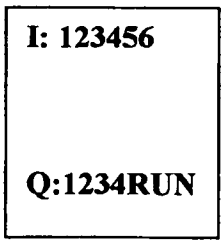
Press **OK.** Cursor will flash on time parameter, move cursor and select Time by using direction buttons. When complete press **OK.**

To move to the next parameter press the down button ▽ , this will bring **Block B17:Par** on screen.
This parameter the the number of times the motor goes into reverse before going into the fail mode. This parameter is always set at 1 number above the count required. Ie count of 4 =motor in reverse 3 times before fail.



To change parameter press **OK.** Cursor will flash on 1st number of parameter setting move cursor and change numbers with the direction buttons.

When the parameter has been changed press **OK** then **ESC** twice to return to the first screen.



CE

DMPO MK2
Electronic Overload Relay

The DMPO overload relay is primarily intended for protection of 3-phase loads eg. cage induction motors. It monitors current flowing in two of the three lines and in the event of an overload condition the output relay will de-energise after a time delay inversely proportional to the overcurrent. The unit will tolerate a wide (> 2:1) variation in supply voltage without loss of performance.

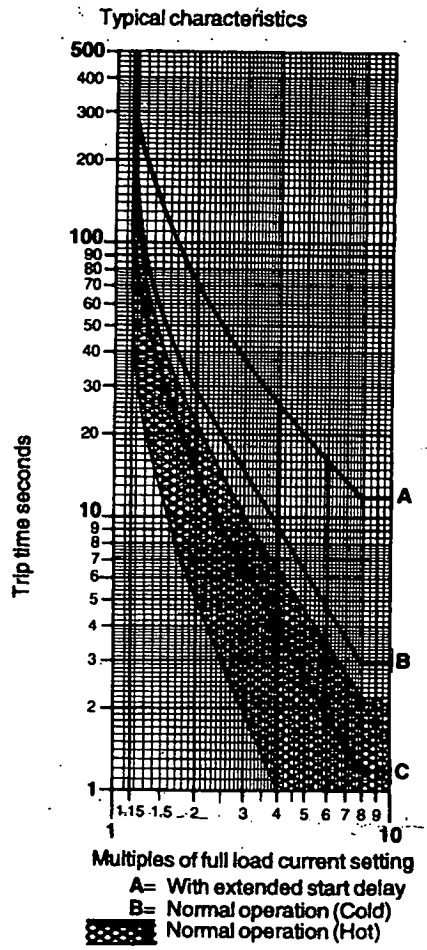
The DMPO is self-contained with two integral current transformers; one unit caters for full load currents from 0,2A up to 32A. A slide switch selects the appropriate current band, with a screwdriver adjustment for final setting. This is best achieved by reducing current setting, with load connected, until the amber 'SET' LED illuminates, then increasing setting until LED is just extinguished. Three current range labels are supplied with each unit, one for each range selected.

A selectable start delay increases the 6 x FLC trip time from approximately 5s to 15s. After a short period (eg. 2m at FLC) the starting characteristic has converged toward the normal inverse time characteristic. This is useful for loads such as fans which have a long run-up time. Nuisance tripping during the starting sequence can thus be avoided, while still maintaining maximum protection during normal running. Other features include hand/auto reset selection, delayed or instantaneous, with a manual reset button for local operation and terminals for connecting a remote reset contact. A test button injects a current equivalent to 6 x FLC into the monitoring input to confirm operation of the internal circuits.

If required, the full load current range can be extended beyond 32A by using two additional current transformers of suitable rating.

Latching versions of the DMPO contain a retentive circuit which is not affected by loss of supply; if supply is removed following a trip condition, the trip starts (in the manual reset mode) is remembered when the supply is restored. The unit can be reset in the manual mode only by momentarily linking terminals R1 and R2 - or operating the RESET button - with supply connected.

Time/current graph



Technical specification

Supply voltage: (Must be specified)	90...270V : 50Hz / 80...220V : 60Hz 220...480V : 50Hz / 185...420V : 60Hz	≤20VA
Load current range: (Switch selectable)	1: 0,2 - 1,2A 2: 1,0 - 6,5A 3: 6,0 - 32,0A Calibration accuracy ±10% approx.	
Output relay:	Ratings (n.c. and n.o. contacts) Resistive load: 5A at 240V 2A at 415V	
A.C. inductive load switching (B600) I_e = 5A max.	120V to 415V max. Make: 3600VA Break: 360VA	
D.C. inductive load switching (Q300) I_e = 2,5A max.	125V & 250V Make: 69VA Break: 69VA	
Ambient temperature range	-10° C to +60° C	
Operations/h:	60 max.	
Indicators:	Green- Power On. Amber- Trip level exceeded / Timing in progress Amber- Overload tripped	
Phase loss:	Normal time-delayed tripping if any line current exceeds set trip level	

Start Delay:
As supplied, the extended start delay, for motors with long run-up times, is enabled. The trip delay at 6 x FLC is in the range 8 to 24s. Normal trip response applies after 2m operation at FLC. Standard starting response, 2-8s, is achieved by linking terminals T1 and T2.

Reset:
Hand/Auto selection by terminal link. Button for local reset, terminals for remote reset. Reset delay (hand or auto) is 10m approx. With terminals R3 and R4 linked, instant reset (100 - 200ms) is possible.
Caution: If supply is removed for a period greater than 10m after a trip condition, non-latching versions reset automatically when supply is restored. Manual reset should be used for latching versions.

Test:	Test button simulates 600% FLC overload to check operation
Enclosure:	IP20, EN35 top hat rail or surface mounting
Terminal cable capacity: 1 x 4mm²	

Terminal functions

A1. / A2. } Supply: 90-270V or 220-480V dependent on model

95. / 96. } Trip contact (Closed when relay is energised)

05. common
06. n.o. (Closed when relay is energised)
08. n.c. (Open when relay is energised)
} Alarm contacts

R1. / R2. } Remote reset / Volt-free n.o. contact required } (Link for auto reset)

R3. / R4. } Reset delay (Link to disable)

T1. / T2. } Start delay (Link to disable)

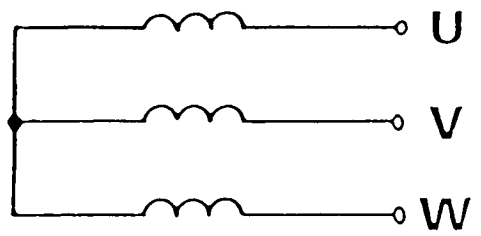
WARNING: Reset terminals R1 - R4 are not isolated from the supply. The remote reset contact, if used, and its associated cabling, must withstand supply voltage. The contact loading is 2mA at 20V d.c. Output terminals 05, 06, 08 and 95, 96 are for control circuit use in accordance with IEC 947 Parts 4 and 5. They should not be used for isolation purposes.

Order references

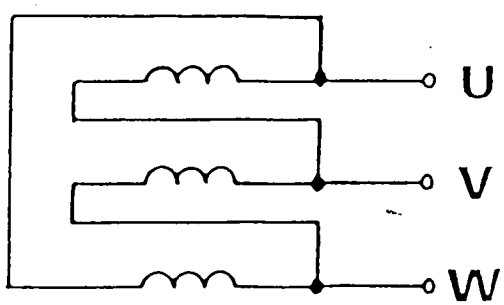
DMPO Standard		DMPO Latching	
90-270V	DMPO 230S 000	90-270V	DMPO 230L 000
220-480V	DMPO 400S 000	220-480V	DMPO 400L 000

CONNECTION DIAGRAM FOR 3 PHASE SINGLE SPEED INDUCTION MOTOR

No. 1 INTERNAL STAR (Y)



No. 2 INTERNAL DELTA (Δ)



6 LEADS FOR STAR (Y) OR DELTA (Δ)

No 3 STAR-DELTA (Y-Δ) STARTING

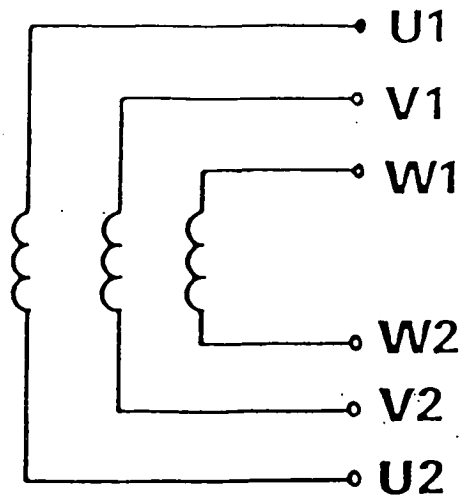
CONNECT ALL 6 LEADS TO STAR-DELTA STARTER

No 3D DIRECT-ON DELTA (Δ)

LINK W2 to U1
U2 to V1
V2 to W1
SUPPLY TO U1, V1, W1

No 3Y DIRECT-ON STAR (Y)

LINK W2 TO U2 TO V2
SUPPLY TO U1, V1, W1

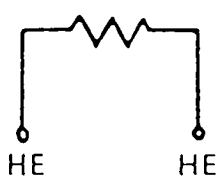


S WOUND ROTOR. CONNECT ROTOR LEADS K, L, M TO STARTING RESISTANCE

TO REVERSE DIRECTION OF ROTATION CHANGE OVER ANY 2 SUPPLY LEADS

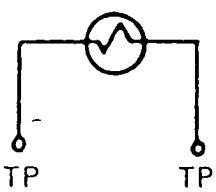
AUXILIARIES (WHEN FITTED) ARE MARKED AS SHOWN BELOW

H HEATER



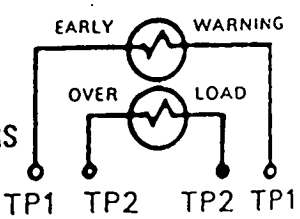
CONNECT TO SINGLE PHASE VOLTAGE SUPPLY

T THERMISTORS



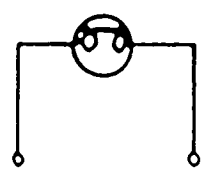
CONNECT TO THERMISTOR CONTROL UNIT

TE THERMISTORS



CONNECT TO THERMISTOR CONTROL UNIT

TB THERMOSTATS



CONNECT TO OVERLOAD PROTECTION CIRCUIT

MAGNETIC BRAKES ARE EITHER CONNECTED INTERNALLY OR EXTERNALLY. WHEN CONNECTED EXTERNALLY THE BRAKE LEADS ARE MARKED WITH THE LETTERS BR. TWO LEADS FOR A SINGLE PHASE BRAKE AND THREE LEADS FOR A THREE PHASE BRAKE.
LEADS ARE EITHER CONNECTED ONTO MOTOR TERMINALS OR LEFT LOOSE IN TERMINAL BOX.

NOTES. REFER TO NAMEPLATE FOR SUPPLY VOLTAGE AND CONNECTION.
LETTER(S) FOLLOWING MAIN DIAGRAM No. DENOTE WOUND ROTOR OR AUXILIARIES e.g. 3YH.

CONTRACT BUILD SHEET GRINDER		ROBBINS MYERS	
Contract ref.	14726	Date	18 July 2001
Client	Morrison Construction	Date req.	12 September 2001
Client O/No.	4677/PD/23	Quantity req.	1
Grinder ref	Mini Monster 20000	Serial no.	-

DESIGN CRITERIA					
Fluid characteristics					
Viscosity	-	Fluid Type	Sewage	Flow rate required	6.5 l/sec.
Temperature	-	Max particle size	-	Solids content	-
Grinder Parameters					
Model number	M-20000/4	Type	Channel	Duty flow rate	6.5 l/sec
Drive shaft cutters	5 tooth 8mm	Driven shaft cutters	11 tooth 8mm	Paint Spec.	Std Blue
Drive selection					
Fitted KW	1.5kW	Output ratio	21:1	Motor type	Brook
Controller	Yes	Voltage	415/3/50	IP rating	68 Eex de

Build List

Part No	Qty	Description	Remarks
M-20000/4	1	Mini Monster	
M-20000/GD12	1	Sumitomo Gearbox	
M-RC01	1	Controller	
M-20000/FW04	1	Guide rail system	

Guide rail system build list

Part Number	Qty	Description
9290020006	1	Guide plate
9221000201	2	Lifting eye
9290020001	1	Guide rail base frame
9290020002	1	Guide rail top section

Notes

JROBBINS MYERS

PRE DELIVERY INSPECTION		
Contract Ref:- 14726	Client:- Morrison construction Ltd	Client Ref:- Cairngorm Funicular Railway
Machine Type:- Channel Muffin Monster	Machine Ref:- M-20000/4	Machine Serial No. 01/14726

DRIVE DETAILS			
Gearbox unit		Motor unit	
Make	Sumitomo	Make	Brook
Model no	CNVM1-4105Y 21	Serial no	F292154/5
Ratio	21:1	IP rating	68
Output Speed	66 rpm	Frame size	A-EF100LB-C
		Kw	1.5
Lubricant	Shell Alvania RA	Speed	1430

INSPECTION PROCEDURES		
Visual inspection	Procedure	Remarks
	General appearance	Good
	Paint specification	Std Blue
	Cutter type drive shaft	5 tooth
	Cutter type driven shaft	11 tooth
	Cutter thickness	8mm
Dimensional inspection	Procedure	Remarks
	Overall Dimensions	Within tolerance
	Mounting hole centres	Within tolerance
	Required clearances	Within tolerance
Mechanical inspection	Procedure	Remarks
	Grinder operation forward	Yes
	Grinder operation reverse	Yes
	Fasteners secure	Yes
	Material specification	As specified
	Noise level acceptable	Yes

Date of Inspection:- 18 October 2001	Inspected by Personal Data Redacted

REPORT / CERTIFICATE NUMBER 14726-1

ROBBINS & MYERS LTD.

GRINDER TEST REPORT AND CERTIFICATE

MODEL M-20000/4 SERIAL NUMBER 01/14726

CUSTOMER NAME MORRISON CUSTOMER ORDER NUMBER 4677/PO/23

DRIVE MANUFACTURER / MODEL SUMITOMO CYCLO

1.5 KW 415 V 3 PH 50 Hz. IP 68

GEAR DRIVE RATIO 21:1

CUTTER CONFIGURATION 5T & 11T 8MM

BODY MATERIAL CAST IRON A395

CUTTER MATERIAL 4130 HEAT TREATED ALLOY STEEL

PAINT SPECIFICATION R & M BLUE

CONTROL SPECIFICATION M-EC01

VISUAL INSPECTION	☑
DRY RUN	☑
HYDROSTATIC TEST N/A	☐
FLOW TEST N/A	☐

COMMENTS

TESTED BY [redacted] DATE 18-10-01

TEST / REPORT ACCEPTANCE [redacted] DATE 18-10-01

EC DECLARATION OF CONFORMITY.

BUSINESS NAME	:	ROBBINS & MYERS LTD.
ADDRESS	:	SCHOOL LANE , CHANDLERS FORD , HAMPSHIRE , S053 - 3DG , ENGLAND.
TELEPHONE	:	+44 (0) 23 80 25 25 28
FACSIMILE	:	+44 (0) 23 80 25 25 29

DESCRIPTION OF THE MACHINERY .

MACHINE TYPE	:	SOLIDS GRINDER.
MODEL NUMBER	:	M-20000/4
SERIAL NUMBER	:	01/14726
M/C MANUFACTURER	:	JWCE

THIS EQUIPMENT COMPLIES WITH :
SUPPLY OF MACHINERY DIRECTIVE
98 / 37 / EC (as amended).

SIGNATURE.... Personal Data Redacted .....

DATE.....19-10-01.....

AUTHORISED SI Personal Data Redacted

SIGNATURE..... .....

DATE.....19-10-01.....

NAME : Personal Data Redacted **POSITION :** Personal Data Redacted

ISO 9001

Certificate No. FS 00623

BROOK Hansen

St.Thomas' Road, Huddersfield HD1 3LJ.
Telephone: (01484) 422150 Telex: 51388
Telefax: (01484) 510848

TYPE TEST CERTIFICATE

SUPPLIED TO

SM-CYCLO UK LTD,
MARFLEET,

KINGSTON UPON HULL,
HU9 5RA.

PURCHASE ORDER REF 920382 2680

ACCOUNT No. 52282

FRAME REF. A-EF100LB-C
EEx de ARGUS 55

OUTPUT	VOLTS	HERTZ	IC	AMPS	REV/MIN	POLES
1.50 KW	415 THREE WIRE STAR	50	IC410	3.20	1430	4

RATING/DUTY	SEC.VOLTS	SEC.AMPS	PHASES	INSULATION	COS Ø	IP
S1			3	F	.80	68

LOCKED - ROTOR

CONN	VOLTS	AMPS	Nm	%FLT	%FLC
DOL	415	18.9	23.0	241	

CALCULATION OF THE EFFICIENCY FROM THE SUMMATION OF LOSSES

TOTALLY ENCLOSED IP68 (SUBMERSION PROOF)
IC410 NON VENTILATED

PERFORMANCE FIGURES

OUTPUT kW	VOLTS	AMPS	INPUT kW	Hz	REV/MIN	Nm	EFFY %	P.F.	SLIP %
NO LOAD	415	1.60	0.228	50	1500				
0.75	415	2.21	1.03	50	1470	4.9	72.7	.651	2.00
1.13	415	2.79	1.49	50	1447	7.5	76.0	.741	3.50
1.50	415	3.36	1.96	50	1420	10.1	76.5	.813	5.33
1.86	415	4.07	2.48	50	1387	12.8	75.0	.848	7.50

COLD RESISTANCE

AMBIENT TEMP.°C	STATOR BETWEEN LINES	ROTOR BETWEEN RINGS
20.0	8.7 Ω	Ω

RESISTANCE @ 75 °C

STATOR BETWEEN LINES	ROTOR BETWEEN RINGS
10.58 Ω	Ω

TEMPERATURE RISES (°C) AFTER 5 HRS FULL LOAD

AMBIENT TEMP.°C	STATOR FRAME	STATOR WINDING	ROTOR WINDING	ROTOR RINGS
20.0	69.0	78.0		

OPEN CIRCUIT SEC.VOLTS	INSULATION RESISTANCE STATOR	INSULATION RESISTANCE ROTOR	HIGH-VOLTAGE (ONE MINUTE) STATOR	HIGH-VOLTAGE (ONE MINUTE) ROTOR	DATE OF ISSUE	ISSUED BY
V	50 MΩ	MΩ	2000 V	V	6/09/99	[redacted]

REMARKS BS5501 GPS IIA & IIB TEMP CLASS T4 CERT EX831408
TO EEx de WORKS SPEC XF INCREASED SAFETY TERMINALS
TO EEX de CERTIFIED FLOODPROOF TO WORKS SPEC XF & 61
INTERNAL TROPICPROOF TREATMENT ONLY

I CERTIFY THAT MOTOR No.(s)
F292154/5

IS/ARE REPRESENTATIVE OF THE SAME RATING AS THAT SHOWN ABOVE & IS/ARE ROUTINELY TESTED IN ACCORDANCE WITH INTERNATIONAL STANDARDS BEFORE DESPATCH FROM OUR WORKS. (PERFORMANCE FIGURES SUBJECT TO TOLERANCES)

Cert Ref. S165636
Int Ref. 10245387 01

Health & Safety Executive

BASEEFA

British Approvals Service for Electrical Equipment in Flammable Atmospheres

1. # CERTIFICATE OF CONFORMITY

2. **BAS NO Ex 831408**

3. This certificate is issued for the electrical apparatus:

A TYPE E100L SQUIRREL CAGE INDUCTION MOTOR

4. Manufactured and submitted for certification by:

BROOK MOTORS LTD
of Huddersfield

5. This electrical apparatus and any acceptable variation thereto is specified in the Schedule to this Certificate and the documents therein referred to.

6. BASEEFA being an Approved Certification Body in accordance with Article 14 of the Council Directive of the European Communities of 18 December 1975 (76/117/EEC) confirms that the apparatus has been found to comply with harmonised European Standards.

BS 5501:Part 1:1977 EN50 014
BS 5501:Part 5:1977 EN50 018

and has successfully met the examination and test requirements which are recorded in confidential Test Report

No 83 (d) 171 and Addenda

7. The apparatus marking shall include the code

EEx d IIB (T4-T6)

File No : SFA/11/85/05

MOTOR NO- F292154/5
ORDER NO- 2680
CUSTOMER REF.- 920382
THIS CERTIFICATE APPLIES TO
MOTORS AS ORIGINALLY SUPPLIED,
IN ORDER TO MAINTAIN VALIDITY IT
IS ESSENTIAL THAT ANY SERVICING
HAS BEEN/IS UNDERTAKEN ONLY BY
ACCREDITED ESTABLISHMENTS. EX831408

Personal Data Redacted

DIRECTOR Sheet 1/5
9 December 1983

119/12

8. The supplier, of the electrical apparatus referred to in this certificate, has the responsibility to ensure that the apparatus conforms to the specification laid down in the schedule to this certificate and has satisfied routine verifications and tests specified therein.

9. This apparatus may be marked with the Distinctive Community Mark specified in Annex II to the Council Directive of 6 February 1979 (Doc 79/196/EEC). A facsimile of this mark is printed on sheet 1 of this certificate.

CERTIFICATE OF CONFORMITY SCHEDULE

NUMBER Ex 831408

DATED 9 December 1983

APPARATUS

A TYPE E100L SQUIRREL-CAGE INDUCTION MOTOR, totally enclosed, fan cooled, rated for continuous duty up to 660V 3 kW 3000 r/min for a 2 pole machine, up to 1100V, 1, 2 or 3 phase, 40, 50 or 60 Hz, or 2-100 Hz, or having alternative equivalent ratings as defined in Table 1 of BS 5000, with 2 poles minimum, 16 poles maximum, with class B insulation, comprising:-

A footed mounted cast iron frame with cast iron end plates, squirrel-cage rotor having ball and/or roller bearings, external metal or plastics cooling fan and metal or plastics cowl, an indirect-entry cast iron terminal box with bolted- on lid, the box being separated from the machine enclosure by a cast iron or steel separator plate through which a number of insulated flameproof bushings pass, provided with terminals for external connection.

Cable entry holes are provided as specified on the cert- ified drawings for the accommodation of suitable BASEEFA approved flameproof cable entry devices, with or without the interposition of a BASEEFA approved flameproof thread adaptor. The cabling methods used in service must be suitable for the conditions of use. Any unused cable entry hole must be closed by a BASEEFA approved flameproof stopping plug.

SPECIAL CERTIFICATION CONDITION

This certificate is conditional upon the manufacture carrying out the tests required by BS 4999:Part 60: 1976 Clause 60.4, as referred to in clause 5 of BS 5000: Part 99: 1973, on the first of each machine design covered by this Certificate to verify that the maximum surface temperature as defined in BS5501: Part 1: 1977 EN50 014, will not exceed the marked T rating, and to hold available a Test Report to this effect.

DRAWINGS

Title	Number	Issue	Date
Sectional arrangement	H1SEC 1159A	2	14.11.83
Termination arrangements	H1SEC 1163A	1	17.3.83
	H1SEC 1776A	Original	12.7.83
Oversize terminal box	H2SEC 1164A	1	25.3.83
Motor with brake	H2SEC 1169A	1	12.3.83
Terminal box spacer	H2SEC 1167A	1	28.3.83
Terminals for uninsulated lugs	H2SEC 1564A	Original	25.3.83
Duct mounted terminations	H2SEC 1165A	3	21.11.83
Rating plate	H4103 1171A	Original	25.6.82
BASEEFA plate	H4103 1168A	2	26.10.83
Motor variations	H1SEC 1162A	3	15.11.83

CERTIFICATE OF CONFORMITY SCHEDULE

NUMBER Ex 831408

DATED 9 December 1983

VARIATION ONE	Omission of the fan and cowl for a non self-ventilated motor for forced air-stream applications to form a Type ENV motor, the ENV replacing the normal E prefix.
VARIATION TWO	For short-time ratings and duty type ratings S2-S8 (as defined in BS4999: Part 30) the rated outputs may be increased by 50%.
VARIATION THREE	For windings of insulation class F or H, outputs may be increased by 15%.
VARIATION FOUR	For 60 Hz rated machines the rated outputs may be increased by 15%.
VARIATION FIVE	For use in ambient temperatures above 40°c and up to 80°c the ambient temperature limit must be marked on the apparatus label and the temperature classification must be assigned by the manufacturer by adding to the maximum surface temperature normally achieved by that machine in a 40°c ambient temperature an amount equal to the difference between the claimed ambient temperature and 40°c. Temperature classifications T3 to T6 may be assigned as relevant.
VARIATION SIX	As an alternative to Variation Six for use in ambient temperatures above 40°c up to 80°c, where the ambient temperature limit is marked as described, the motor may be suitably derated so as to avoid invalidating the normal termperature classification.
VARIATION SEVEN	Alternative mounting arrangements comprising deletion of the mounting feet and substitution of 3, or alternatively 4, mounting pads cast integrally on to the periphery of the frame, or mounting flanges provided at either end of the motor.
VARIATION EIGHT	Variations in numbers and size of terminations as shown on the drawings.
VARIATION NINE	Deletion of the normal size terminal box and the addition of an extension/adaptor box mounted direct to the motor, with a larger separator plate and terminal box fitted to the box, the plate and terminal box being as used in the E132 size motor, this arrangement permitting the use of larger numbers and/or higher ratings of terminals.
VARIATION TEN	The use of certified electro-mechanical brake unit assembled to the non-drive end.

CERTIFICATE OF CONFORMITY SCHEDULE

NUMBER Ex 831408

DATED 9 December 1983

VARIATION ELEVEN	Addition of a terminal box extension box fitted between the motor body and the separator plate.
VARIATION TWELVE	Provision of an alternative terminal box having one or alternatively two extended facings, the facings supporting one or alternatively, two bolted-on sealing chambers suitable for compound filling, the outer face of each chamber being provided with suitable cable entry mountings, the top face being provided with a compound filler plug. The cable entry plate may be aluminium, cast iron, steel, or phosphor-bronze, with or without cable entry holes.
VARIATION THIRTEEN	Optional provision of anti-condensation heaters, with suitable extra terminations.
VARIATION FOURTEEN	Optional provision of thermostats or thermistors embedded into the stator windings, with suitable extra terminations.
VARIATION FIFTEEN	Deletion of the terminal box and separator plate and substitution of a compound-filled chamber having jointed cables cast-in by the manufacturer.
VARIATION SIXTEEN	Deletion of the terminal box, but with retention of the seperator plate and terminal bushings, and substitution of a smaller-than-normal terminal box of one-piece construction, i.e. without lid.
VARIATION SEVENTEEN	For multi-speed motors the provision of dual wound or tapped windings where necessary.
VARIATION EIGHTEEN	For duct-mounted motors the adoption of a motor terminal box as either Variation Sixteen or Seventeen with a further terminal box mounted on the outside of the ducting. This external box may be used either without terminals as a conduit inspection box, or with terminals for user connection. The wiring between the two boxes is effected by suitable cabling, with suitable entry devices into the boxes.

Health & Safety Executive

BASEEFA

British Approvals Service for Electrical Equipment in Flammable Atmospheres

CERTIFICATE OF CONFORMITY VARIATION

THIS IS TO CERTIFY THAT CERTIFICATE OF CONFORMITY BAS NO Ex 831408

Issued to BROOK MOTORS LTD
of Huddersfield

for the TYPE E100L SQUIRREL CAGE INDUCTION MOTOR

is hereby extended to apply to apparatus designed and constructed in accordance with the specification set out in the Schedule of the said Certificate but having the variations in the attached Schedule.

Code: EEx d e IIB (T4-T6)

File No : SFA 11/85/05
Test Report No 84(e) 198

Personal Data Redacted

CERTIFICATE OF CONFORMITY BAS NO Ex 831
Sheet 1/2
122/42

Dated 1 November 1984

CERTIFICATE OF CONFORMITY SCHEDULE

NUMBER Ex 831408/1

DATED 1 November 1984

VARIATION ONE

The indirect-entry cast iron terminal box with bolt-on lid as shown on certified drawing H1SEC1159A issue 2 dated 14.11.83 is converted to an increased safety enclosure , EEx e, by inclusion of neoprene or neoprene nitrile cork gaskets to all joints applicable to the increased safety enclosure.

The incoming supply, rated up to 660V, is connected to terminals, reference 8171/022AA, mounted and screwed through the terminal plate. The terminals are manufactured by R.Stahl GmbH & Co and have Component Certificate PTB No Ex-79/1004U.

VARIATION TWO

Deletion of the above mentioned normal size, increased safety, terminal box and the addition of an adaptor box mounted direct to the motor, as shown on certified drawing H2SEC1164A issue 1 dated 25.3.83 so that the increased safety terminal box, terminal plate, terminals and gland entry plate used on the E132 size motor can be fitted.

The terminal box for the E132 size motor is converted to increased safety by a similar arrangement to the terminal box described in variation one.

For variations one and two the gland entry plate is threaded for the reception of a cable entry device chosen in accordance with a recognised code of practice, which ensures the IP54 integrity of the terminal box.

The cabling methods used in service must be suitable for the conditions of use.

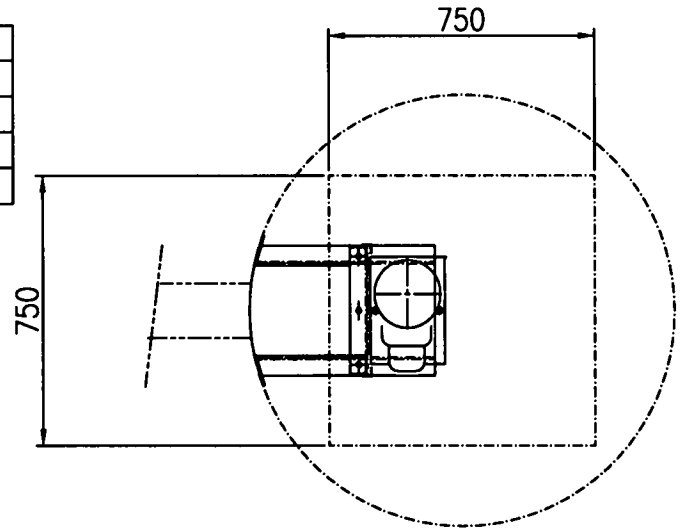
The motor with this terminal arrangement is restricted to an ambient temperature of 60 oC. The ambient temperature limit must be marked on the apparatus label.

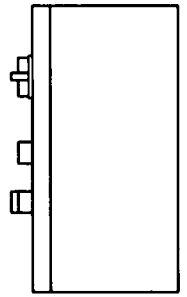
DRAWING

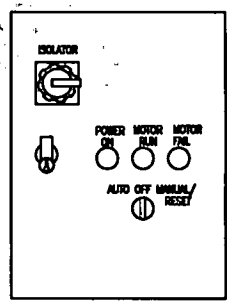
Title	Number	Issue	Date
Increased Safety Terminal Box for E90S-E200L Motors	H1SEC2415A	1	21.5.84
BASEEFA Plate	H41032414A	Original	13.4.84

IF ... OUBT ASK | DIMENSIONS IN MILLIMETRES | THIRD ANGLE PROJECTION | DO NOT SCALE DRAWING | REMOV ...RP EDGES

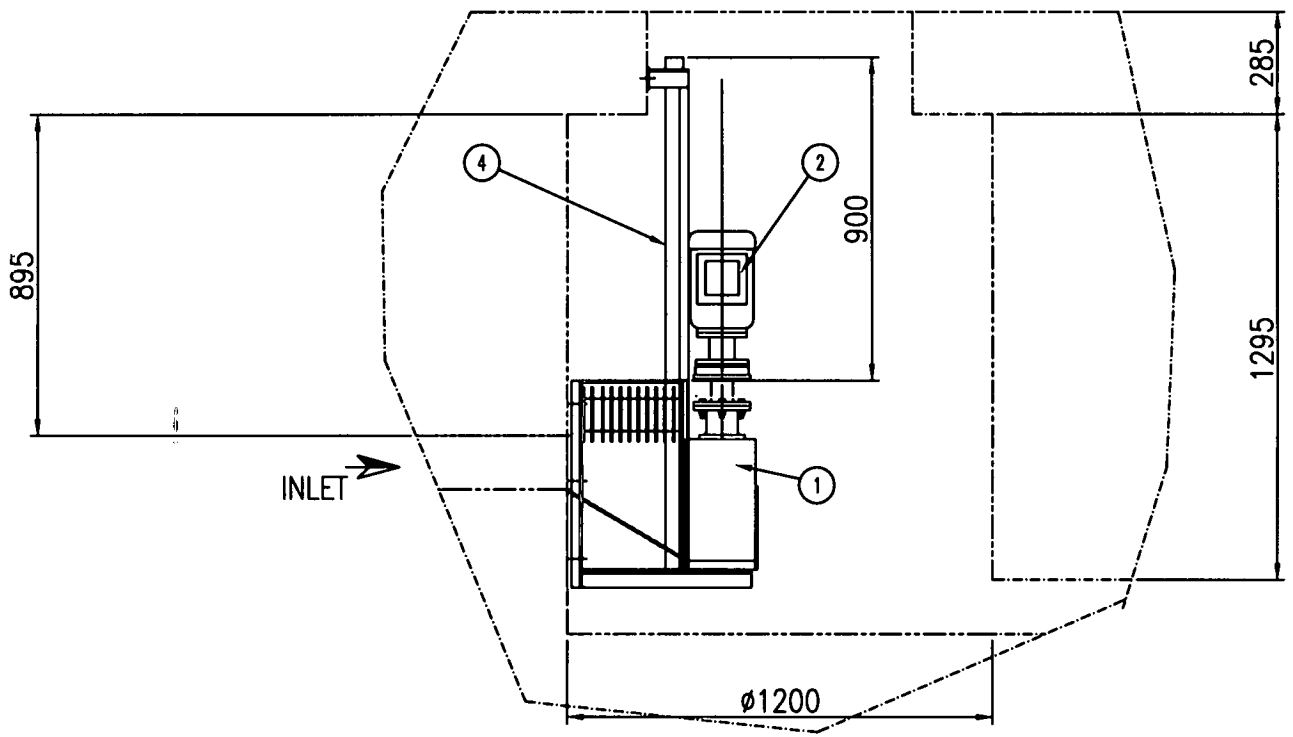
ITEM	QTY	PART NO./DRG REF	DESCRIPTION
1	1	M-20000/4	CHANNEL MINI MONSTER
2	1	M-20000/GD12	GEARBOX
3	1	M-RC01	CONTROLLER
4	1	M-20000/FW04	GUIDE RAIL SYSTEM







③ POSITION OF CONTROL PANEL –BY CLIENT



ISSUE	MOD.No.	REVISION	DRAWN	DATE	ISSUE	MOD.No.	REVISION	DRAWN	DATE

MATERIAL –

FINISH –

WEIGHT –

TOLERANCES UNLESS OTHERWISE STATED
DECIMAL PLACES ± –
GENERAL TOL. ± –
ANGULAR ± 1/2°

SURFACE FINISHES IN ACCORDANCE WITH BS 1134

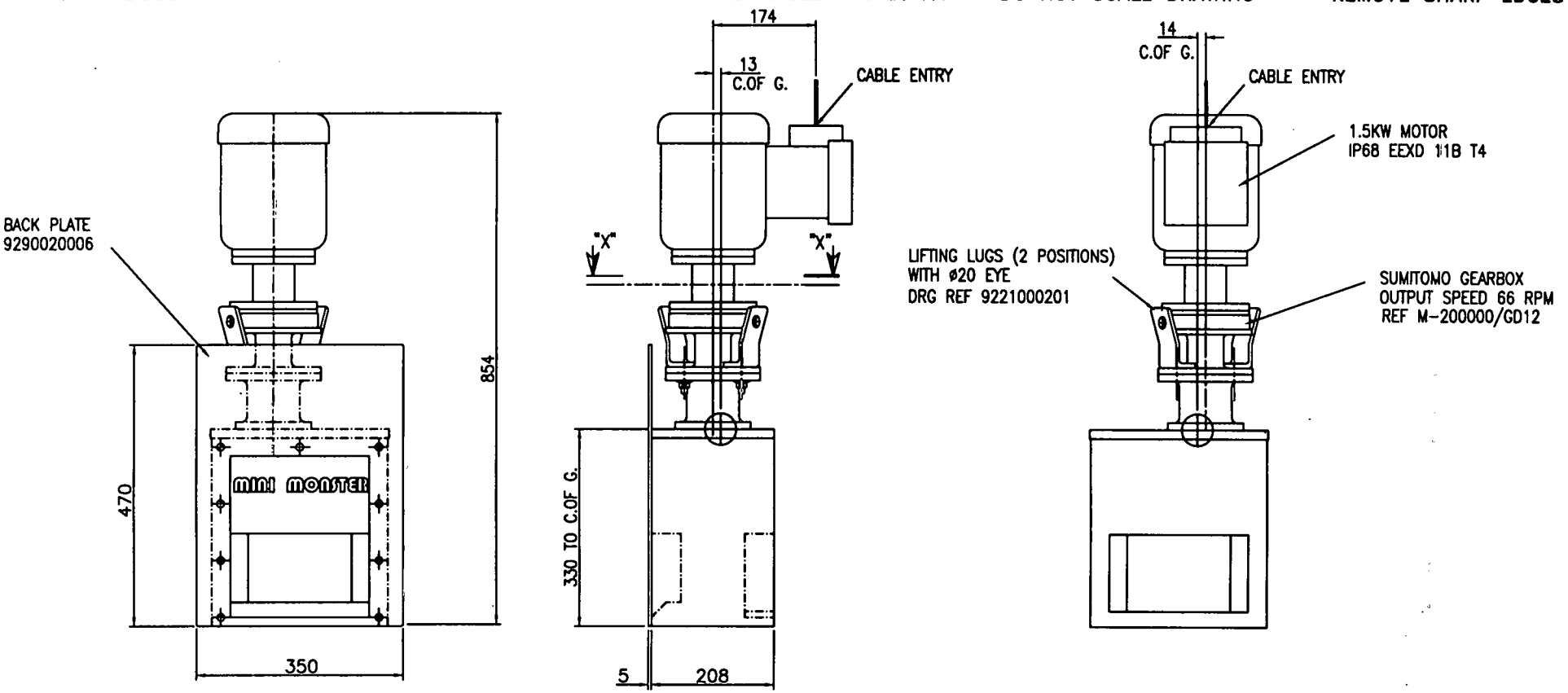
ROBBINS MYERS
SCHOOL LANE CHANDLERS FORD HAMPSHIRE SO53 3EW TEL(44) 01703 252228 FAX(44) 01703 252229

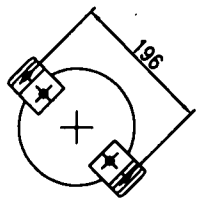
DRAWN	[redacted]
CHECKED	–
APPROVED	–
DATE	
SCALE	1:10

TITLE
GRINDER INSTALLATION

DRAWING No.
14725

IF IN DOUBT ASK | DIMENSIONS IN MILLIMETRES | THIRD ANGLE PROJECTION | DO NOT SCALE DRAWING | REMOVE SHARP EDGES





VIEW ON 'X-X'

ISSUE	MOD.No.	REVISION	DRAWN	DATE
1				
0		NEW ISSUE	[redacted]	6.6.00

MATERIAL
—

FINISH
—

WEIGHT
125KG

TOLERANCES
UNLESS OTHERWISE STATED
DECIMAL PLACES ± —
GENERAL TOL. ± —
ANGULAR ± 1/2°

SURFACE FINISHES IN ACCORDANCE WITH BS 1134

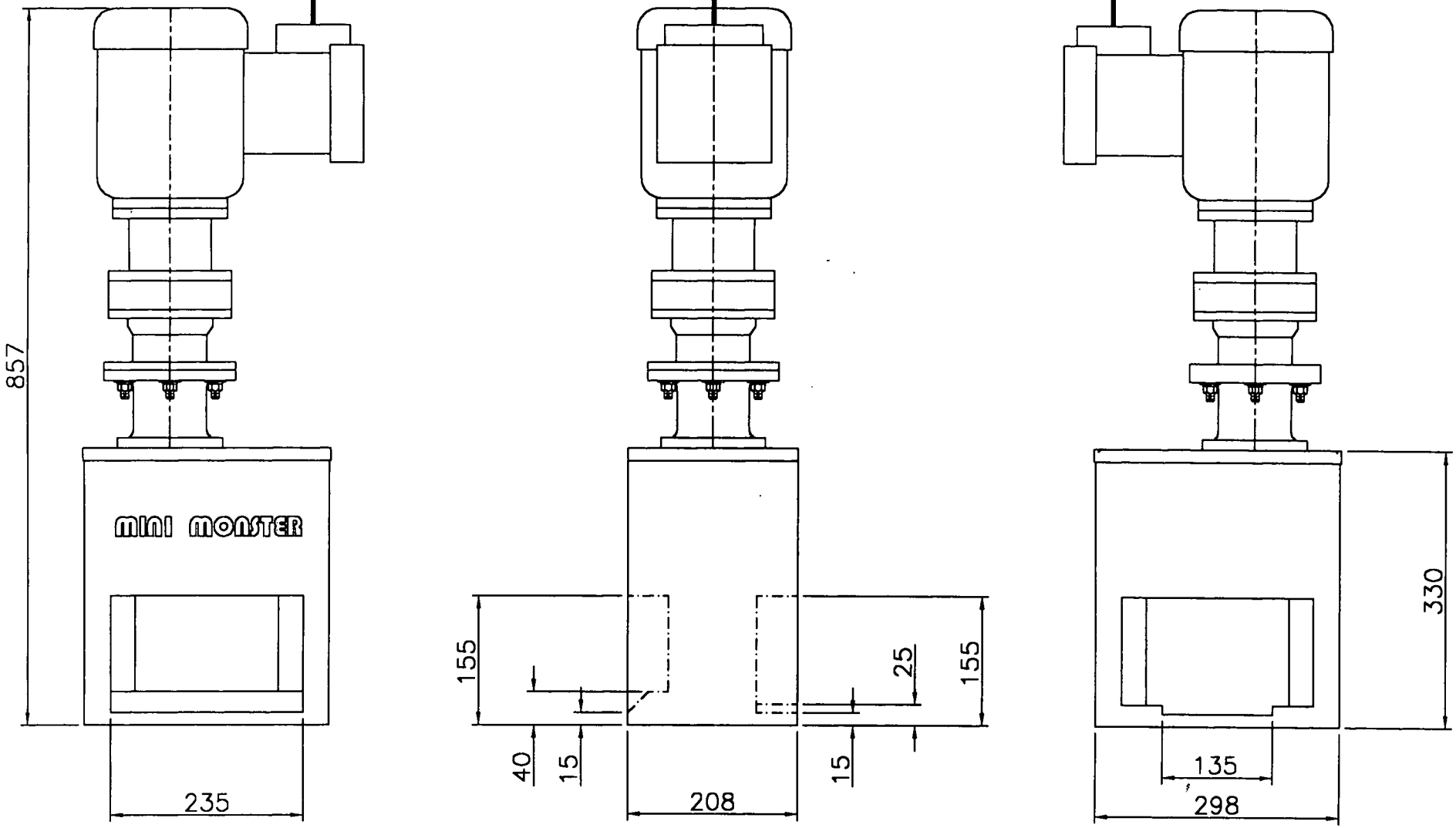
ROBBINS MYERS
SCHOOL LANE
CHANDLERS FORD
HAMPSHIRE
SO53 3QG
TEL.(44) 01703 252528
FAX.(44) 01703 252529

DRAWN	[redacted]
CHECKED	—
APPROVED	—
DATE	8.6.00
SCALE	—

TITLE
MINI-MONSTER

DRAWING No.
M-20000/4

IF IN DOUBT ASK | DIMENSIONS IN MILLIMETRES | THIRD ANGLE PROJECTION | DO NOT SCALE DRAWING | REMOVE SHARP EDGES



ISSUE	MOD.No.	REVISION	DRAWN	DATE

MATERIAL: –

FINISH: –

WEIGHT: 125KG

TOLERANCES UNLESS OTHERWISE STATED
DECIMAL PLACES ± –
GENERAL TOL. ± –
ANGULAR ± 1/2°

SURFACE FINISHES IN ACCORDANCE WITH BS 1134

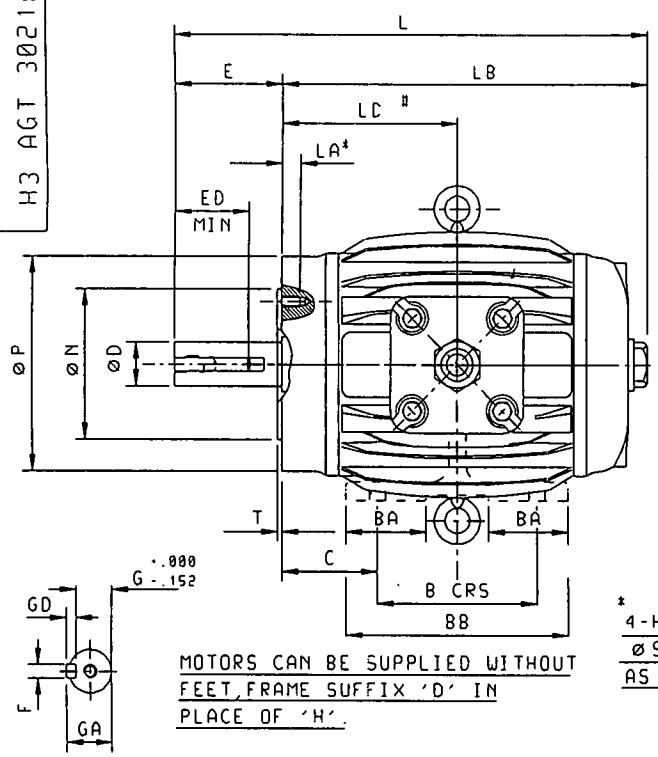
ROBBINS MYERS
SCHOOL LANE
CHANDLER'S FORD
HAMPSHIRE
SO53 3DG
TEL.(44) 01703 262626
FAX.(44) 01703 252929

DRAWN	[redacted]
CHECKED	–
APPROVED	–
DATE	–
SCALE	1:5@A3

TITLE: MINI–MONSTER

DRAWING No. 20000–IP68

DRAWING NUMBER H3 AGT 3021A

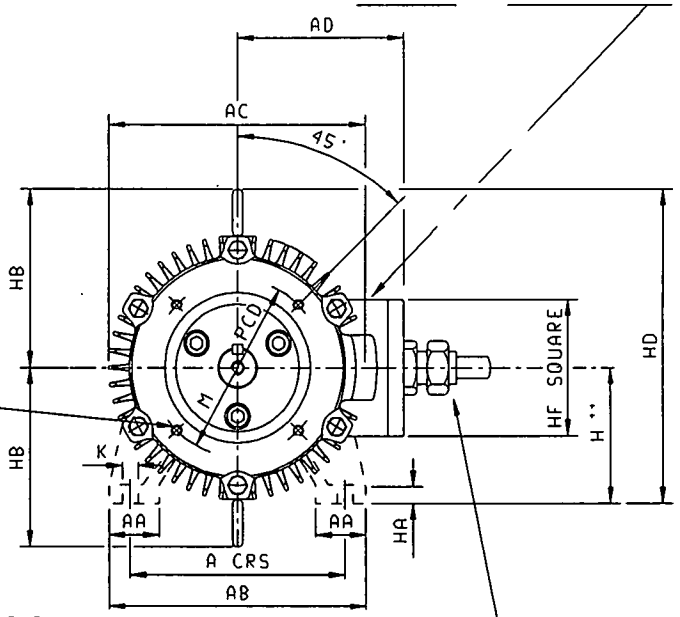


MOTORS CAN BE SUPPLIED WITHOUT FEET, FRAME SUFFIX 'D' IN PLACE OF 'H'.

DRIVE END

SHAFT DRILLED AND TAPPED. SEE TABLE.

ALL DIMENSIONS ARE IN mm EXCEPT 'KK' CONDUIT WHICH SHOWS METRIC UPTO AND INCLUDING E160L.



* 4-HOLES TAPPED BLIND ØS, EQUALLY SPACED AS SHOWN.

CONDUIT ENTRY TAP KK. CABLE AND GLAND TO BE ASSEMBLED BY MANUFACTURER.

CUSTOMER	SM-CYCLO [illegible] LTD
ORDER NO.	2680
SERIAL NO.	F2921[illegible]
FRAME SIZE	A-EF100LB-C
KW. 1.50	HERTZ 1500
VOLTS 50	R.P.M(SYN) 3[illegible]
PHASE 415	POLES 4

SPECIAL REMARKS.

EEx de ARGUS 55
IC410 NON VENTILATED
FACE, NO FEET, B14
BS5501 GPS IIA & IIB TEMP CLASS T4

PROJECT NO : 2411

** DIMENSION 'H' IS +.000 -.500

FRAME ENV	A	B	C	H **	K	L	AA	AB	AC	AD		BA	BB	HA	HB	HD	HF	LB	LD	KK	D	TOL. ON SHAFT	E	ED	FxGD	G	GA	FLANGE	P	N	TOL ON N	LA	M	T	S	SHAFT D & T
	140	100	56	90	10	266	38	175	187	135		—	127	12	146	236		216	106	20	24		50	32	8 X 7	20	27									
	140	125	56	90	10	291	38	175	187	135		—	152	12	146	236		241	118.5	20	24	j6	50	32	8 X 7	20	27	F115	140	95	h8	10	115	3		M8X19
100LH	160	140	63	100	12	358	38	194	208	145		62	187	14	152	252	115	298	144 *	20	28	+.009 -.004	60	40	8 X 7	23.9	30.9				+.000 -.054	14			M8	
	190	140	70	112	12	344	38	229	250	164		57	179	16	174	286		284	140	25	28		60	40	8 X 7	23.9	30.9	F130	160	110		15.5	130	3.5		M10X22
	216	140	89	132	12	401	52	260	270	181		65	178	19	187	319		321	159	25	38		80	56	10x8	33	41									
	216	178	89	132	12	439	52	260	270	181		65	216	19	187	319		359	178	25	38	k6	80	56	10x8	33	41	F165	200	130	h8	17.5	165		M10	M12X28
	254	210	108	160	15	536	64	318	333	208		81	267	19	216	376	143	426	213	32	42	+.018 +.002	110	80	12x8	37	45				+.000 -.063	19				
	254	254	108	160	15	580	64	318	333	208		81	311	19	216	376		470	235	32	42		110	80	12x8	37	45	F215	250	180			215	4	M12	M16X36

TITLE: OUTLINE ARRANGEMENT OF ENV90SH-160LH 'C' FLANGE MOTORS GROUPS 2A/B TO BS 5501 PARTS 1/5. (FOR DIRECT ENTRY).

DRN. DON.B | CK'D. DAL | DATE 14-6-85

SHEET SIZE A3

O.A. APPROVED

UNTOLERANCED M/C DIMENSIONS 0.13mm

CERTIFICATED DRGS MUST NOT BE ALTERED WITHOUT BASEEFA APPROVAL. CERTIFICATE RELATED DRGS MUST NOT BE ALTERED WITHOUT DESIGN MANAGER'S APPROVAL.

BROOK Hansen

HUDDERSFIELD HD1 3LJ ENGLAND

DATE 2nd SEPTEMBER

SCALE

MAT'L.

DRAWING NUMBER H3 AGT 3021A

MORRISON

CAIRNGORM FUNICULAR

7. MATERIAL AND TESTING CERTIFICATION

This section provides material and test certification for the main items used on the Project.

1 METROTWINFLEX DUCTS.

2 CARES - REINFORCING STEEL.

3 BRIDGE BEARINGS.

4 CONCRETE DESIGN.

5 WATER MAIN PIPE & FUSION EQUIPMENT.

6 DRINKING WATER INTAKE SCREEN.

7 CROSS BRACING BOLTS.

8 SEWER PIPES.

9 TEE BOLTS. (RAIL TO BEAM)

10 TYBAR WATER MAIN.

11 AGGREGATES.

12 STRUCTURAL STEEL GALVANISING.

13 WAVIN DRAINAGE PIPE.

14 CROSS HEAD HOLDING BOLTS.

15 ISCHBECK ANCHORS.

16 BAUDER TOTAL ROOF SYSTEM.

17

18

19

20

Quality Test Report

APL

To : Ken Marshall

From : Bill McMaster

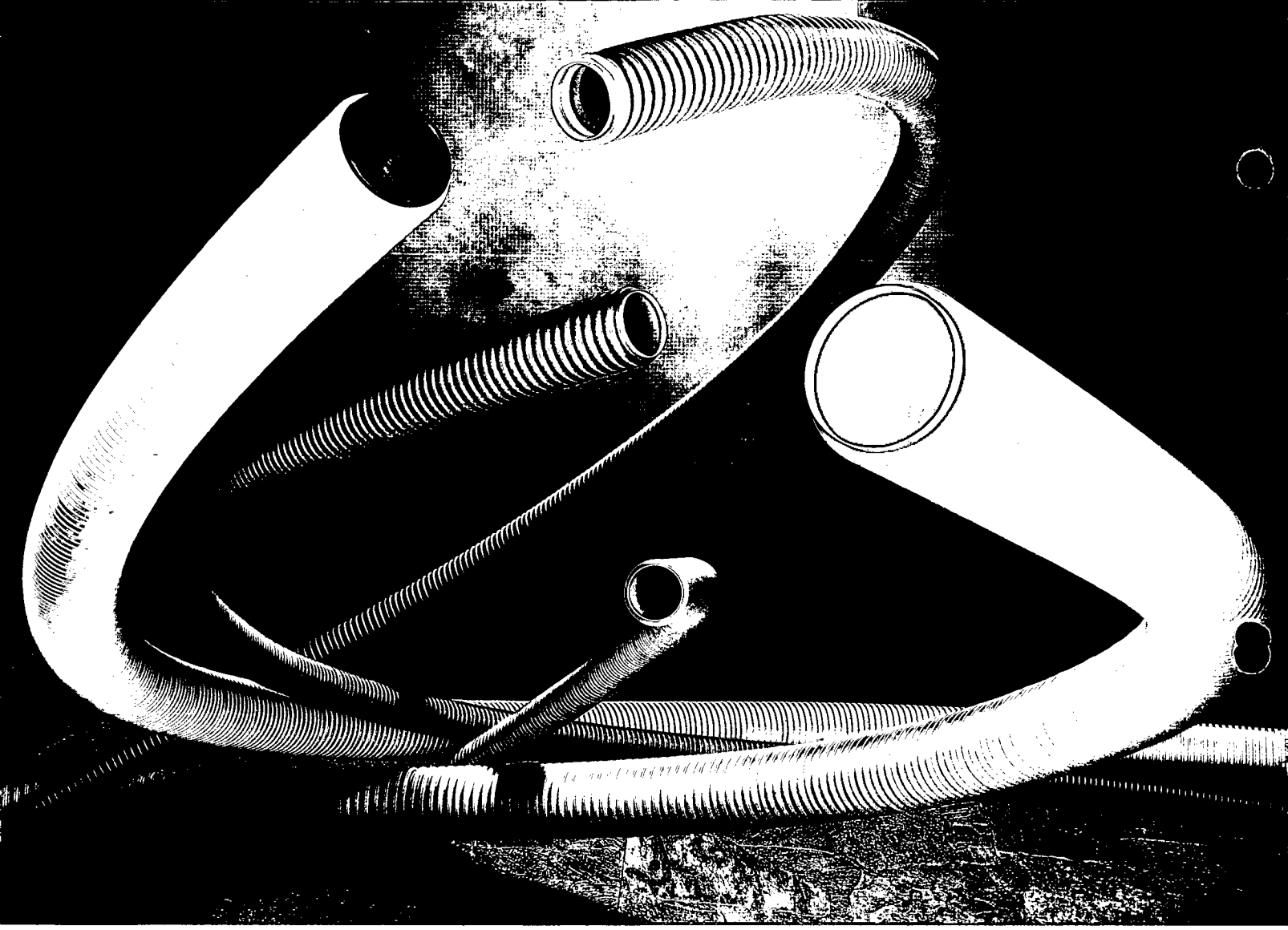
Date : 19th August 1999

Subject : COMPRESSION TESTS ON 100 / 118 METROTWINFLEX DUCT

REFERENCE STANDARD:	BS EN ISO 9969 : 1995	BS EN 50086 - 2 - 4 : 1994
MANUFACTURER'S NAME:	APL	
PRODUCT NAME:	100 / 118 Metrotwinflex - coilable corrugated twin wall duct	
COLOUR:	Grey outer wall, White inner wall	
MATERIALS:	Outer wall: High density polyethylene & Masterbatch (grey) Inner wall: High density polyethylene	
WEIGHT PER METRE:	683 grams	
PRODUCTION DATE:	16th August 1999	
LENGTH OF TEST PIECES:	300 mm	200 mm
TEST TEMPERATURE:	22 degrees Celsius	
COMPRESSION:	3.0 mm (3%)	5.0 mm (5%)
DATE OF TEST:	19th August 1999	

RESULTS OF TESTS:

	Ring stiffness Value (kN / m^2)	Compression Value (Newtons)
Sample 1:	13.7	655
Sample 2:	13.4	662
Sample 3:	13.9	670



APL

metro cable duct systems

metro twinflex double wall underground duct with draw-line option

Description
A flexible, premium quality duct ideal for use in street lighting, traffic signals and other service duct applications. A generous inner wall provides a low friction path and helps prevent cable burn through.
As an option, **metro twinflex** can now be ordered with a factory installed high breaking strain nylon draw-line. The draw-line can be attached to draw cord to aid the insertion of cables and service pipes.

Dimensions and Physical Performance

Type Ref	ID mm	OD mm	Draw Line	Coil metres	Ring Stiffness BSEN 9969	Compression BSEN 50086-2-4
AB063	50	63	✓	50 & 100	> 15kN/m²	> 600N
AB105	90	105	✓	50	> 11kN/m²	> 600N
AB118	100	118	✓	50	> 10kN/m²	> 500N

Materials
Prime grade, virgin HDPE is used for *both* walls on colour coded duct. Black duct may have re-cycled material on the outer wall only. UV stabilisers and light fast pigments for optimum weathering properties.

Colours
Variety of colours to suit local authority and NJUG requirements: green for cable tv, orange or purple for traffic control, street lighting, etc.

Performance and Quality
metro twinflex comfortably meets the requirements of the European Standard EN50086-2-4 (type 450N) "Specification for Underground Conduit". Metro underground duct is manufactured under a quality system assessed by BSI to BS EN ISO 9002:1994.

Accessories
A wide range of accessories are available to complete the duct system including Column Shoes, Access Chambers, Lids and Frames, Repair Kits and Seals. Full details available on request.

Installation
metro twinflex should be installed in accordance with our instructions.
Trench reinstatement should comply with the New Roads and Street Works Act 1991 "Specification for the Reinstatement of Openings in Highways".

Argival Plastics Limited, 45-49 Cowley Street, Methil, Fife KY8 3QQ
Telephone: (01592) 713801 Fax: (01592) 714700 Web: www.aplcableduct.com

BRITISH STANDARDS INSTITUTION

Certificate of Registration

BSI REGISTERED FIRM

This is to certify that

Argival Plastics Limited

45-49 Cowley Street
Methil, Fife KY8 3QQ, U K

hold Certificate No. Q 06167 and operate a quality management system which complies with the requirements of BS EN ISO 9002:1994 for the activities detailed in the scope of registration.

Originally registered 15 June 1989.
This certificate does not expire. To check its validity telephone +44 (0) 1908 220700

Director and General Manager
BSI Quality Assurance

BSI

BSI Quality Assurance PO Box 375 Milton Keynes United Kingdom MK14 6LL

Certificate of Registration

BSI REGISTERED FIRM

Certificate Number Q 06167

ARGIVAL PLASTICS LIMITED

45-49 COWLEY STREET
METHIL
FIFE SCOTLAND KY8 3QQ

operate a quality management system which complies with the requirements of BS EN ISO 9002:1994

Accredited by the Dutch Council for Certification

Signed on behalf of BSI

Originally registered 15 June 1989 Amendments to 1 February 1995

This certificate remains the property of the British Standards Institution and shall be returned immediately upon request. This certificate does not expire. To check its validity telephone +44 (0)1908 227700

The British Standards Institution is incorporated by Royal Charter.

BSI Quality Assurance PO Box 375 Milton Keynes United Kingdom MK14 6LL

Registration Number 003

0007172

SYSTEM FOR THE REGISTRATION OF FIRMS OF ASSESSED CAPABILITY

Appendix

NUMBER ONE PAGE 1

to Certificate Number Q 6167

This appendix declares the scope of registration of the certificate granted to:

ARGIVAL PLASTICS LIMITED
45-49 COWLEY STREET
METHIL
FIFE
KY8 3QQ

Scope of registration

THE MANUFACTURE OF UNDERGROUND CONDUIT SYSTEMS FROM POLYPROPYLENE OR POLYETHYLENE IN COLOURS AND SIZES TO CUSTOMER REQUIREMENTS.

The activities of this scope are included within the following Standard Industrial Classification code, for which BSI QA is accredited by NACCB and RvC.

SIC 4834 PLASTICS BUILDING PRODUCTS

This appendix supersedes appendix dated 15 June 1989.

Signed on behalf of BSI Quality Assurance N. Morris

N MORRIS For Director

Date 18 JANUARY 1994

BSI QUALITY ASSURANCE BSI Quality Assurance PO Box 375 Milton Keynes MK14 6LL

UK Certification Authority for Reinforcing Steels

Certificate of Approval

Product Conformity Certification

This is to certify that

BRC (Newhouse) Limited

at its establishment at

Newhouse

has satisfied the Authority that it operates a Quality System that complies with the requirements of BS EN ISO 9002 and the relevant CARES Quality and Operations Assessment Schedules. Where appropriate, and as listed below, it has further satisfied the Authority that it manufactures and/or supplies products that conform with the stated product standards and is entitled to use the CARES marks on its products.

BS 4449, BS 4466
Distribution of BS 4482 and BS 4483
Application of Erico Lenton Mechanical Couplers to BS 8110 Part 1
Size Range 12 to 50mm

using the processes and procedures registered with the Authority.
This Certificate is the property of the Authority and is issued subject to the Regulations of the Authority.
The Certificate Number is:

850303

Issue Date: **14 Jun 2000** Expiry Date: **31 Dec 2000**

Signed on behalf of the Board of Management

Executive Director

The use of the Accreditation Mark indicates accreditation in respect of those activities covered by the accreditation certificate number 002.

Issue: November 1996

CARES

UKAS PRODUCT CERTIFICATION

002

UK Certification Authority for Reinforcing Steels

Certificate of Approval

Product Conformity Certification

This is to certify that

BRC (Newhouse) Ltd

at its establishment at

Newhouse

has satisfied the Authority that it operates a Quality System that complies with the requirements of BS EN ISO 9002 and the relevant CARES Quality and Operations Assessment Schedules. Where appropriate, and as listed below, it has further satisfied the Authority that it manufactures and/or supplies products that conform with the stated product standards and is entitled to use the CARES marks on its products.

BS 4449, BS 4466
Distribution of BS 4482 and BS 4483

using the processes and procedures registered with the Authority.
This Certificate is the property of the Authority and is issued subject to the Regulations of the Authority.
The Certificate Number is:

850303

Issue Date: **01 Jan 1999** Expiry Date: **31 Dec 1999**

Signed on behalf of the Board of Management

Executive Director

The use of the Accreditation Mark indicates accreditation in respect of those activities covered by the accreditation certificate number 002.

Issue: November 1994

CARES

NATIONAL ACCREDITATION OF CERTIFICATION BODIES
Registration Number
002

Ancon CCL®

Ancon CCL International
President Way, President Park
Sheffield S4 7UR
Tel: +44 (0)114 276 3030
Fax: +44 (0)114 238 1240
Email: enquiries@anconccl.com

CERTIFICATE OF CONFORMITY

Morrison Construction Limited
Site Office
Funicular Railway
Main Ski Car Park
Cairgorm By Aviemore

TEST CERTIFICATE NO: 00/26

DATE: 6 September 00

CUSTOMER O/NO: C10146/4677

WORKS ORDER NO: 9700039

CERTIFIED THAT THE PRODUCTS DETAILED HEREON HAVE BEEN INSPECTED AND TESTED IN ACCORDANCE WITH THE CONDITIONS AND REQUIREMENTS OF THE CONTRACT OF PURCHASE ORDER AND UNLESS OTHERWISE NOTED BELOW CONFORM IN ALL RESPECTS TO THE SPECIFICATION(S), DRAWING(S) RELEVANT THERETO:-

PGC50 Centre Guided Bearing G1	**QTY:**	99
PS50 Free Sliding Pot Bearing S1		101

For and on behalf of
ANCON CCL INTERNATIONAL

Personal Data Redacted

MIX DESIGN CERTIFICATE: Concrete

CALEDONIAN
QUARRY PRODUCTS LTD

Mix Design Certificate: *1000474335* **Quotation Number:** *1000415441*
Dated: 17.04.2000 **Your Ref.:** c09621/4677

To: MORRISON CONSTRUCTION GROUP LTD
37 HARBOUR ROAD
INVERNESS
IV1 1UA

Site: Cairngorm Funicular Railway
Aviemore

A Personal Data Personal Data R **Our Representative:** Personal Data Redacted

Caledonian Q. Products
Central Sales Office
Daviot Quarry
Inverness
IV2 5XL
Tel: 01463 772210
Fax: 01463 772043

Specification **Our Ref.:**

Plant	Aviemore Concrete	Aviemore Concrete	Aviemore Concrete	Aviemore Concrete
Concrete Grade	RC40	GEN 1	C30	RC40
Cement Type	PC 42.5	PC 42.5	PC 42.5	PC 42.5
Maximum Aggregate Size (mm)	20	20	20	20
Target Slump (mm)	50	50	50	50
Minimum Cement Content	325	175		325
Max Water / Cement Ratio	0.55			0.55

Mix Design: Materials & Mix Proportions: kg/m³ at SSD

PC 42.5	360	175	275	360
10mm Granite Caledonian QP - Daviot	840	770	805	840
20mm Granite Caledonian QP - Daviot	360	330	345	360
Grade M Fine Aggregate Caledonian QP - Alturlie	693	923	838	716
WRDA 90 Water Reducer Grace (C P) - Warrington			1.38	
2 Retarder Grace (C P) - Warrington				1.44
Water	180	190	170	170
Aggregate/ Cement Ratio	5.26	11.56	7.23	5.32
Water/ Cement Ratio	0.50	1.09	0.62	0.47
Percentage Fines	36.61	45.63	42.15	37.37

HEALTH & SAFETY
When cement is mixed with water, alkali is released. Prevent skin contact with wet cement or concrete by wearing suitable clothing. If cement or concrete enters the eye, immediately wash it out thoroughly with clean water and seek medical treatment without delay. Wash wet concrete off the skin immediately.

For and on behalf of
CALEDONIAN PRODUCTS

This design is relevant to the above quotation of which it is a part thereof and subject to our Standard Conditions of Sale

Technical Department

MIX DESIGN CERTIFICATE: Concrete

QUARRY PRODUCTS LTD

Mix Design Certificate: *1000474335* **Quotation Number:** *1000415441*
Dated: 17.04.2000 **Your Ref.:** c09621/4677

To: MORRISON CONSTRUCTION GROUP LTD
37 HARBOUR ROAD
INVERNESS
IV1 1UA

Site: Cairngorm Funicular Railway
Aviemore

FAO: *ROY MILLER*

Our Representative: *Mr Hamish McLennan*

Caledonian Q. Products
Central Sales Office
Daviot Quarry
Inverness
IV2 5XL
Tel: 01463 772210
Fax: 01463 772043

Specification **Our Ref.:**

Mix Design: Materials & Mix Proportions: kg/m³ at SSD

EM 42.5	360
20mm Granite Caledonian QP - Daviot	840
10mm Granite Caledonian QP - Daviot	360
Grade M Fine Aggregate Caledonian QP - Alturlie	716
SP2 Retarder Grace (C P) - Warrington	1.44
Water	170
Aggreg Cement Ratio	5.32
Water/ Cement Ratio	0.47
Percentage Fines	37.37

HEALTH & SAFETY
When cement is mixed with water, alkali is released. Prevent skin contact with wet cement or concrete by wearing suitable clothing. If cement or concrete enters the eye, immediately wash it out thoroughly with clean water and seek medical treatment without delay. Wash wet concrete off the skin immediately.

For and on behalf of
CALEDONIAN PRODUCTS

This design is relevant to the above quotation of which it is a part thereof and subject to our Standard Conditions of Sale

ISO 9001 — THE QUALITY MARK FOR READY MIXED CONCRETE — UKAS PRODUCT CERTIFICATION 009

Technical Department

FUSION PROVIDA Ltd
Chesterfield Trading Estate,
Sheepbridge,
Chesterfield S41 9PZ.
Telephone: (01246) 262626
Telex: 547776 Fusion G
Fax: (01246) 262806

CERTIFICATE OF CONFORMITY

Product Description: 40V SERIES 65 BOX PLANT

Serial/Plant No: EDRC65/326 - 65CE0531

This is to certify that the product identified on this certificate has been tested, using equipment traceable to National/International Standards. These tests are carried out in accordance with the manufacturer's specification and conform to this requirement.

Quality records are maintained in accordance with our Quality Management System. These records demonstrate conformance to the manufacturer's specifications and test methods.

For and on behalf of Fusion Provida Ltd

Signature Personal Data Redacted Date 1/9/99

Registered in England No 3563739

Hepworth
BUILDING PRODUCTS

PADIHAM SITE
POLLARD MOOR PADIHAM BURNLEY LANCASHIRE BB12 7JR
TELEPHONE 01282 772533 FACSIMILE 01282 774888

Certificate Ref.: DM/010

Personal Data Redacted
John Davidson Ltd,
The Pipe Yard,
22 Seafield Road,
Longman Industrial Estate,
Inverness,
IV1.

1 September 1999

CERTIFICATE OF CONFORMITY

I can confirm that the 12 coils of PH90U16B50 High Strength MRS100 Dark Blue P.E pipe, supplied against your order ref. 18-210555 were manufactured, tested and inspected in accordance with the requirements of WIS 4.32.13 respectively, and conform to the requirements of the Standards in full.

Manufacture, quality control and supply of the products falls within the scope of our BS EN ISO 9000 approval, B.S.I Certificate no. FM 01415.

Yours sincerely,
HEPWORTH BUILDING PRODUCTS LIMITED

Personal Data Redacted

ADVICE NOTE/ CERTIFICATE OF CONFORMITY 5582 /

HIGHLAND CONSTRUCTION SERVICES LTD.

Tomich Industrial Estate, Muir of Ord, Ross-shire, IV6 7UA
Telephone (01463) 870194 Fax. (01463) 870667

TO: MADISON CONST' LTD.

DATE: 6-7-2000.

CONTRACT: CAIRNGORM FUNICULAR.

YOUR ORDER No.: C10648/4677.

W.O. NUMBER: 1901.

QUANTITY	DESCRIPTION	WEIGHT
1	GALVANISED SCREEN	
2	" ANGLES.	

THESE GOODS CONFORM TO THE QUALITY STANDARDS AND SPECIFICATIONS AS REQUIRED

FINAL INSPECTION: [redacted].

E. & O.E.

TOTAL WEIGHT KGS.

SPECIAL INSTRUCTIONS:

DESPATCHED BY Personal Data Redacted

For H.C.S.

DESPATCHER: Personal Data Redacted

VEHICLE NUMBER: .....

RECEIVED BY: .....

PRINT NAME: .....

RS 00506

McLean Buchanan & Wilson (Glasgow) Ltd.

250 Helen Street, Glasgow G51 3JG Telephone: 0141-445 3045 e-mail: sales@mbw.co.uk Facsimile: 0141-440 1225

Morrison Construction Ltd.
Civil Engineering North
37 Harbour Road
Inverness

20/12/00

Certificate of Conformity

Your order no. C10989/4677 dated 22/09/00

We hereby certify that goods supplied to the above order have been inspected in accordance with the conditions and requirements of the contract or purchase order and unless noted below conform in all aspects to the specification(s), drawing(s) relevant thereto.

6492	M24 x 70	Grade 8.8 Hex Setscrews & Nuts Galvanized	A/Note 28975/002
648	M24 x 200	Grade 8.8 Hex Bolts & Nuts Galcanized	
32	M24 x 220	ditto	
10016	M24	MS Washers Galvanized	
3520	M24 x 100	MS Washers Galvanized	
800	M24 x 200	Grade 8.8 Hex Bolts & Nuts Galvanized	A/Note 28975/003
96	M24 x 220	ditto	
1340	M24 X 200	Grade 8.8 Hex Bolts & Nuts Galvanized	A/Note 28975/004
683	M24	Grade 10 Hex Nuts Galvanized	A/Note 28976/002
1140	M24	MS Washers Galvanized	
570	M24 x 575	8.8 Screwed Rod Galvanized	
457	M24	Grade 10 Hex Nuts Galvanized	A/Note 28976/003
1600	M24	Grade 10 Hex Nuts Galvanized	A/Note 28977/002
6100	M24	MS Washers Galvanized	
4500	M24	Grade 10 Hex Nuts Galvanized	A/Note 28977/0

Personal Data Redacted

RS 00506

McLean Buchanan & Wilson (Glasgow) Ltd.

250 Helen Street, Glasgow G51 3JG Telephone: 0141-445 3045 e-mail: sales@mbw.co.uk Facsimile: 0141-440 1225

Morrison Construction Ltd.
Civil Engineering North
37 Harbour Road
Inverness

20/12/00

Certificate of Conformity

Your order no. C10989/4677 dated 27/09/00

We hereby certify that goods supplied to the above order have been inspected in accordance with the conditions and requirements of the contract or purchase order and unless noted below conform in all aspects to the specification(s), drawing(s) relevant thereto.

2600	M24 Grade 6 Hex Lock Nut	A/Note 29114/001

Personal Data Redacted

Polypipe Building Products

Neale Road Manufacturing Plant
Neale Road, Wheatley Hall Road, Doncaster, South Yorkshire DN2 4NW
Telephone: (01302) 326161 - General Reception

Rubber Division, Polyplumb Manufacturing & Domus Fan Manufacturing:
Telephone: (01302) 326300 · Fax: (01302) 326444

MDPE Manufacturing:
Telephone: (01302) 552900 · Fax: (01302) 326171

Certificate of Conformity

Date of Issue: 25/08/99 **Certificate Number: NR 02**

Supplied To: JDP (INVERNESS)

Address: **JOHN DAVIDSON PIPES LTD**
THE PIPE YARD
22 SEAFIELD ROAD
INVERNESS
IVI 1SG

Polypipe Order No: 73339 **Customer Order No: 99/209369**

Quantity	Description
10 x 50 METRE LENGTHS	0901050BU

This is to certify that the supplies / services detailed hereon have been inspected and tested in accordance with the conditions and requirements of the contract or purchase order and unless otherwise noted below, conform in all respects to the specification(s), drawing(s) relevant thereto.

Personal Data Redacted

QC 110

Polypipe Building Products

Neale Road Manufacturing Plant
Neale Road, Wheatley Hall Road, Doncaster, South Yorkshire DN2 4NW
Telephone: (01302) 326161 - General Reception

Rubber Division, Polyplumb Manufacturing & Domus Fan Manufacturing:
Telephone: (01302) 326300 · Fax: (01302) 326444

MDPE Manufacturing:
Telephone: (01302) 552900 · Fax: (01302) 326171

Certificate of Conformity

Date of Issue: 24/08/99 **Certificate Number: NR 01**

Supplied To: JDP (INVERNESS)

Address: C/O MORRISON CONSTRUCTION
TOP SKI CAR PARK
CAIRNGORN
AVIEMORE HIGHLAND

Polypipe Order No: 83982 **Customer Order No: 18110459**

Quantity	Description
183 12 METRE LENGTHS	1600612B
101 6 METRE LENGTHS	1600606B

This is to certify that the supplies / services detailed hereon have been inspected and tested in accordance with the conditions and requirements of the contract or purchase order and unless otherwise noted below, conform in all respects to the specification(s), drawing(s) relevant thereto.

Personal Data Redacted

QC 110

[redacted]

Polypipe plc

INTERNAL SPECIFICATION

Specification No PS 23

Issue No 01
Issue Date 04-01-94
Amendment No 02
Page 1 of 1

NON STANDARD LARGE DIAMETER MDPE & HDPE PIPE

1. QUALTITY PLAN REFERENCE : QP 34B

2. MATERIAL: MDPE: Ridgidex PC002 -50 R968 /R102
HDPE: Rigidex PC 3100F / PC 4100F

3. COLOUR: Blue /Black

4. DIMENSIONS: See below

Nominal size mm	Outside Diameter (mm)		Wall Thickness (mm) 10 Bar SDR 11		6 Bar SDR 17.6		Coil Dimensions
	min	max	min	max	min	max	
75	75.0	75.0	6.9	7.7	4.3	5.0	As 90mm SDR 11 (See PS 135)
82	82.0	82.8	7.5	8.5	4.7	5.4	As 90mm SDR 11 (See PS 135)
110	110.0	110.6	10.0	11.2	6.3	7.2	(see PS 135)
160	160.0	161.0	14.6	16.3	9.1	10.2	(see PS 135)
200	200.0	201.3	18.2	20.3	11.4	12.9	N/A
225	225.0	226.4	20.5	22.8	12.8	14.3	N/A
250	250.0	251.5	22.7	25.2	14.2	15.8	N/A
280	280.0	281.6	25.4	28.1	15.9	17.7	N/A

5. MARKING: Polypipe logo, material code (Pex or HDPE),nominal size and bar rating on both sides: Shift, line and date coding shall be marked on one side.

5.1 MARKING COLOUR: 10 Bar - Dark Blue
6Bar -Red

Q4?

REGISTERED IN ENGLAND NO. 2132076
VAT REGISTRATION NO. 478 6623 96
TEL No. (01384) 400441
No. (01384) 400179

CANMEC LIMITED

CERTIFICATE NO. 20855

UNIT 7, DAWLEY BROOK ROAD, KINGSWINFORD, WEST MIDLANDS, DY6 7BD

CERTIFICATE OF CONFORMITY

CUSTOMER:

Redd Fasteners Ltd
Unit 1Seafield Trading Estate
51 Seafield Road
Inverness
IV1 1SG

[redacted]

)UR ORDER NO: ED 15540
)UR ORDER NO: R31/14360/140

DATE SENT: 7.8.00

ITEM NO.	QTY.	DESCRIPTION	MATERIAL SPEC	DIMS SPEC
1	2590	M24 x 250mm Tee Head Bolts c/w 1 Nut & Washer All items hot dip galvanised.	Gr 8.8 Gr 8	Per Sample

WE HEREBY CERTIFY THAT, TO THE BEST KNOWLEDGE AND BELIEF, ALL MATERIALS SUPPLIED AGAINST THE ABOVE ORDER NUMBER ARE FULLY IN ACCORDANCE WITH THE REQUESTED SPECIFICATIONS.

SIGN
on be

Personal Data Redacted

CL22D Iss.1

Stanton

STANTON PLC - COMPANY QUALITY DEPARTMENT

FM 12908
BS EN ISO 9001

LOWS LANE,
STANTON-BY-DALE,
ILKESTON, DERBYSHIRE DE7 4QU
TEL: 0115 - 930 5000 FAX: 0115 - 932 8137

Morrison Construction Ltd.
Civil Engineering Division
Cairngorms Funicular Project
C/O Cairngorms Chair Lift Co. Ltd.
Cairn Gorm Ski Area
Avimore
Inverness
PH22 1RB

8th October 1999.

Attn. Personal Data Redacted

CERTIFICATE OF CONFORMITY.

We hereby certify that the DN 80 Ductile Iron Tybar Pipes supplied by Stanton PLC, with respect to the above project, have been pressure tested to, and comply with the requirements of EN 545: 1995.

Regards,

Personal Data Redacted

Quality Assurance Dept.

MORRISON CONSTRUCTION LTD
CAIRNGORM FUNICULAR RAILWAY
13 OCT 1999

ORIG	COPIES	INFO	ACTION
Q4 FILE	Personal Data Redacted		

The Highland Council
Comhairle na Gaidhealtachd
SERVING The Highland Community

Director of Roads and Transport

Report No : **085-70-235/22 / A2235 / A01 / 1**

AGGREGATE PARTICLE SIZE ANALYSIS

BS 812:Part 103:Section 103.1

Scheme : **CAIRNGORM FUNICULAR RAILWAY**
Site Ref : **4677/03**
Location : **STOCKPILE @ STORE**

Material : **Type 1 Granular sub-base**
Spec. : **SHW clause 803 table 8/2 Type 1 sub-base**
Source : **NOT SPECIFIED**

Date Received : **15/10/99**
Date Tested **18/10/99**

Sieve	Passing %	Specification
75mm	100	100
37.5mm	96	85 - 100
20mm	66	60 - 100
10mm	45	40 - 70
5mm	34	25 - 45
600µm	16	8 - 22
75µm	5	0 - 10

Test	Result	Specification
Moisture Content(%)		N/A
Specified Size (%)		N/A
Flakiness Index :		N/A
Uniformity :	80	N/A

RUCTION LTD.
VERNESS
21 OCT 1999
4677/ Site ✓ Site.
Q 4

Was Sampling Certificate Received : Y

TEST METHOD 7.2 / 7.3

Remarks

Client : **MORRISON CONSTRUCTION LTD**
MORRISON CONSTRUCTION LTD
CIVIL ENGINEERING DIVISION
37 HARBOUR ROAD
INVERNESS
IV1 1UA

Personal Data Redacted

Signed

Name :

19 October 1999

812SIV

UKAS TESTING
0977
0977 S1

The Highland Council
Comhairle na Gaidhealtachd
SERVING The Highland Community

Director of Roads and Transport [redacted]

Report No: 085-70-235/22 / A2211 / A01 / 1 Page : 1 of : 1

AGGREGATE PARTICLE SIZE ANALYSIS

BS 812:Part 103:Section 103.1

Scheme : CAIRNGORM FUNICULAR RAILWAY
Site Ref : CFR1
Location : STOCKPILE

Material : BEDDING LAYER AND SURROUNDING PIPES 20-5mm
Spec. : SHW clause 503 Tb 5/3 PIPE BEDDING 20-5mm Date Received :03/09/99
Source : ROSS - MID LAIRGS Date Tested : 06/09/99

Sieve	Passing %	Specification
37.5mm	100	100
20mm	100	90 - 100
14mm	78	40 - 80
10mm	49	30 - 60
5mm	9	0 - 10

Test	Result	Specification
Moisture Content(%):		N/A
Specified Size (%) :		
Flakiness Index :		N/A
Uniformity :	2	N/A

MORRISON CONSTRUCTION LTD.
09 SEP 1999
COPIES ACTION
4677 Site
Q4

Was Sampling Certificate Received : Y
Remarks:

TEST METHOD 7.2 / ~~7.3~~

Client : MORRISON CONSTRUCTION LTD
MORRISON CONSTRUCTION LTD
CIVIL ENGINEERING DIVISION
37 HARBOUR ROAD
INVERNESS
IV1 1UA

Personal Data Redacted

Signed [redacted]
Name
07 September 1999

812SIV

UKAS TESTING 0977 0977 SI

ROADS & TRANSPORT CONSULTANCY : Offices at Brora, Dingwall and Inverness
REPLY TO: Laboratory Manager, Materials Laboratory, Diriebught Road, Inverness IV2 3QN
Telephone No. (01463) 703140 Fax No. (01463) 703145

THE HIGHLAND COUNCIL
MATERIALS TESTING LABORATORY
DIRIEBUGHT ROAD
INVERNESS

CERTIFICATE OF SAMPLING - AGGREGATES

CONTRACT OR JOB NAME : CAIRNGORM FUNICULAR RAILWAY

COST CODE : ..... CLIENT SAMPLE NO. : CFR1

LOCATION OF SAMPLING(CHAINAGE) : STOCKPILE

MATERIAL SPECIFICATION : 20-5

MATERIAL : 20-5

NOMINAL DESCRIPTION : (a) TYPE : ..... (b) SIZE : .....

(c) COMMENTS ON SAMPLE : .....

NAME OF MANUFACTURER AND SOURCE : A ROSS

SAMPLING SPECIFICATION : .....

SAMPLING PLAN : .....

REASON FOR SAMPLING : .....

SAMPLED FROM : .....

CONDITION OF MATERIAL : .....

ENVIRONMENTAL CONDITIONS : .....

DEVIATIONS FROM SAMPLING SPEC. : .....

DATE AND TIME OF SAMPLIN Personal Data Redacted .....

SIGNATURE OF SAMPLER : ... Personal Data Redacted NAME (BLOCK CAPITALS) : ... Personal Data Redacted

---

TESTING INSTRUCTIONS : .....

ADDITIONAL INFORMATION RELEVANT TO SAMPLE : .....

CLIENTS NAME AND ADDRESS : MORRISON CONSTRUCTION LTD . TEL. CODE : .....

CAIRNGORM TEL NO. : .....

ATTEMORE FAX NO. : .....

.....

DATE OF ISSUE OF CERTIFICATE : .....

SIGNATURE : ..... NAME (BLOCK CAPITALS) : .....

FOR LAB. USE ONLY

LAB. JOB REF. NO. : 085 70-235/22 **LAB. SAMPLE REF. NO. :** A2211

13·6kg

The Highland Council
Comhairle na Gaidhealtachd
SERVING The Highland Community

Director of Roads and Transport
Mr P.H. Shimmin B.Sc., C.Eng., F.I.C.E., F.I.H.T.

Report No: **085-70-235/22 / A2212 / A01 / 1**

AGGREGATE PARTICLE SIZE ANALYSIS

BS 812:Part 103:Section 103.1

Scheme : **CAIRNGORM FUNICULAR RAILWAY**
Site Ref : **CFR1**
Location : **STOCKPILE**

Material : **Type 1 Granular sub-base**
Spec. : **SHW clause 803 table 8/2 Type 1 sub-base**
Source : **G.F. JOB, AVIEMORE**

Date Received : **03/09/99**
Date Tested : **06/09/99**

Sieve	Passing %	Specification
75mm	100	100
37.5mm	99	85 - 100
20mm	78	60 - 100
10mm	60	40 - 70
5mm	44	25 - 45
600µm	19	8 - 22
75µm	6	0 - 10

Test	Result	Specification
Moisture Content(%):		N/A
Specified Size (%) :		N/A
Flakiness Index :		N/A
Uniformity :	59	N/A

Was Sampling Certificate Received : [Y]

TEST METHOD 7.2 / ~~7.3~~

Remarks:

Client : **MORRISON CONSTRUCTION LTD**
MORRISON CONSTRUCTION LTD
CIVIL ENGINEERING DIVISION
37 HARBOUR ROAD
INVERNESS
IV1 1UA

Signed Personal Data Redacted

Name :

07 September 1999

812SIV

THE HIGHLAND COUNCIL
MATERIALS TESTING LABORATORY
DIRIEBUGHT ROAD
INVERNESS

CERTIFICATE OF SAMPLING - AGGREGATES

CONTRACT OR JOB NAME : CAIRNGORM FUNICULAR

COST CODE : ..... CLIENT SAMPLE NO. : CFR 1

LOCATION OF SAMPLING(CHAINAGE) : STOCKPILE

MATERIAL SPECIFICATION : MOT TYPE 1

MATERIAL : .....

NOMINAL DESCRIPTION : (a) TYPE : ..... (b) SIZE : .....

(c) COMMENTS ON SAMPLE : .....

NAME OF MANUFACTURER AND SOURCE : GJ JOB

SAMPLING SPECIFICATION : .....

SAMPLING PLAN : .....

REASON FOR SAMPLING : .....

SAMPLED FROM : .....

CONDITION OF MATERIAL : .....

ENVIRONMENTAL CONDITIONS : .....

DEVIATIONS FROM SAMPLING SPEC. : .....

DATE AND TIME OF SAMPLING Personal Data Redacted .....

SIGNATURE OF SAMPLER : Personal Data Redacted ..NAME (BLOCK CAPITALS) : Personal Data Redacted .....

TESTING INSTRUCTIONS : .....

ADDITIONAL INFORMATION RELEVANT TO SAMPLE : .....

CLIENTS NAME AND ADDRESS : ..... TEL. CODE : .....

..... TEL NO. : .....

..... FAX NO. : .....

.....

DATE OF ISSUE OF CERTIFICATE : .....

SIGNATURE : ..... NAME (BLOCK CAPITALS) : .....

FOR LAB. USE ONLY

LAB. JOB REF. NO. : 085-70-235/22 **LAB. SAMPLE REF. NO. :** A2212

PAGE NO. 1 OF 1 PAGES

23.4 kg

REPLY TO: Laboratory Manager, Materials Laboratory, Diriebught Road, Inverness IV2 3QN
Telephone No. (01463) 703140 Fax No. (01463) 703145

0877
0877 B

CFRT
4687/01

07-SEP-99 10:50 THC MATERIALS LAB TEL:01463703145 P:03

The Highland Council
Comhairle na Gaidhealtachd
SERVING The Highland Community

Director of Roads and Transport
Mr P.H. Shimmin B.Sc., C.Eng., F.I.C.E., F.I.H.T.

Report No: 085-70-235/22 / A2212 / A01 / 1

AGGREGATE PARTICLE SIZE ANALYSIS

BS 812:Part 103:Section 103.1

Scheme : CAIRNGORM FUNICULAR RAILWAY
Site Ref : CFR1
Location : STOCKPILE

Material : Type 1 Granular sub-base
Spec. : SHW clause 803 table 8/2 Type 1 sub-base
Source : G.F. JOB, AVIEMORE

Date Received :03/09/99
Date Tested : 06/09/99

Sieve	Passing %	Specification
75mm	100	100 ✓
37.5mm	99	85 - 100 ✓
20mm	78	60 - 100 ✓
10mm	60	40 - 70 ✓
5mm	44	25 - 45 ✓
600µm	19	8 - 22 ✓
75µm	6	0 - 10 ✓

Test	Result	Specification
Moisture Content(%):		N/A
Specified Size (%) :		N/A
Flakiness Index :		N/A
Uniformity :	59	N/A

Sampling Certificate Received : Y

Remarks:

TEST METHOD 7.2 / 7.3

Client : MORRISON CONSTRUCTION LTD

The Highland Council
Comhairle na Gaidhealtachd
SERVING The Highland Community

~~CFR1~~ 4677/02

Director of Roads and Transport
[redacted]

Report No: 085-70-235/22 / A2211 / A01 / 1 Page : 1 of : 1

AGGREGATE PARTICLE SIZE ANALYSIS

BS 812:Part 103:Section 103.1

Scheme : CAIRNGORM FUNICULAR RAILWAY
Site Ref : CFR1
Location : STOCKPILE

Material : BEDDING LAYER AND SURROUNDING PIPES 20-5mm
Spec. : SHW clause 503 Tb 5/3 PIPE BEDDING 20-5mm Date Received :03/09/99
Source : ROSS - MID LAIRGS Date Tested : 06/09/99

Sieve	Passing %	Specification
37.5mm	100	100
20mm	100	90 - 100 ✓
14mm	78	40 - 80 ✓
10mm	49	30 - 60 ✓
5mm	9	0 - 10 ✓

Test	Result	Specification
Moisture Content(%):		N/A
Specified Size (%) :		
Flakiness Index :		N/A
Uniformity :	2	N/A

Was Sampling Certificate Received : Y
Remarks:

TEST METHOD 7.2 / 7.3

Client : MORRISON CONSTRUCTION LTD
MORRISON CONSTRUCTION LTD
CIVIL ENGINEERING DIVISION
37 HARBOUR ROAD
INVERNESS
IV1 1UA

Personal Data Redacted

Signe [redacted]
Name
07 September 1999

812SIV

The Highland Council
Comhairle na Gaidhealtachd
SERVING The Highland Community

Director of Roads and Transport [redacted]

Report No 085-70-235/22 / A2235 / A01 / 1

AGGREGATE PARTICLE SIZE ANALYSIS

BS 812:Part 103:Section 103.1

Scheme : CAIRNGORM FUNICULAR RAILWAY
Site Ref : 4677/03
Location : STOCKPILE @ STORE

Material : Type 1 Granular sub-base
Spec. : SHW clause 803 table 8/2 Type 1 sub-base
Source : NOT SPECIFIED

Date Received : 15/10/99
Date Tested 18/10/99

Sieve	Passing %	Specification
75mm	100	100
37.5mm	96	85 - 100
20mm	66	60 - 100
10mm	45	40 - 70
5mm	34	25 - 45
600µm	16	8 - 22
75µm	5	0 - 10

Test	Result	Specification
Moisture Content(%)		N/A
Specified Size (%)		N/A
Flakiness Index :		N/A
Uniformity :	80	N/A

RUCTION LTD.
VERNESS
21 OCT 1999
4677/ Site
Q4 Site

Was Sampling Certificate Received : Y

TEST METHOD 7.2 / 7.3

Remarks

Client : MORRISON CONSTRUCTION LTD
MORRISON CONSTRUCTION LTD
CIVIL ENGINEERING DIVISION
37 HARBOUR ROAD
INVERNESS
IV1 1UA

Personal Data Redacted

Signe [redacted]

Name

19 October 1999

812SIV

UKAS TESTING
0977
0977 S1

MORRISON CONSTRUCTION LTD.
37 HARBOUR ROAD, INVERNESS
12 NOV 1999

The Highland Council
Comhairle na Gaidhealtachd
SERVING The Highland Community

Director of Roads and Transport [redacted]

Report No: 085-70-235/22 / A2245 / A01 / 1

Page : 1 of : 1

RECEIVED 12 NOV 1999

AGGREGATE PARTICLE SIZE ANALYSIS

BS 812:Part 103:Section 103.1

Scheme : CAIRNGORM FUNICULAR RAILWAY
Site Ref : 4677/
Location : DAYLODGE STOCKPILE AREA

Material : BEDDING LAYER AND SURROUNDING PIPES 20-5mm
Spec. : SHW clause 503 Tb 5/3 PIPE BEDDING 20-5mm
Source : NOT SPECIFIED

Date Received : 05/11/99
Date Tested : 05/11/99

Sieve	Passing %		Specification
37.5mm	100		100
20mm	81	*	90 - 100
14mm	47		40 - 80
10mm	34		30 - 60
5mm	8		0 - 10

Test	Result	Specification
Moisture Content(%):		N/A
Specified Size (%) :		
Flakiness Index :		N/A
Uniformity :	3	N/A

Was Sampling Certificate Received : Y

TEST METHOD 7.2 / ~~7.3~~

Remarks:

Client : MORRISON CONSTRUCTION LTD
MORRISON CONSTRUCTION LTD
CIVIL ENGINEERING DIVISION
37 HARBOUR ROAD
INVERNESS
IV1 1UA

Signed Personal Data Redacted

Name :

06 November 1999

812SIV

UKAS TESTING
0977
0977 SI

ROADS & TRANSPORT CONSULTANCY : Offices at Brora, Dingwall and Inverness
REPLY TO: Laboratory Manager, Materials Laboratory, Diriebught Road, Inverness IV2 3QN
Telephone No. (01463) 703140 Fax No. (01463) 703145

GALVANIZING CONFORMITY CERTIFICATE

CORROSION FREE ZONE

Personal Data Redacted

[redacted]
BLACKMUIR
BY KEITH

AB55 3PE

Date 10/08/2000

Our Ref G31446

Your Ref 637/638

Details:

27	203x203x46 @ VARIOUS SIZES
15	254x254x73 UC @ VARIOUS SIZES
2	305x305x198 UC @ 7807
17	LOOSE CLEATS
17	305x165x46 UB @ VARIOUS SIZES
6	356x171x45 @ VARIOUS SIZES
1	533x210x82 @ 7880

It is hereby certified that the materials detailed hereon have been inspected in accordance with our Terms and Conditions of Sale and, unless otherwise noted, conform in all respects to

BS EN ISO 1461 : 1999 HOT DIP GALVANIZED COATINGS ON FABRICATED IRON AND STEEL ARTICLES – SPECIFICATIONS AND TEST METHODS.

for HIGHLAND GALVANIZERS

Personal Data Redacted

[redacted]

BSI REGISTERED FIRM

Certificate No. FM11228

HIGHLAND GALVANIZERS

HIGHLAND METALS LIMITED
PINEFIELD INDUSTRIAL ESTATE, ELGIN, MORAY IV30 3JA

A Member of GA GALVANIZERS ASSOCIATION

GALVANIZING CONFORMITY CERTIFICATE

CORROSION FREE ZONE

Personal Data Redacted
BLACKMUIR
BY KEITH

AB55 3PE

Date 11/08/2000

Our Ref G31466

Your Ref 639/640/641

Details:

23	254X146 UB
2	200X75 PFC
43	305X165 UB
4	356X171 UB
39	203X203 UC

It is hereby certified that the materials detailed hereon have been inspected in accordance with our Terms and Conditions of Sale and, unless otherwise noted, conform in all respects to

BS EN ISO 1461 : 1999 HOT DIP GALVANIZED COATINGS ON FABRICATED IRON AND STEEL ARTICLES - SPECIFICATIONS AND TEST METHODS.

for HIGHLAND GALVANIZERS

Personal Data Redacted

Certificate No. FM11228

HIGHLAND GALVANIZERS

HIGHLAND METALS LIMITED
PINEFIELD INDUSTRIAL ESTATE, ELGIN, MORAY IV30 3JA

A Member of GA GALVANIZERS ASSOCIATION

GALVANIZING CONFORMITY CERTIFICATE

CORROSION FREE ZONE

Personal Data Redacted
BLACKMUIR
BY KEITH

AB55 3PE

Date 07/08/2000

Our Ref G31395

Your Ref 631

Details:

3	203X203X46	1@3821	1@4518	1@5859
3	203X203X46	1@1449	1@1183	1@5592
3	203X203X46	1@5860	1@3330	1@4705
5	203X203X46	2@4480	2@3318	1@7439
3	203X203X46	1@7439	1@8968	1@499
2	203X203X46	1@3595	1@3105	

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for HIGHLAND GALVANIZERS

Personal Data Redacted

BSI REGISTERED FIRM
Certificate No. FM11228

HIGHLAND GALVANIZERS
HIGHLAND METALS LIMITED
PINEFIELD INDUSTRIAL ESTATE, ELGIN, MORAY IV30 3JA

A Member of GA GALVANIZERS ASSOCIATION

GALVANIZING CONFORMITY CERTIFICATE

CORROSION FREE ZONE

Personal Data Redacted
BLACKMUIR
BY KEITH

AB55 3PE

Date 15/08/2000

Our Ref G31488

Your Ref 559/560

Details:

9	250x150 RHS
1	305x165 UB
11	203x203 UB
22	406x178 UB
5	470x305 UB
1	305x305 UC
16	254xx146 UB
3	457x191 UB

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for HIGHLAND GALVANIZERS

Personal Data Redacted

Certificate No. FM11228

HIGHLAND GALVANIZERS

HIGHLAND METALS LIMITED
PINEFIELD INDUSTRIAL ESTATE, ELGIN, MORAY IV30 3JA

A Member of GA GALVANIZERS ASSOCIATION

GALVANIZING CONFORMITY CERTIFICATE

CORROSION FREE ZONE

Personal Data Redacted
BLACKMUIR
BY KEITH

AB55 3PE

Date 28/08/2000

Our Ref G31656

Your Ref 572

Details:

9	254X146X31 UB
2	203X203X60 UC
8	203X133X30 UB
5	305X165X40 UB
2	200X200X6 SHS
35	152X152X30 UC

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for HIGHLAND GALVANIZERS

Personal Data Redacted

Certificate No. FM11228

HIGHLAND GALVANIZERS

HIGHLAND METALS LIMITED
PINEFIELD INDUSTRIAL ESTATE, ELGIN, MORAY IV30 3JA
Tel: (01343) 548855 Fax: (01343) 545551

A Member of GA GALVANIZERS ASSOCIATION

GALVANIZING CONFORMITY CERTIFICATE

CORROSION FREE ZONE

Personal Data Redacted
BLACKMUIR
BY KEITH

AB55 3PE

Date 28/08/2000

Our Ref G31656

Your Ref 573

Details:

16	152X152X30 UC
2	146X127X22 TEE X 3910
1	356X171X51 X 1245
11	FABRICATED FRAMES 152X152X23

It is hereby certified that the materials detailed hereon have been inspected in accordance with our Terms and Conditions of Sale and, unless otherwise noted, conform in all respects to

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for HIGHLAND GALVANIZERS

Personal Data Redacted

Certificate No. FM11228

HIGHLAND GALVANIZERS

HIGHLAND METALS LIMITED
PINEFIELD INDUSTRIAL ESTATE, ELGIN, MORAY IV30 3JA

A Member of GA GALVANIZERS ASSOCIATION

GALVANIZING CONFORMITY CERTIFICATE

CORROSION FREE ZONE

Personal Data Redacted

BLACKMUIR
BY KEITH

AB55 3PE

Date 28/08/2000

Our Ref G31656

Your Ref 574

Details:

8	457X191X67
22	T PLATE BRACKETS
14	215X80X150

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for HIGHLAND GALVANIZERS

Personal Data Redacted

Certificate No. FM11228

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HIGHLAND METALS LIMITED
PINEFIELD INDUSTRIAL ESTATE, ELGIN, MORAY IV30 3JA
Tel: (01343) 548855 Fax: (01343) 545551

A Member of GA GALVANIZERS ASSOCIATION

GALVANIZING CONFORMITY CERTIFICATE

CORROSION FREE ZONE

Personal Data Redacted
BLACKMUIR
BY KEITH

AB55 3PE

Date 31/08/2000

Our Ref G31713

Your Ref 579/580/581

Details:

24	80x80x10 RSA @ VARIOUS LENGTHS
8	120x15 FLAT BARS @ VARIOUS LENGTHS
39	150x150x15 RSA @ VARIOUS LENGTHS
25	152x152x23 UC @ VARIOUS LENGTHS
2	80x80x5 SHS @ 1832
5	457x191x67 UB @ VARIOUS LENGTHS
1	200x200x16 RSA @ 2998
2	356x171x51 UB @ VARIOUS LENGTHS
2	406x178x60 UB 1@3734 1@5789
3	305x165x46 UB 1@4381 1@4381 1@2275
1	610x229x129 UB @ 7547
1	533x210x92 UB @ 6388
1	203x203x60 UC @ 8939
3	200x300x6.3 RHS @ VARIOUS LENGTHS
1	250x150x6.3 RHS @ 5383
13	254x146x31 UB @ VARIOUS LENGTHS
34	152x152x30 UB OUTRIGGERS
5	102x50 ESC @ VARIOUS LENGTHS

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for HIGHLAND GALVANIZERS

Personal Data Redacted

BSI REGISTERED FIRM — NATIONAL ACCREDITATION OF CERTIFICATION BODIES

Certificate No. FM11228

HIGHLAND GALVANIZERS
HIGHLAND METALS LIMITED
PINEFIELD INDUSTRIAL ESTATE, ELGIN, MORAY IV30 3JA

A Member of GA GALVANIZERS ASSOCIATION

GALVANIZING CONFORMITY CERTIFICATE

CORROSION FREE ZONE

Personal Data Redacted
BLACKMUIR
BY KEITH

AB55 3PE

Date 08/09/2000

Our Ref G31828

Your Ref 597

Details:

5	RAFTERS	457X190	RSJ
4	RAFTERS	530X210	RSJ
4	RAFTERS	305X165	RSJ

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for HIGHLAND GALVANIZERS

Personal Data Redacted

Certificate No. FM11228

HIGHLAND GALVANIZERS

HIGHLAND METALS LIMITED
PINEFIELD INDUSTRIAL ESTATE, ELGIN, MORAY IV30 3JA
Tel: (01343) 548855 Fax: (01343) 545551

A Member of GA GALVANIZERS ASSOCIATION

GALVANIZING CONFORMITY CERTIFICATE

CORROSION FREE ZONE

Personal Data Redacted
BLACKMUIR
BY KEITH

AB55 3PE

Date 11/09/2000

Our Ref G31851

Your Ref .....

Details:

1	152X152 UC X 4480
1	152X152 UC X 3820
2	152X152 UC 3560X1460 CRANK
2	330X90 RSC X 610
2	456X190 RSJ X 8000
1	540X215 RSJ X 11500
1	540X215 SJ X 10000
2	540X215 RSJ X 12000
1	203X203 UC 7400X1700
1	203X203 UC 9500X2000
1	203X203 UC 4100X1700
2	170 CHS X 2750 POST
11	170 CHS BRACERS
10	102X50 RSC FRAMES X 520 WIDE
1	102X50 4280
5	152X152 UC X 3100
3	152X152 UC X 6000

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for HIGHLAND GALVANIZERS

Personal Data Redacted

Certificate No. FM11228

HIGHLAND GALVANIZERS

HIGHLAND METALS LIMITED
PINEFIELD INDUSTRIAL ESTATE, ELGIN, MORAY IV30 3JA
Tel: (01343) 548855 Fax: (01343) 545551

A Member of GALVANIZERS ASSOCIATION

Produced by Pollard's. Tel. (01392) 445333 H.415.16 (DM) 070

GALVANIZING CONFORMITY CERTIFICATE

CORROSION FREE ZONE

Personal Data Redacted

BLACKMUIR
BY KEITH

AB55 3PE

Date .....07/08/2000.....

Our Ref ....G31395.....

Your Ref ...630.....

Details:

2	203X203X46 UC 1@11082 1@11970
2	203X203X46 UC 1@10830 1@11404
2	203X203X46 UC 1@9760 1@9405
1	203X203X46 UC X 9523
1	406X12.5 CHS X 11950
1	244X8 CHS X 9089
1	610X229X125 UB X 8076
2	254X254X107 UC 1@7895 1@11960
2	254X254X107 UC 1@7895 1@11960
2	254X254X107 UC 1@3511 1@11072
2	254X254X107 UC 1@5450 1@11072
2	254X254X107 UC 1@3643 1@4343
2	254X254X107 UC 1@3311 1@3335
2	254X254X107 UC 1@5144 1@4585
2	254X254X107 UC 1@3087 1@3039
2	254X254X107 UC 1@3486 1@3443

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for HIGHLAND GALVANIZERS

Personal Data Redacted

Certificate No. FM11228

HIGHLAND GALVANIZERS
HIGHLAND METALS LIMITED
PINEFIELD INDUSTRIAL ESTATE, ELGIN, MORAY IV30 3JA

A Member of GA GALVANIZERS ASSOCIATION

Wavin Industrial Products Limited

Wavin Industrial Products Limited
Meadowfield Industrial Estate
Meadowfield
Durham DH7 8RJ
Telephone (0191) 3780841
Facsimile (0191) 3789172

PRODUCT SPECIFICATION

SPECIFICATION FOR WAVINCOIL PVC-u PIPE and FITTINGS FOR USE AS SUBSOIL AGRICULTURAL, CIVILS and SPORTSFIELD DRAINAGE SYSTEMS

" WavinCoil PVC-u Pipe and Fittings for use as Subsoil Agricultural, Civils and Sportsfield Drainage systems, 60mm to 200mm Diameter, are manufactured in accordance with the British Standard"

BS4962 : 1989

The Company operates a Quality Management System which has been accredited to BS EN ISO 9002 : 1994 (Certificate No.FM 00217) and is listed in the BSI Register of Firms of Assessed Capability

RoSPA 19 97
GOLD
Award

INVESTOR IN PEOPLE

NORMANBY INDUSTRIES LTD

TELEPHONE NO.01724 875555
FAX NO. 01724 280129
E MAIL DAVIDH@NORMANBY.CO.UK

FACSIMILE TRANSMITTAL SHEET

TO: Personal Data Redacted

COMPANY:	DATE:
Morrison Cons	21/12/00
FAX NUMBER:	TOTAL NO. OF PAGES INCLUDING COVER.
01479 861720	5
PHONE NUMBER:	SENDER'S REFERENCE NUMBER:
01479 861732	N9628 /00SF
RE:	YOUR REFERENCE NUMBER:
Test Certificates	O.no. C10484 / 4677

☑ URGENT ☐ FOR REVIEW ☐ PLEASE COMMENT ☐ PLEASE REPLY ☐ PLEASE RECYCLE

NOTES/COMMENTS

I refer to our telecon this am. Please find enclosed further copies of the test certificates to cover all items used in the above contract :

O.no.	Description	Test Cert No	Notes
19430	32mm dia Rebar	880603	
19181	25mm plates-Gd. 50A	15523 12	Cert no 32982 sent on 20/6 in error
19445	M33 Gd. 8 nuts & s.f.washers	SC110803	
19445	Washers & Cotter Pins	SC115733	Please see below.

Regarding SC115733 for the washers & cotter pins - this part of O.no. 19445 was sent to you in error. This O.no. contained other items apart from your contract & our Q.A.Dept selected this L.O.C. as the one to cover the nuts & washers in error. The correct L.O.C. is SC 110803 as enclosed.

I hope this now clarifies all queries but please do not hesitate to contact us if we can be of any further assistance.

Regards ,

Personal Data Redacted

MANNABERG WAY, SCUNTHORPE
N.LINCS. DN15 8QS

MAREK
ON 19430

RWD

BSW

Werkszeugnis nach DIN 50 049-3.1
Mill Test Certificate
Certificat d'Usine (DIN 50 049-3.1)

Datum/Date 06.12.1999

880603

Besteller: Wessex Steel Company Limited
Customer: Balham High Road
Contact: SW 12 9A London

Qualitätsvorschrift: BRITISH STANDARD REBAR GRADE ... Certificate No 880603
Quality Specification:
Prescription de Qualité

Empfänger: Wessex Steel Company Limited
Receiver:
Destinataire . BRIMSDOWN

Bestell Nr:
Order No:
Nr de Commande:

Werkauftrag Nr:
Workorder No:
No d'Usine.

Lieferung vom 05.12.1999 /Nr 20432744
Delivered on
Livraison du:

Menge weight quantité t	Abmessung dimension diameter mm	Schmelze Nr. cast No. fusion No.	Streckgrenze yield point Limite d'etirage ReH N/mm2	Rp02 N/mm2	Zugfestigkeit tensile strength Resistance à la traction Rm N/mm2	Dehnung elongation Allongement A10%	A5%	Ag%	Rippenfläche	Gewichtstol. tolerance on mass tolerance (%)	Querschnitt effective cross section section	Chemische Zusammensetzung in % chemical analysis in % composition chimique en % C	Si	Mn	P	S	Cu	Cr	Ni	Mo	V	Ceqv
	20.0	1 18483	557		666	21.7				-2.6	342.2	0.17	0.26	1.11	0.012	0.037	0.42	0.06	0.13	0.04	0.038	0.435
	20.0	1 18483	558		668	27.5				-2.0	307.8	0.17	0.26	1.11	0.012	0.037	0.42	0.06	0.13	0.04	0.002	0.435
	20.0	1 18484	560		676	20.2		64.9		-1.8	306.4	0.18	0.28	1.13	0.009	0.031	0.32	0.09	0.13	0.04	0.002	0.421
	20.0	1 18484	556		676	20.6				-1.2	310.2	0.18	0.29	1.12	0.009	0.031	0.32	0.09	0.13	0.04	0.002	0.421
	20.0	1 18484	556		672	23.0				-1.6	308.0	0.18	0.29	1.12	0.009	0.031	0.32	0.09	0.13	0.04	0.002	0.421
182.570	25.0	1 18189	546		637	21.9		66.7		0.2	491.4	0.16	0.25	0.75	0.014	0.038	0.42	0.12	0.10	0.02	0.002	0.372
	25.0	1 18189	547		638	19.3				0.4	492.4	0.16	0.25	0.75	0.014	0.038	0.42	0.13	0.10	0.02	0.002	0.372
	25.0	1 18189	547		638	20.6				0.1	491.2	0.16	0.25	0.75	0.014	0.038	0.42	0.13	0.10	0.02	0.002	0.372
	25.0	1 18191	540		632	19.6		56.0		-1.4	483.9	0.16	0.27	0.74	0.011	0.040	0.36	0.14	0.11	0.02	0.002	0.366
	25.0	1 18191	544		638	19.2				-2.7	477.1	0.16	0.27	0.74	0.011	0.043	0.36	0.14	0.11	0.02	0.002	0.366
	25.0	1 18191	546		636	24.4				-3.6	476.0	0.16	0.27	0.74	0.011	0.040	0.36	0.14	0.11	0.02	0.002	0.366
	25.0	1 18212	530		635	24.3		65.4		0.2	490.5	0.15	0.21	0.73	0.008	0.029	0.42	0.10	0.13	0.02	0.006	0.361
	25.0	1 18212	532		634	20.7				0.5	491.9	0.15	0.21	0.73	0.008	0.029	0.42	0.10	0.13	0.02	0.006	0.361
	25.0	1 18212	525		632	24.6				0.3	492.1	0.15	0.21	0.73	0.008	0.029	0.42	0.10	0.13	0.02	0.006	0.361
120.010	32.0	1 18390	560		684	20.3		51.3		-2.3	706.1	0.17	0.27	1.01	0.011	0.038	0.35	0.11	0.12	0.02	0.007	0.398
	32.0	1 18390	554		667	19.9				-2.0	707.6	0.17	0.27	1.01	0.011	0.038	0.35	0.11	0.12	0.02	0.007	0.398
	32.0	1 18390	553		667	21.3				-2.3	705.2	0.17	0.27	1.01	0.011	0.038	0.35	0.11	0.12	0.02	0.007	0.398
	32.0	1 18392	541		661	22.8		46.8		-2.1	786.6	0.18	0.25	1.01	0.012	0.036	0.32	0.12	0.12	0.03	0.004	0.405
	32.0	1 18392	542		662	25.4				-1.7	790.6	0.18	0.25	1.01	0.012	0.036	0.32	0.12	0.12	0.03	0.004	0.405

T32

Sonstige Untersuchungen ALL REBEND TESTS OK
other testing.
autres Essais:
Werkszeugnis Nr: 71728

BAR IDENTITY

Badische Stahlwerke GmbH
Qualitätsstelle
Personal Data Redacted
Industriestraße 45
77694 Kehl am Rhein
Tel.: 07851/83-0 Fax 07851/83483

QUALITY CERTIFICATE / S TEST CERTIFICATE

DATA / DATE 03/10/1998 ORIGINAL

CLIENTE/CUS

PRODUTO/PRODUCT HOT ROLLED STEEL PLATE

ESPECIFICAÇÃO/SPECIFICATION EN 10025 S355K2G3/FE510D0D1

ON 19181

Nº PEDIDO / ORDER Nº 15523 12

CEX 2835 - 936

Nº AE

IDENTIFICAÇÃO / IDENTIFICATION							PROPRIEDADES FÍSICAS / PHYSICAL PROPERTIES																				
DIMENSÕES ESPESSURA LARGURA COMPRIM / MM			PESO WEIGHT KILO	CORRIDA/ HEAT	Nº INSPEÇÃO INSPECTION Nº	Nº VOLUME PACKAGE Nº	ENSAIO DE TRAÇÃO TENSION TEST					IMPACTO/IMPACT TEST 10X10MM						FINURA		DUREZA HARDNESS	Z %	DWTT		TAMANHO DO GRÃO / GRAIN SIZE		
							LO = 5,65√So					2V - 20 C														
THICKN	STH LENGTH						LE/Y.P.S.	LR/T.S.	AVEL	LE / LR Y.S / T.S	ALONGAMENTO %							R	H							
							MPA		%			MÁXI MÁX	MÉDIO AVE	MÍNI MÍN												
25.00	2500	10000	4.906	822043	0280036	90839401	369	519	32	71		266	268	268												
"	"	"	4.906	"	"	90839901	"	"	"	"		"	"	"												
"	"	"	4.906	"	0280049	90839301	381	529	28	72		242	238	236												
"	"	"	4.906	"	"	90839501	"	"	"	"		"	"	"												
"	"	"	4.906	"	"	90839601	"	"	"	"		"	"	"												
"	"	"	4.906	"	"	90839701	"	"	"	"		"	"	"												
"	"	"	4.906	"	"	90839801	"	"	"	"		"	"	"												
"	"	"	4.906	"	"	90840001	"	"	"	"		"	"	"												
"	"	"	4.906	"	"	90840101	"	"	"	"		"	"	"												
"	"	"	4.906	"	"	90840201	"	"	"	"		"	"	"												
TOTAL WEIGHT...			49.060																							

WE HEREBY CERTIFY THIS IS A TRUE & ACCURATE COPY OF THE ORIGINAL CERTIFICATE HELD AT OUR WORKS.
Q.A. M. NAGEF
A.J. MARSHALL (LEEDS) LTD

COMPOSIÇÃO QUÍMICA % / CHEMICAL COMPOSITION %

CORRIDA / HEAT	C	Mn	P	S	Si	Al	Cu	Cr	Ni	N	Mo	Ti	Nb	V	Sn	B	As	O	H	Ca		Ceq
822043	14	141	24	6	26	37	0	4	2	62	0	2	34	1	0	1	0			0		38

TRATAMENTO TÉRMICO / HEAT TREATMENT

TEMPER. ENCHARQUE/BOAKING TEMPERATURE	900	°C
TEMPO DE ENCHARQUE/SOAKING TIME	10	MIN
RESFRIAMENTO/QUENCHING	AR	

OBSERVAÇÕES / REMARKS

ACCORDING TO BSEN10204 3.1B

NORMALIZED

Personal Data Redacted

BAPP Industrial Supplies Scunthorpe

N9628

5 Colin Road,Scunthorpe,North Lincolnshire,DN16 1TT.
TELEPHONE 01724 282112 FAX 01724 861868

LETTER OF CONFORMITY

Normanby Ind.

THE ABOVE NAMED COMPANY HEREBY DECLARES THAT THE GOODS/SERVICES SUPPLIED AGAINST YOUR PURCHASE ORDER NO: 19445 AND ADVISED ON OUR ADVICE NOTE NO: SC/15803 DATED 30/5/00 CONFORM TO THE RELEVANT INDUSTRY STANDARDS LISTED BELOW.

METRIC MILD STEEL SETSCREWS AND BOLTS BS 4190
METRIC HIGH TENSILE SETSCREWS AND BOLTS BS 3692
UNF/UNC SETSCREWS AND BOLTS BS 1768
UNC HEAVY SERIES BOLTS AND NUTS BS 1769
BSW SETSCREWS AND BOLTS BS916
CUP ROUND/CSK MILD STEEL BOLTS BS4933
CUP-SQUARE BOLTS AND NUTS BS 4933
HIGH STRENGTH FRICTION GRIP BOLTS AND NUTS BS4395
MILD STEEL MACHINE SCREWS BS4183
METRIC SOCKET SCREWS BS 4168
IMPERIAL SOCKET SCREWS BS2470
"U-BOLTS" AND NUTS BS3974
METRIC /IMPERIAL FULLNUTS/NYLOC NUTS BS3692 ✓
METRIC AND IMPERIAL FLAT WASHERS BS4320 ✓
METRIC AND IMPERIAL SPRING WASHERS BS4464
STEEL COTTER PINS BS1574
THRUBOLTS/RAWLBOLTS ETC STG 3711/81 ISO 9001
OTHER NAMED ITEMS _____

ADDITIONAL FINISHES

BRIGHT ZINC PLATING BS1706
GALVANISING BS729 ✓
SHERARDISING BS4921
STAINLESS STEEL BS970/BS1449

PLACE AND DATE THIS CERTIFICATE ISSUED: 27/9/00

NAME AND SIGNATURE AS WELL AS POSITION OF DECLARANT:

Personal Data Redacted

FURTHUR DOCUMENTATION ON FILE YES/NO Y

ISO 9002 CAS Quality Assured Company

N9601 N15L

BAPP Industrial Supplies Scunthorpe

5 Colin Road,Scunthorpe,North Lincolnshire,DN16 1TT.
TELEPHONE 01724 282112 FAX 01724 861688

LETTER OF CONFORMITY

~~FAE~~ Normanby Ltd

THE ABOVE NAMED COMPANY HEREBY DECLARES THAT THE GOODS/SERVICES SUPPLIED AGAINST YOUR PURCHASE ORDER NO: 19445 AND ADVISED ON OUR ADVICE NOTE NO: SC115731 DATED 30/5/00 CONFORM TO THE RELEVANT INDUSTRY STANDARDS LISTED BELOW.

METRIC MILD STEEL SETSCREWS AND BOLTS BS 4190
METRIC HIGH TENSILE SETSCREWS AND BOLTS BS 3692
UNF/UNC SETSCREWS AND BOLTS BS 1768
UNC HEAVY SERIES BOLTS AND NUTS BS 1769
BSW SETSCREWS AND BOLTS BS916
CUP ROUND/CSK MILD STEEL BOLTS BS4933
CUP-SQUARE BOLTS AND NUTS BS 4933
HIGH STRENGTH FRICTION GRIP BOLTS AND NUTS BS4395
MILD STEEL MACHINE SCREWS BS4183
METRIC SOCKET SCREWS BS 4168
IMPERIAL SOCKET SCREWS BS2470
"U-BOLTS" AND NUTS BS3974
METRIC /IMPERIAL FULLNUTS/NYLOC NUTS BS3692
METRIC AND IMPERIAL FLAT WASHERS BS4320 ✓
METRIC AND IMPERIAL SPRING WASHERS BS4464
STEEL COTTER PINS BS1574 ✓
THRUBOLTS/RAWLBOLTS ETC STG 3711/81 ISO 9001
OTHER NAMED ITEMS_____

ADDITIONAL FINISHES

BRIGHT ZINC PLATING BS1706
GALVANISING BS729
SHERARDISING BS4921
STAINLESS STEEL BS970/BS1449

PLACE AND DATE THIS CERTIFICATE ISSUED: 27/7/00

NAME AND SIGNATURE AS WELL AS POSITION OF PERSON ABOVE

Personal Data Redacted

FURTHUR DOCUMENTATION ON FILE YES/NO 7

ISO 9002 CAS Quality Assured Company

TOTAL P.05

BSW

FIAREK
ON 19430

RND

Werkprüfzeugnis nach DIN 50 049-2.3
Mill Test Certificate
Certificat d'Usine (DIN 50 049-2.3)

Datum/Date 06.12.199

880603

Abnehmer: Wessex Steel Company Limited
Customer:
Client: Balbam High Road
SW 12 9A London

Qualitätsvorschrift: BSTOWSTAHLPARK. BEDAR GRADE ... Certificate No 880603
Quality Specification:
Prescription de Qualité

Empfänger: Wessex Steel Company Limited
Receiver:
Destinataire BIRMINGHAM

Bestell Nr:
Order No:
Nr de Commande:

Werksauftrag Nr:
Workorder No:
No d'Usine.

Lieferung vom 05.12.1990 /Nr 29621944
Delivered on
Livraison du:

Menge weight quantité t	Abmessung dimension diamètre mm	Schmelze.Nr. cast No. Fusion No.	Streckgrenze yield point Limite d'etirage ReH N/mm2	Rp02 N/mm2	Zugfestigkeit tensile strength Resistance à la traction Rm N/mm2	Dehnung elongation Allongement A10%	A5%	Ag%	f86%	Biegeprüfung Gewichtstol. tolerance on mass tolerance (%)	Istquerschnitt effective cross section section	Chemische Zusammensetzung in % chemical analysis in % composition chimique en % C	Si	Mn	P	S	Cu	Cr	Ni	Mo	V	Ceqv
	20,0	9 18483	557		666		21,7			-2,6	312,3	0,17	0,28	1,11	0,012	0,037	0,42	0,05	0,13	0,06	0,032	0,42
	20,0	9 18483	558		669		27,5			-2,6	307,8	0,17	0,26	1,11	0,013	0,037	0,42	0,09	0,13	0,04	0,002	0,42
	20,0	9 18484	560		674		20,2		64,9	-1,8	308,4	0,18	0,29	1,12	0,009	0,031	0,32	0,09	0,13	0,04	0,002	0,42
	20,0	9 18484	554		678		24,6			-1,2	310,2	0,18	0,29	1,12	0,009	0,031	0,32	0,09	0,13	0,04	0,002	0,42
	20,0	9 18484	556		673		23,0			-1,6	309,0	0,18	0,29	1,12	0,009	0,031	0,32	0,09	0,13	0,04	0,002	0,42
182.570	25,0	9 18148	544		637		21,9		48,7	0,2	491,6	0,18	0,25	0,75	0,014	0,038	0,43	0,11	0,10	0,08	0,002	0,37
	25,0	9 18148	547		636		19,3			0,4	492,4	0,18	0,25	0,75	0,014	0,038	0,43	0,11	0,10	0,08	0,002	0,37
	25,0	9 18148	547		638		20,6			0,1	491,2	0,18	0,25	0,75	0,014	0,038	0,42	0,11	0,10	0,08	0,002	0,37
	25,0	9 18191	540		632		19,6		34,0	-1,6	483,0	0,18	0,27	0,74	0,011	0,040	0,36	0,14	0,11	0,08	0,002	0,36
	25,0	9 18191	544		638		19,3			-2,7	477,3	0,18	0,27	0,74	0,011	0,040	0,36	0,14	0,11	0,08	0,002	0,36
	25,0	9 18191	546		636		24,4			-3,0	476,0	0,18	0,27	0,74	0,011	0,040	0,36	0,14	0,11	0,08	0,002	0,36
	25,0	9 18222	510		635		24,3		45,4	0,2	491,5	0,16	0,21	0,79	0,008	0,029	0,41	0,10	0,13	0,02	0,006	0,36
	25,0	9 18222	512		634		20,7			0,3	491,9	0,16	0,21	0,79	0,008	0,029	0,41	0,10	0,13	0,02	0,006	0,36
	25,0	9 18222	525		632		24,8			0,3	492,1	0,16	0,21	0,79	0,008	0,029	0,41	0,10	0,13	0,02	0,006	0,36
130.010	12,0	9 18190	558		664		24,3		51,3	-2,3	785,1	0,17	0,27	1,01	0,011	0,038	0,35	0,13	0,12	0,02	0,007	0,39
T32	12,0	9 18190	556		667		19,9			-2,0	787,6	0,17	0,27	1,01	0,011	0,038	0,35	0,13	0,12	0,02	0,007	0,39
	12,0	9 18190	551		667		23,1			-2,3	785,2	0,17	0,27	1,01	0,011	0,038	0,35	0,13	0,12	0,02	0,007	0,39
	12,0	9 18192	561		661		22,4		46,8	-2,1	786,6	0,18	0,25	1,01	0,012	0,036	0,32	0,12	0,12	0,01	0,004	0,40
	12,0	9 18192	562		662		25,4			-1,7	790,4	0,18	0,25	1,01	0,012	0,036	0,32	0,12	0,12	0,01	0,004	0,40

Sonstige Untersuchungen ALL ASSEMB TESTS OK
other testing
autres Examen:
Werkszeugnis Nr: 71726

BAR IDENTITY

Badische Stahlwerke GmbH
Qualitätsstelle
Graudenzerstraße 45
77694 Kehl am Rhein
Tel.: 07851/83-0 Fax 07851/83483

Det Danske Stålvalseværk A/S

DK-3300 Frederiksværk · Telefon 47 77 03 33 · Telefax 42 12 44 66 · Telex 40191

Seite/Page: 1.1 Nr./No.: 32982
Type: EN 10204/3.1B (2)

Ihrer Auftrag/Your order: DAN175
Unser Auftrag/Our order: 14351
Datum/Date: 25.11.1999
Lieferstelle/Delivery address:

5100 S355JR 00

EN 10025 S355JR (CEQ MAX 0,47)

Lieferung/Delivery: M/S ANDERS ROUSING

Toleranz/Tolerance: BS 4360

Pos.	Zeichen/Marking	Abmessungen/Dimension			Stk./Pcs.	Gewicht/Weight	Schmelze/Heat	Slab	Walzer./Mann.	
1	1 DANSTEEL LI	8000	2000	30,0	2	7536	58080	B1	1812R 0	N
2	2 DANSTEEL LI	10000	2500	40,0	1	7850	57418	B1	9213N 0	N

Gewicht durch tatsächliche Abmessungen berechnet
Calculated weight based on nominal dimensions 3 15386

	C	Mn	Si	P	S	Cr	Cu	Ni	Mo	Sn	Al	Nb	Ti	V	B	N	Ceq – Carbon-Equivalent (IIW - formula)
1	17	140	32	21	6	8	24	9	1		42	2				66	45
2	17	145	23	12	14	9	28	9	1		43	22				66	46
	½ x 100			½ x 1000			½ x 100				½ x 1000					½ x 10.000	½ x 100

Lieferzustand/Condition of Delivery
– + Walzzustand/as rolled
N = Normalisierend gewalzt/Normalized Rolled
oder/or Normalisiert/Normalized 900°C
· 25 mm min. 3 Minuten/Minutes
25,1 - mm min. 9 Minuten/Minutes
M = TM-gewalzt/TM-rolled
Maßkontrolle, Bescheinigung: Ohne Beanstandung
Dimension check, inspection: Without remarks

Kennzeichnung/Marking

Stahlsorte/Quality
S355JR

Sachverständigen/Quality inspector:

Schmelz nr./Heat no.
1-49.999 Elektro-Ofen/Electric-arc-furnace
im Pfanne raffiniert/Ladle refined
50.000-99.999 Konverterverfahren/Oxygen converter

	Zugversuch quer/Tensile test transverse						Kerbschlagbiegeversuch/Impact test											Wärmeversuch/Hot tensile test	
	Re	Rm	A	Re	Rm	A	1	2	3	Mittel/Average	Temp	1	2	3	Mittel/Average	Temp	%	Re,t	Temp
1	369	556	26																
2	382	543	27																
	N/mm²		%	N/mm²		%	Joule				°C	Joule				°C		N/mm²	°C

Dehnung/Elongation: A5

• Probelage und Zustand
Test piece location and condition

Probenlage Width of range	Lage/location
1 10.0	Oberfläche/Surface
2 10.0	Mitte/Center
3 10.0	1/2t von Oberfl./from surface
4 10.0	1/4t von Oberfl./from surface
5 5.0	
7 7.5	
9 Blechdicke/Plate thickness	

Zustand/Condition

Prüfumfang/Test Type – –

Wir bestätigen, daß die Lieferung den Anforderungen der obenbezeichneten Lieferbedingungen entspricht.
We hereby certify, that the material has been made and tested in accordance with the mentioned specifications.

Personal Data Redacted

[redacted]

Your Order No 18754

Signed [redacted]

Geotechnical Institute
Geological Engineering Department

LGA
Landesgewerbeanstalt Bayern

Expert opinion

No. GI 9613712

Your reference: is-r/12/10-290 BR.WPS
Our reference: Hoh/Re
Contact: [redacted]
Telephone: (09 11) 6 55-5558

Client: Friedrich Ischebeck GmbH
Loher Str. 51 - 69
D-58256 Ennepetal

Project: TITAN anchor pile

Commission: Expert opinion on the TITAN drilled anchor pile in accordance with DIN 4128

Nuremberg, 1997-08-19

This expert opinion includes 10 pages of text and 3 appendices.

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Geotechnical Institute
Geological Engineering Department

LGA
Landesgewerbeanstalt Bayern

GI 9613712

Contents

Geotechnical Institute
Geological Engineering Department

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1 Motive

In accordance with the "European Construction Products Directive" of December 21th, 1988*, approvals need only be given if there is significant divergence from the standard in question.

On the other hand it may be of assistance for builder-owners, authorities and test institutes, if expert opinions are available which are appropriate to replace testing in individual cases or at least to examine the relevant criteria.

Those are the reasons for the following expert opinion on the compliance of drilled "TITAN anchor piles" with DIN 4128 "Injection piles (in situ concrete piles and composite piles" and for their use under normal circumstances.

2 System demarcation

Bearing systems in accordance with DIN 4128 (injection piles) mainly differ from those in accordance with DIN 4125 (ground anchorages) in the following features:

Table 1: Distinguishing features

	Bearing systems in acc. with DIN 4128	Bearing systems in acc. with DIN 4125
Free movement area	no	yes
Pre-stressing	not usual	yes
Steel supporting unit	nominal yield strength < 500 N/mm^2	usually pre-stressed steels
Load	tensile and compressive	only tensile

* Dr Breitschaft: "Harmonisation of technical rules for civil engineering, as a contribution to the creation of the internal European market"; Concrete Year Book 1995, part 2, Berlin

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3 Description of the Ischebeck-TITAN anchor pile and compliance of the construction with the requirements in accordance with DIN 4128

3.1 Construction

Details of construction and use may be taken from the company documents of Friedrich Ischebeck GmbH - in particular the "Working File" - as well as the building supervisory approvals Z-20.1-70, TITAN 30/11 temporary anchor and Z-34.13-206, TITAN 30/11 soil nail.

3.2 Steel bearing element

The steel bearing element and the couplers consist of fine-grain construction steel, with Z-30 89.1 building supervisory approval (see Concrete Year book 1994, part 1, page 139).

The nominal yield strength of the steel is given as 460 N/mm^2. In accordance with DIN 4128, Para. 6.2, steels with a yield strength of up to 500 N/mm^2 may be installed.

3.3 Proof of serviceability for couplers and rounded connecting nuts

Tests were carried out for these screw connections at MPA North Rhine-Westphalia in Dortmund, as well as at FMPA Baden-Württemberg, with the results being recorded in test certificates - see the list of tests carried out, **Group of Documents 1.**

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3.4 Cracking width limitation

As there is a reinforcing steel thread, in accordance with DIN 488, the requisite cracking width limitation to the characteristic 0.1 mm, in accordance with DIN 4128, Para. 9.2, is thus inevitably given. **Group of Documents 2** (proofs supplied by Ischebeck) also includes calculatory considerations and proofs, in accordance with DIN 1045, as well as composite tests with cracking width measurements on expansion units in accordance with **Group of Documents 3** (Composite tests report no. 1129, TU Munich).

3.5 Geotechnical compliance with DIN 4128

The expert opinions on soil mechanics produced by Prof. Floss, 9941/13 and 9941b/16, attest that the TITAN 73/53 and TITAN 40/16 composite piles examined comply with the above-mentioned standard.

A further significant finding is that the bore hole is safeguarded by a cement fluid mud, acting as a support liquid, instead of the sheathed bore hole in the case of unstable soil, as required. This system is known, for example from large bore piles in accordance with DIN 4014 and is, so to speak, the "state of the art".

3.6 Summarized "Check list" (compliance with DIN 4128)

Table 2: Compliance with DIN 4128

Section	Norm	Ischebeck anchor pile
1 + 3.4	Shank diameter 100 - 300 mm	Shank diameter > 95 - 260 mm
2	Designation: injection pile, DIN 4128 - V	Appropriate
3.1	Concrete or composite pile	Composite pile

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Section	Norm	Ischebeck anchor pile
3.2	Internal and external load-bearing capacity	Appropriate
3.4	Pile shaft diameter	See section 1
3.5	Injection, reinjection	Compressive pressure 25 to 60 bar, depending on soil
4	Exploration of soil at building site	Appropriate
5	Exploration of structural facilities	Appropriate
6	Construction of individual piles	Appropriate
6.2	Composite pile	Appropriate
6.3	Measures in the case of aggressive soil or ground water, see Table 1	Appropriate
Table 1	30 - 45 mm concrete coating, depending on degree of aggression, or expert opinion	Theoretical "concrete coating" or 37 - 78 mm or expert opinion
7	Manufacture	Appropriate
7.1	Construction of cavity	See section 3.5
7.2	Injection Material for injection Compressive pressure at least 5 bar	See 3.5 Cement glue 5 - 20 bar
7.3	Subsequent compression	25 to 60 bar, depending on soil
7.4	Certificate of manufacture	Appropriate
8	Quality tests	Appropriate, or are available
9	Design and proofs	Appropriate
9.1	Proof of external load-bearing capacity	Appropriate
9.2	Proof of internal load-bearing capacity	In acc. with proofs of serviceability, see items 3.4 and 3.5 of this document.

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Section	Norm	Ischebeck anchor pile
9.3	Proof of resistance to buckling	Appropriate
9.4	Bending strain	Appropriate
9.5	Stability and resistance to deformation of the system as a whole	Appropriate; see also load lifting curves in "Ischebeck Working File"

4 Norms for the use of drilled TITAN anchor piles without double corrosion protection under tensile and compressive load, based on DIN 4128

TITAN drilled anchor piles are, in our opinion, well suited for all practical applications, both temporary and permanent.

Without making any claims to completeness, some practical construction applications are e.g.: foundations and subsequent foundation work in structures, surface and underground workings for historical buildings, harbour walls, stabilising road shoulders, noise protection walls, stabilising supporting structures (re-coverings), stabilising upward pressure on foundations, rock stabilising, mast anchors and lots more.

As far as corrosion protection is concerned, we only consider special measures and considerations necessary in applications from Section 6.3 of the standard - in accordance with footnotes 3 and 4 of Table 1 of the standard also with the involvement of experts.

Trial loadings and/or expert opinions are also required to prove the external load-bearing capacity if the coefficients of friction for the sheathing contained in Table 3 are exceeded, or in the case of "difficult soils" (e.g. silt and clay with a friction angle of $< 30°$, including cohesion, with a shear strength of $c_u < 10$ kN/m^2, with peak pressure soundings of < 20 SPT).

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The following figures may be used for preliminary design: in gravel 200 - 250 kN/m², in sand 150 kN/m² and in cohesive soil 100 kN/m².

For the purpose of calculating the critical sheathing area, the pile shank diameter may be set at D = 2 x bore crown diameter.

The internal load-bearing capacity of a injection pile is determined by the failure of the pile materials. The internal load-bearing capacity of a composite pile with cement stone covering is additionally limited by the permissible crack width "very slight", in accordance with DIN 1045 (December 1978).

The decisive factor for the internal load-bearing capacity of all TITAN anchor piles is the average flow load of the steel supporting units measured in load tests (installation group 1) and the characteristic crack width (equipment group 3).

The starting material: St E 355 or St E 460 fine-grain construction steel is secured by screw shaping. The critical flow loads are produced from tensile tests on unshaped steel supporting units. These, plus a safety factor of S = 1.75, give the following "internal" working loads:

Pile type	TITAN	30/16	30/11	40/16	52/26	73/53	103/78
Internal load-bearing capacity	kN	180	260	525	730	970	1570
Internal working load	kN	100	180	300	400	554	900

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The final anchoring of the TITAN anchor piles is made by

- purely adhesive connection in accordance with DIN 1045, Table 19 (e.g. at least 1.7 m for B25 concrete and TITAN 73/53),

- screw plate,

- welded reinforcing steel hooks.

Proofs of tension for the support of the pile caps may be carried out by using compressive strain with joint face load in accordance with DIN 1045, Section 17.3.3.

In individual cases, shearing reinforcement against punching or bending, or spiral reinforcement against bursting is also to be scheduled.

20 to 35 mm of cement stone covering is sufficient as simple corrosion protection for compressive and tensile piles, as in accordance with DIN 4128, Table 1, depending on how aggressive the soil is.

It should be noted that in the case of "expansive bodies" installed in the soil, as a result of the circular compressive strain, significant crack widths do not occur until greater loads than those used in the test (Composite Trials, report no. 1129 TU Munich, Group of Documents 3).

The "notched" compression body resulting from the installation without sheathed bore causes an even distribution of small cracks in the same direction and ensures that the steel unit is not obstructed from expanding.

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5 Final comments

The drilled TITAN anchor pile, in accordance with DIN 4128, is a versatile and practical construction system for temporary and permanent applications, being robust, stable and easy to use. Its particular advantages are its high impact resistance and imperviousness to tension crack corrosion, heat treatment and transverse pressure.

If you have any further queries, we should be happy to assist.

LGA Geotechnical Institute
Department GI

Personal Data Redacted

Director

Contact:
signed at draft stage

Personal Data Redacted

Appendix: List of documents

UDC 624.154.6 : 001.4 : 620.1 DEUTSCHE NORM April 1983

Small diameter injection piles (cast-in-place concrete piles and composite piles)

Construction procedure, design and permissible loading

DIN 4128

Verpresspfähle (Ortbeton- und Verbundpfähle) mit kleinem Durchmesser; Herstellung, Bemessung und zulässige Belastung

As it is current practice in standards published by the International Organization for Standardization (ISO), the comma has been used throughout as a decimal marker.

This standard is the outcome of many years of consultation within a joint committee of section *Baugrund* of the *Normenausschuss Bauwesen* (Building Standards Committee) of *DIN Deutsches Institut für Normung e. V.* and the *Deutsche Gesellschaft für Erd- und Grundbau* (German Society for Earthworks and Foundation Engineering). It has been recommended to the Laender building inspectorates by the *Institut für Bautechnik* (Institute for Building Technology), Berlin, for inclusion in the official approval procedure.

The term "load" is used for forces acting on a system from outside; the same applies to terms which include the word "load" (see DIN 1080 Part 1).

Because the planning, design and execution of injection piles call for sound knowledge of the method of construction and wide experience, only those contractors and engineers may be entrusted therewith who meet these requirements and ensure expert construction. Only such persons as possess a thorough knowledge of the method of construction and its execution may be appointed as the responsible contractor's agent. Supervision of the work may be exercised only by trained foremen drillers, site foremen or gangers who have already successfully constructed injection piles. Sufficient time shall be allowed for preparing piles.

See DIN 4014 Part 1 for bored piles of conventional type.

Contents

Continued on pages 2 to 7

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12.83

DIN 4128 Engl. Price group 6

Sales No. 0108

1 Field of application and scope

This standard serves as a basis for the planning and execution, and for the assessment of the bearing capacity of non-prestressed injection piles (cast-in-place concrete piles and composite piles) with shaft diameters of less than 300 mm with circular shaft cross sections or comparable similar cross-sectional shapes. The required minimum shaft diameters are 150 mm for cast-in-place concrete piles and 100 mm for composite piles. Piles are formed vertically or raked and are usually axially stressed. Piles transmit their loads into the ground by skin friction, unless the pile rests on rock.

Injection piles are used for temporary purposes, normally for not more than 2 years, and for permanent purposes.

The general principles of pile foundations specified in DIN 1054, November 1976 edition, clause 5, shall apply.

2 Designation

The designation of an injection pile (V) shall read:

Injection pile DIN 4128 – V

3 Concepts

3.1 Injection pile

An injection pile is a cast-in-place concrete pile or a composite pile in which the transmission of stress to the surrounding ground is achieved by the injection of concrete or cement mortar.

A cast-in-place concrete pile has a longitudinal reinforcement of reinforcing steel running its whole length. It may be formed of concrete as specified in DIN 1045 or of cement mortar.

A composite pile has a prefabricated load bearing member of reinforced concrete or steel running its whole length. The load bearing member is either placed in a cavity in the ground or inserted into the soil with the aid of a foot, larger than the load bearing member, e.g. in the form of an impact-driven injection pile. In this case, the cavity may already be filled before insertion of the load bearing member. In the process, the grout surrounds the load bearing member over its entire length in the ground. The stress is transmitted through the bond from the load bearing member into the grout along the whole or part of the pile length.

3.2 Internal and external bearing capacity

The internal bearing capacity of an injection pile is determined by the failure of the materials of which the pile is made.

The external bearing capacity of an injection pile is determined by the failure of the ground supporting the pile.

3.3 Stress transmitting length

The stress transmitting length is that length of the pile shaft through which the pile stress is transmitted into the ground.

3.4 Diameter of pile shaft

The diameter of the pile shaft is the greatest outside diameter of the drilling tool, casing pipe, casing or driving shoe. In the case of piling with external flushing, it may be assumed that the diameter of the pile shaft is equal to the outside diameter of the casing pipe plus 20 mm.

3.5 Injection, re-injection

Injection is a method in which grout is placed at a pressure greater than the hydrostatic pressure. Pressure can be applied to the grout by atmospheric pressure or by liquid pressure.

Re-injection is a method in which a single or repeated injection is effected after the first injection has set or hardened.

4 Soil investigation

Before piles are formed, the sequence of strata, the condition of the soil and the groundwater circumstances shall be investigated as described in DIN 1054, November 1976 edition, clause 3, to an adequate depth below the pile base.

In non-cohesive soils, the strength properties shall be determined by soundings (static soundings, standard soundings, drop-penetration soundings or lateral pressure soundings) and the particle size distribution of the individual soil strata ascertained.

In cohesive soils, the particle size distribution, the consistency index, the uniaxial compressive strength and the shear strength of the individual soil strata shall be determined.

In rock and rocky soils, those methods of exploration and investigation shall be selected which, in addition to determining the sequence of strata, the types of rock and the strength of the rock, also permit conclusions to be drawn regarding formation strength, permeability to water and sensitivity to water.

Groundwater and subsoil shall be examined for properties harmful to concrete and other building materials including, where appropriate, those which could affect the mechanical properties of a supporting liquid.

5 Investigation of existing structures

At an early stage of plannning, where work on or in the vicinity of existing structures is involved, investigations shall be made into their depth, the width and height of their foundations and the method of construction of the building materials used and their strength. If no stability computations are available, the loads shall be determined. In this connection, particular attention shall be paid to horizontal loads.

When selecting the method of formation of injection piles, the structural condition, with particular reference to sensitivity to deformation and vibration, shall be taken into account.

6 Design of individual piles

6.1 Cast-in-place concrete piles

Cast-in-place concrete piles shall be reinforced as specified in DIN 1045. Table 1 applies to the concrete cover of the reinforcement. Where these minimum dimensions are not ensured by the method of manufacture, bar spacers shall be fitted as a centre guide; they shall continue to provide adequate cover after withdrawal of the

casing or casing pipe, e.g. spring cage bar spacers. Especially in the case of piles inclined at more than 15° to the vertical, bar spacers shall be so constructed that there is no danger of the reinforcement cage sinking down into the freshly mixed concrete.

6.2 Composite pile

The load bearing member of a composite pile shall be located centrally, if necessary with the aid of suitable bar spacers (see subclause 6.1) and shall extend over the whole length of the pile.

DIN 1045 shall be observed regarding the design of load bearing members of reinforced concrete.

In the case of steel load bearing members, the cross section may be in the form of a solid round bar, a pipe or sectional steel. It shall be formed as specified in DIN 1050. In addition to the steels listed therein, other steels approved by the building inspectorates, with a nominal tensile yield point of up to 500 N/mm², may be used. Steel load bearing members shall be protected against corrosion over their whole length. Table 1 applies to the concrete cover of load bearing members.

6.3 Measures against aggressive soil or groundwater

Should the soil or groundwater attack concrete within the meaning of DIN 4030 or be aggressive within the meaning of DVGW-Datenblatt (Data Sheet) GW 9, the contents of table 1 shall be observed.

7 Formation of cavity and injection

7.1 Formation of cavity

Boring methods, driving methods and vibratory methods are suitable for producing the cavity for an injection pile. Internal or external flushing may be used to transport drill cuttings. Loosening of the soil by flushing methods only is not permissible. A stable cavity of the intended geometrical cross section shall be created over the entire length. The method of producing it shall be adapted to the subsoil involved.

The spacing between the axes of piles in the area of the stress transmitting lengths shall be not less than 0,80 m. This minimum axial spacing may be reduced if damage to adjacent piles can be excluded during their formation.

Cavities inclined at more than 15° to the vertical may be formed only with sufficiently rigid casings or casing pipes.

Piles shall not be inclined at more than 80° to the vertical.

Cavities shall be checked for position, length and inclination.

Where adequately rigid casings or casing pipes are used, the inclination can normally be measured at the uppermost casing or casing pipe.

Checking of the inclination is especially important in the case of groups of piles.

By way of departure from DIN 4014 Part 1, the joints of the casing pipe may be formed with internal nipples

Table 1. Minimum dimensions of concrete cover of reinforcement or of the steel load bearing member

Line	Degree of aggressiveness		Concrete cover [1], [5] in mm
	Attack on concrete in accordance with DIN 4030	Permissible aggressiveness to steel in accordance with DVGW-Datenblatt (Data sheet) GW 9	
1	not aggressive	aggressive, slightly aggressive or barely aggressive [4]	30
2	not aggressive, but with a sulfate content classified in DIN 4030 as slightly aggressive		30 [2]
3	slightly aggressive		35 [3]
4	very aggressive		45 [3]

[1] The figures apply to concrete; where cement mortar is used, they may be reduced by 10 mm.

[2] An HS cement shall be used for forming the pile shaft.

[3] Piles may be inserted only if an expert in matters of corrosion of steel and concrete confirms that the long-term load bearing behaviour is not affected by a time-dependent reduction of the skin friction. In the zone outside the stress transmitting length, other protective measures, in place of an increase in the concrete cover, may be taken (see DIN 1045, December 1978 edition, subclause 13.3), but the concrete cover shall at least conform to table 1, line 1.

[4] In the case of injection piles for temporary purposes, piles may also be formed in soils which are strongly aggressive to steel provided that it can be shown by an expert that the load bearing behaviour is not impaired.

[5] In the case of piles for temporary purposes, the figures may be reduced by 10 mm.

(internal sockets) provided that, when the casing pipe is withdrawn, there can be no possibility of damage to the reinforcement or to the load bearing member.

If drilling takes place below groundwater level, overpressure of the flushing or supporting liquids shall be used to prevent soil from entering the cavity.

The borehole shall be cleared of residue from drilling.

7.2 Injection

Concrete or cement mortar are used as grout. To form the shaft, an injection pressure shall be applied which should be not less than 5 bar in the vicinity of the stress transmitting length.

The concrete shall be made up as specified in DIN 1045, December 1978 edition, subclause 6.5.2. Contrary thereto, the minimum cement content of the concrete shall be 500 kg/m^3. The concrete shall conform at least to strength category B 25. Contrary to DIN 1045, December 1978 edition, subclause 6.5.7.1, concrete injected by the tremie method, see DIN 4126 Part 1 (at present at the stage of draft), shall be produced in the conditions applicable to concrete B I. If piles are injected in injectable or fissured ground, the proportion of cement shall be correspondingly increased.

The maximum particle size of the aggregate shall not be greater than half of the concrete cover or of the clear space between reinforcing bars. In the case of piles with a shaft diameter less than 200 mm, the diameter of the maximum particle size of the aggregate shall not exceed 8 mm.

Where cement mortar is used, materials conforming to DIN 1045, December 1978 edition, clause 6, shall be employed. By way of departure from DIN 1045, December 1978 edition, subclause 2.1.3.1, the addition of a concrete aggregate may be dispensed with. The compressive strength of the cement mortar shall conform at least to concrete strength category B 25.

Injection operations in the stress transmitting length shall take place immediately following completion of the cavity. Placing of the grout shall start at the bottom and proceed continuously upwards.

Grout shall be fed in by pumps through pipes, hose or the drill pipe. On withdrawal, its discharge opening shall terminate not less than 3,0 m in the grout.

7.3 Re-injection

Re-injection is always necessary if the cavity has not been injected as specified in subclause 7.2, paragraph 1.

The injection equipment should be located symmetrically in the cross section of the pile. The re-injection material, pressures and quantities shall be adapted to the type of subsoil and to local conditions. The re-injection material shall be of such a composition that voids are filled up again.

Piles under load shall not be re-injected.

7.4 Record of formation

Records shall be kept for all injection piles during their formation. For this purpose, the information corresponding to the type of pile used shall be taken from Appendix A.

8 Quality testing

DIN 1045, December 1978 edition, clause 7, applies to the verification of the quality of building materials. Where cement mortar is used, then, contrary to what is stated in DIN 1045, verification of the compressive strength shall be provided as specified in DIN 4227 Part 5. For quality tests, however, 2 sets of 3 cylinders shall be produced and tested on each of 7 working days or for each building site.

9 Design and verification

9.1 Verification of external bearing capacity

The stress transmitting length of injection piles shall be located in adequately firm subsoil, as described in DIN 4014 Part 1, August 1975 edition, subclause 13.1, and shall be not less than 3 m. In rock or soils similar to rock, the stress transmitting length may be appropriately reduced. However, it shall be not less than 0,5 m.

In the case of pressure piles, the thickness of the soil stratum shall be checked to ensure that lower lying strata cannot give rise to harmful settlements as a result of the pile loading.

Where existing foundations are being strengthened, then by way of departure from DIN 1054, November 1976 edition, subclause 5.2.1, injection piles may also be used to transmit partial loads, provided that the compatibility of the deformation behaviour of the foundation elements involved is taken into account.

The permissible pile loading shall be specified on the basis of trial loadings which shall be carried out as described in DIN 1054, November 1976 edition, subclause 5.8 and appendix. Trial loadings shall be carried out on not less than 2 piles, but on at least 3 % of all piles. Tests shall be carried out at those points where, on the basis of soil investigations, the least favourable soil profile for the bearing capacity of the piles can be expected, unless appropriate trial loadings are carried out for each characteristic profile.

When carrying out the trial loading, skin friction shall be eliminated by constructive measures in sectors which are excavated in the working condition of the pile foundation. In those cases in which it is necessary that the pile

Table 2. Safety coefficients η for injection piles

Injection piles used as		η for loading case as defined in DIN 1054		
		1	2	3
pressure piles		2,0	1,75	1,5
tension piles with	0 to 45° deviation from the vertical	2,0	1,75	1,5
	80° deviation from the vertical	3,0	2,5	2,0
For tension piles, values between 45 and 80° shall be interpolated.				

loads be transmitted to a limited length of the shaft, constructive measures shall be taken during the trial loading to prevent the stress from being transmitted into other sections. In exceptional cases, this proportion of the skin friction may be estimated by calculation.

If structural piles are used as test piles, then it shall be shown that their bearing capacity does not suffer as a result of the test loading.

The safety level shall conform at least to the figures in table 2. The lowest trial value shall be taken for determining the permissible pile loading.

Note. As specified in DIN 1054, November 1976 edition, table 8 and to the *Empfehlungen des Arbeitsausschusses "Ufereinfassungen"* (Recommendations of Technical Committee Bank Surrounds) EAU 1980 – E 26, the safety coefficients η are, in the case of tension piles, for static and geometrical reasons, reduced as the deviation of the tension pile from the vertical increases. In contrast thereto, in this standard, the safety coefficients for injection piles used as tension piles are increased as the deviation from the vertical becomes greater, because of the more extensive utilization made in such cases of skin friction. The intention is to achieve, in comparison with injection anchors as described in DIN 4125 Part 1 and Part 2, a comparable level of safety despite the abandonment of the principle of an acceptance test.

The results of tensile tests on injection piles may be used for assessing the bearing capacity of pressure piles provided that the pile stresses are mainly transmitted into the ground by skin friction over the entire length.

Trial loadings need not be carried out if the results of trial loadings in comparable circumstances are available.

If, in exceptional cases, no trial loadings are carried out, the limit skin friction values given in table 3 may be applied. Point bearing shall not additionally be taken into account.

Table 3. Limit skin friction values for injection piles

Type of soil	Pressure piles MN/m²	Tension piles MN/m²
Medium gravel and coarse gravel	0,20	0,10
Sand and gravelly sand	0,15	0,08
Cohesive soil	0,10	0,05

The permissible skin friction values are obtained by dividing the limit skin friction values given in table 3 by the safety coefficient η shown in table 2.

For individual piles of a total length up to 10 m and without freestanding parts, axial displacements of the pile head of up to 10 mm must be expected under the permissible loading. These figures include elastic and plastic deformations.

9.2 Internal bearing capacity

Cast-in-place piles made with concrete shall be designed as specified in DIN 1045. Evidence of serviceability shall be provided for the design of composite piles and of cast-in-place concrete piles which do not conform to DIN 1045 (e.g. injection piles formed with cement mortar).

In the case of cast-in-place concrete piles, evidence of limitation of the crack width, as described in DIN 1045, December 1978 edition, subclause 17.6.2, shall be provided for a "very small" expected crack width.

If, in the case of composite piles, concrete or cement mortar is used for protection against corrosion, the appropriate procedure shall be adopted.

Other measures shall be regarded as effective protection against corrosion only if it is shown that, for the stresses in question, they provide long-term protection equivalent to that of concrete or cement mortar.

9.3 Evidence of safety against buckling

If the shear strength of an undrained cohesive soil, as defined in DIN 18 137 Part 1 or DIN 4096 is less than 10 kN/m², then, in addition to the specifications of DIN 1054, November 1976 edition, subclause 5.2.10, evidence of safety against buckling shall be provided for a bar which is not laterally supported.

9.4 Bending stress

In addition to the specifications of DIN 1054, November 1976 edition, subclause 5.3.3, the bending stress caused by lateral pressure shall be taken into account in accordance with the DGEG recommendations *"Seitendruck auf Pfähle durch Bewegung von weichen bindigen Böden* (Lateral pressure on piles due to movement of soft cohesive soils)".

In order to avoid bending stresses on individual piles caused by unintentional eccentric loading, piles shall be so arranged that such eccentricities can be regarded as harmless to the individual pile.

Note. This implies, for example, the arrangement of at least three piles under a point load or of two rows of piles under a linear load, unless other structural measures are adopted.

9.5 Stability and deformation behaviour of the system as a whole

Evidence shall be provided of the stability and deformation behaviour of the system as a whole. In so doing, the procedure set out in DIN 1054, November 1976 edition, subclauses 5.2.3 and 5.3, shall be followed as appropriate.

Where injection piles are used for purposes of anchoring, DIN 4125 Part 1, June 1972 edition, subclauses 5.6 to 5.8, shall be taken into account as appropriate.

In the case of repeated unidirectional loading and of alternating stresses, the unidirectional and alternating loading in the working state shall be simulated, in addition to the usual trial loading for determining the breaking load. The number of load reversals in the test shall be sufficient to enable an estimate to be made of the dying down to zero of the increase in deformation. In the case of repeated unidirectional loading, this test may be dispensed with if the unidirectional loading is less than 50 % of the working load.

Appendix A

Statement of the record of the formation of injection piles as specified in DIN 4128

1 General information relating to the building project
1.1 Company
1.2 Site
1.3 Pile plan No.
1.4 Reinforcement plan No.
1.5 Placing plan No.
1.6 Description of the pile system
1.7 Permit No.
1.8 Drilling equipment / pile driver
1.9 Casing pipe outside diameter/inside diameter
1.10 Bit outside diameter / pile shoe dimension
1.11 Internal nipple
1.12 Flushing: air / water / suspension / external / internal
1.13 Placing of grout using hose / pipe / drill pipe
1.14 Injection equipment
1.15 Injection by air / liquid
1.16 Strength category of concrete / cement mortar
1.17 Composition of mixture
1.17.1 Cement: type, strength category, proportion by weight per unit of volume
1.17.2 Aggregate: maximum particle size, proportion by weight per unit of volume
1.17.3 Addition agent: type, proportion by weight referred to the cement weight
1.17.4 Additive: type, proportion by weight per unit of volume
1.17.5 Water / cement ratio
1.17.6 Result of suitability test
1.18 Reinforcement joint: cover / welding / or joint of load bearing member: socket / dowel pin

2 Data relating to the individual pile
2.1 General
2.1.1 Pile number
2.1.2 Pile diameter
2.1.3 Inclination to the vertical
2.1.4 Pile head position relative to the drilling plane and structural zero or absolute
2.1.5 Pile length
2.1.6 No-load length
2.1.7 Stress transmitting length
2.2 Sequence of strata as specified in DIN 4014 Part 1, August 1975 edition, appendix, or driving reports according to DIN 4026, August 1975 edition, appendix
2.3 Pile reinforcement / load bearing member
2.3.1 Length or reinforcing cage / of load bearing member
2.3.2 Top of reinforcing cage / of load bearing member relative to the drilling plane and structural zero or absolute
2.3.3 Number of blows
2.4 Injection, re-injection
2.4.1 Injection pressure in the stress transmitting length (discharge pressure at the pump)
2.4.2 Volume of grout used per valve
2.4.3 Total volume of grout used
2.5 Time needed for
2.5.1 drilling / driving
2.5.2 reinforcing / installation of load bearing member
2.5.3 injecting
2.5.4 re-injecting
2.6 Remarks / special points
2.7 Signatures
2.7.1 Foreman driller / site foreman / ganger
2.7.2 Contractor's agent
2.7.3 Owner's representative
2.8 Date

Standards referred to and other documents

DIN 1045	Concrete and reinforced concrete; design and construction
DIN 1050	Steel in building construction; calculation and constructional design
DIN 1054	Subsoil; permissible loading of subsoil
DIN 1080 Part 1	Terms, symbols and units used in civil engineering; principles
DIN 4014 Part 1	Bored piles of conventional type; manufacture, design and permissible loading
DIN 4026	Driven piles; manufacture, dimensioning and permissible loading
DIN 4030	Evaluation of liquids, soils and gases aggressive to concrete
DIN 4096	Subsoil; vane testing, dimensions of apparatus, mode of operation, evaluation
DIN 4125 Part 1	Earth and rock anchors; injection anchors for temporary purposes in loose rock; design, execution and testing
DIN 4125 Part 2	Earth and rock anchors; injection anchors for permanent anchorages (permanent anchors) in soil; design, execution and testing
DIN 4126 Part 1	(at present at the stage of draft) Mole walls; cast-in-place mole walls; design and execution
DIN 4227 Part 5	Prestressed concrete; injection of cement mortar into prestressing concrete ducts
DIN 18 137 Part 1	(Preliminary standard) Subsoil; examination of soil samples, determination of shear strength, concepts and basic principles of test conditions
EAU (1980)	*Empfehlungen des Arbeitsausschusses "Ufereinfassungen"* of the *Hafenbautechnische Gesellschaft* (Technical Harbour Construction Association) and the *Deutsche Gesellschaft für Erd- und Grundbau* (1981), 6th edition, published by *Ernst & Sohn*
DVGW-Arbeitsblatt GW 9	*Merkblatt für die Beurteilung der Korrosionsgefährdung von Eisen und Stahl im Erdboden* (Data Sheet for the assessment of the risk of corrosion of iron and steel in soil) *ZFGW-Verlag*, Frankfurt am Main

Recommendations of AK 5 of the *Deutsche Gesellschaft für Erd- und Grundbau: Seitendruck auf Pfähle durch Bewegung von weichen bindigen Böden* (Lateral pressure on piles due to movement of soft cohesive soils), *Geotechnik* 1978, pp 100 et seq.

Obtainable from DGEG, Kronprinzenstrasse 35 a, 4300 Essen

International Patent Classification

E 02 D 5/34

Recent Projects Using Ischebeck Titan Injection Tie Back Anchors.

Project	Consulting Engineer	Client	Contractor	Application
Millennium Walkway, Torr Vale	Derbys. Consulting Engineers	Derbys. C.C.	Thyssen C./ Precision Drilling	Permanent Ground Anchors
Lister Drive, Liverpool	Liverpool City Council	Liverpool City Council	L.B. Construction	Grout Sock Inox Anchors
Northumberland Wall	Rendel Palmer Tritton	Northumberland C C	Northumberland Contracting	Permanent Anchors
Chorley Outfall Main	Bechtel Water Tecnology	North West Water	Birse Construction/ AIDS	Permanent Anchors
Whatley Quarry	M.J. Crowson	Hanson Quarrys	Precision Drilling	Permanent Tie Down Anchors
Manchester Inner Relief Route	Manchester Design Consultancy	Manchester MBC	Birse Con./ Phi Group	Temporary Ground Anchors
Stade Pumping Station	Mott McDonald	Southern Water	PSC Freyssinet/ Saxton	Permanent Pile Wall Anchors
Downholme Bridge N. Yorks.	Mouchel N. Yorks.	N yorks. C.C. Highways	Wilf Noble	Inox Tie Back Anchors
Woodlands Drive Landslip	Alan Wood & Partners	Private Householder	Wilf Noble	Permanent Gabion Wall Anchors
A697 Retaining Wall	Rendel Palmer Tritton	Northumberland C.C	Advanced Drilling Services	Permanent Tie-Back Anchors
Devonport Dock Wall	Building Property Consultancy	Ministry of Defence	Albion Drilling Services	Permanent Tie-Back Anchors
Black Isle Bridge No 5	Scott Wilson Kirkpatrick	Scot Rail	Albion Drilling Services/BICE	Permanent Tie-Back Anchors
Preston Over Bridge	Scott Wilson IDG	Rail Track	Keller Ground Engineering	Permanent Tie-Back Anchors
Belfast Sheet Pile Wall	S B Tietz & Partners	WAM (GB)	Albion Drilling Services	Permanent Tie-Back Anchors
CTRL 330 (1)	John Wardle	RLE	WT Group	Temporary Ground Anchors
Lockes Wharf	Halcrow	Environment Agency	WT Group	Permanent Tie-Back Anchors
Gloucester Sharpness Canal	Evans Grant	British Waterways	Albion Drilling Services	Permanent Ground Anchors
HMNB Plymouth	B.D.G.	MOD	Albion Drilling Services	Permanent Ground Anchors
Chatham Docks	Nigel Nixon & Partners	Hayes Distribution	WT Group	Permanent Grout Sock Anchor/Pile
Kennedy and Horgan Quays	Pettit & Co	Cork Corporation	Ascon / Descon	Permanent Marine Tie-Backs
Cosley Tunnel	British Waterways	British Waterways	WT Group	Permanent Ground Anchors
Gun Wharf Quays	John Wardle	Swift Structures	WT Group	Temporary Ground Anchors
CTRL 330 (2)	John Wardle	R L E	WT Group	Temporary Ground Anchors

Recent Projects Using Ischebeck Titan Injection Micro Piles.

Project	Consulting Engineer	Client	Contractor	Application
Cairngorm Fernicular Railway	A.F. Cruden	Cairngorm Fernicular Rail.	Morrison Con./Rock Solutions	Cableway Anchor Piles
Millennium Footbridge, Stockton	Ove Arup	Stockton MBC	Birse Con./Albion Drilling	Tension/ Compression Piles
Newark Town Wharf	Macarthy Hughes International	Newark District Council	Tomlinson / Albion Drilling	Tension/ Compression Piles
Wakefield Gantry foundations	Wardell Armstrong	Rail Track	Rail First / APB Group	Tension/ Compression Piles
Sanyo, Loughborough	Macarthy Hughes International	Sanyo Gallenkamp	Albion Drilling	Tension/ Compression Piles
Lombard Street, Newark	Macarthy Hughes International	Payne+Gamble	Precision Drilling	Tension/ Compression Piles
Woodlands Drive Landslip	Alan Wood & Partners	Private Householder	Wilf Noble	Compression Piles
Barnes Bridge Station	W S Atkins	Railtrack	WT Group	Mini Piles
Langley Station	Laing Technology	Railtrack	Thyssen Geotechnical	Mini Piles
Tesco Swansea	White Young Green	Britannia Construction	Thyssen Geotechnical	Mini Piles
A 13	John Wardle	Highways Agency	W T Group	Mini Piles
Ugley Landfill	Golder Associates	Essex C C	W T Group / Albion Drilling	Tension Piles
King's Lynn WWTW	Anglian Water	Anglian Water	Thyssen Geotechnical	Compression Piles
Stanstead Radial Gate	Halcrow	Environment Agency	Tilbury Douglas	Tension Piles

Recent Projects Using Ischebeck Titan Injection Rock Bolts

Project	Consulting Engineer	Client	Contractor	Application
Canary Wharf, London	Ove Arup	Taylor Woodrow	Keller Ground Engineering	900kN Permanent Tie Rods
Stirling Rock Fences	TRL - Babtie Geotechnical	Stirling District Council	Phase 1 Can Ltd Phase 2 Rocklift	Permanent Rock Bolts
West Highland Line Tunnels	Bullen Consultants	Scot Rail	Albion Drilling (Services) Ltd	Permanent Roof Bolts
Ratho Quarry Climbing Centre	Ramage Young & Partners	Moidart Developments Ltd	Albion Drilling (Services) Ltd	Permanent 1500kN Rock Bolts
Liffey Board Walk	Muir Associates	Dublin Corporation	Descon / Pierse Contracting	Permanent Rock Bolts

Recent Projects Using Ischebeck Titan Soil Nails.

Project	Consulting Engineer	Client	Contractor	Application
Aberdare Station Ret. Wall	Bullen Consultants	Rail Track	Construction Marine/Drilltec N.	Temporary soil Nails
Rock Mill, Leamington Spa	P. Forker	Wilson Homes	P. Forker	Permanent Soil Nails
Holden Wood Reservior	Allott and Lomax	North West Water	JVT Construction	Permanent Soil Nails
Edinburgh Castle	John Wardle	Historic Scotland	WT Group	Permanent Soil Nails
Tondu Iron Works	James & Nicholas	Welsh Office	WT Group	Permanent Soil Nails
Rainswick Bay WWTW	AGE Ltd	Yorkshire Water	Taylor Woodrow / A&J GEO.	Permanent Soil Nails
Westbury Embankment	CEDG	GTRM	A. McAlpine / Albion Drilling	Permanent Soil Nails
M 73 Gartcosh Interchange	Babtie Geotechnical	Lanark D C	R.J McLeod / Albion Drilling	Permanent Soil Nails
Storr Loch, Skye	Van Elle Ltd	Scottish Hydro Ltd	Van Elle Ltd	Permanent Soil Nails
Edinburgh By Pass A720	Babtie Geotechnical, Bullen, Scott Wilson (Glasgow) Ltd	Scottish Office	W J Barr	Permanent Soil Nails
M1 Widening at Junction 21	Gibb & Partners	Highways Agency	Norwest Holst/Phi/ Ritchies	Permanent Soil Nails
M4 Widening at Newport	W S Atkins	Welsh Office	Phi Group	Permanent Soil Nails
A470 Improvement at Merthyr	Rendel Palmer Tritton	Welsh Office	Phi Group	Permanent Soil Nails
Kintore By-Pass	Scott Wilson Kirkpatrick	Grampian R C	Phi Group	Permanent Soil Nails
Althorp Embankment	W S Atkins	Railtrack	WT Group	Permanent Soil Nails
Kettering-Corby Embankment	W S Atkins	Railtrack	WT Group	Permanent Soil Nails
Manton Embankment	W S Atkins	Railtrack	WT Group	Permanent Soil Nails
Manton East Embankment	Hyder Consulting	Railtrack	WT Group	Permanent Soil Nails
CTRL 430 - Ashford	Ove Arup	RLE	Kvaerner	Temporary Soil Nails
Wigston Embankment	WSP Consultants	Railtrack	Albion Drilling Services	Permanent Soil Nails
A 13 Cambridge	Highways Agency	Highways Agency	WT Group	Permanent Soil Nails
Seaton Cliff Stabilisation	Posford Duvivier	East Devon D C	WT Group	Permanent Soil Nails
Dungannon Court House	W S Atkins	MOD	WT Group	Permanent Soil Nails

ISCHE-BECK

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DIN EN ISO 9001 -

August 1994 Issue

Registration No.: DE-96-010
Valid until December 2000
Lead Quality Auditor

Ing. Arntz

Düsseldorf, 12.23.1997
Certification Body

Dipl.-Ing. Lehmann

DVS ZERT

THE BAUDER TOTAL ROOF SYSTEM GUARANTEE

WHAT IT COVERS:

Provided that the criteria for the guarantee, as set out in ***Erisco-Bauder's*** *technical literature is adhered to, the* ***Erisco-Bauder System Guarantee*** *comes into force insurance underwritten.*

The guarantee is insurance backed on an annually renewable basis by Board of Trade approved underwriters on the London Market.

The guarantee covers the following:-

1. *Remedial work including materials and labour to a maximum value of £3,000,000, (£500,000 per roof area) should the guaranteed system become non-waterproof due to faulty workmanship involving* ***BAUDER*** *products or faulty manufacture of* ***BAUDER*** *products.*
2. *Consequential damage to buildings and their contents caused by ingress of water due to faulty workmanship involving Bauder products or faulty manufacture of Bauder products, up to a maximum of £3,000,000*
3. *Problems arising from our design, advice, formula and specification where Bauder products are concerned up to a maximum of £3,000,000*
4. *Financial losses arising from any loss or damage to the building as a result of water ingress up to a maximum of £250,000*

* *Minor problem areas do not automatically entitle the Client to renewal of the whole system.*

** *Where claims arise* ***Erisco-Bauder Limited*** *must inspect the system concerned and their approval in writing must be obtained before any remedial work commences.*

THE ERISCO-BAUDER SYSTEM GUARANTEE DOES NOT COVER:

1. *The aesthetic appearance of the system or failure due to lack of maintenance, as outlined in the 'Maintenance Procedure'.*
2. *Water ingress or system failure due to failure of non-Bauder products.*
3. *Damage to the system caused by excessive movement of the main structure or any part of the main structure, i.e. structural movement over and above the tolerances of* ***BAUDER*** *products as set out in* ***Erisco-Bauder's*** *technical literature and sample packaging.*
4. *Damage to, or failure of the system caused by accident (mechanical or chemical), vandalism, storms, ground movement or any Act of God.*
5. *We will accept no responsibility for problems or failures caused by existing moisture in, or deterioration of, any overlaid old waterproofing/insulation system and/or its associated deck.*

Whilst our guarantee covers ***Erisco-Bauder*** *and the Approved Installer network, the Policy cannot in Law release the contractors from their obligations under Contractual Law and Maintenance Period Agreements.*

Under the Policy all remedial works must be carried out by the Approved Installer and, in the interim, should the original Installer have ceased trading, the Policy provides for the work to be carried out by another contractor from the Approved List.

All remedial works instituted under this guarantee must be carried out with ***Erisco-Bauder*** *system products.*

Ref: PJF/RCW/SL/M767

MAINTENANCE PROCEDURE

THE BAUDER TOTAL ROOF SYSTEM

The following procedures should be carried out at yearly intervals in order to ensure that the roof is maintained in first class condition, and to protect the validity of the guarantee.

1/ Ensure safe access can be gained to the roof and that relevant Health and Safety procedures are followed.

2/ Clear all debris from the roof surface, rainwater outlets, chutes, gutters, etc. Debris must be removed from the roof and not simply flushed down rainwater pipes.

3/ Ensure that all rainwater pipes are free from blockages and that water flows freely through them.

4/ Remove any vegetation growth that may have occurred, taking care not to remove the mineral finish or damage the waterproofing membranes in any way.

5/ Ensure that any protective metal flashings or termination bars remain securely fixed and in place.

6/ Examine all mastic sealant and mortar for signs of degradation.

7/ Where promenade tiles or pavers are in use, ensure that they remain in position, secure and in good condition.

8/ Ensure that any items of plant/equipment that may have been introduced to the roof are sited on a suitable slab, and that any fixings that may have been used to secure them do not penetrate the waterproofing.

9/ Report any signs of damage or degradation to Erisco-Bauder immediately so that arrangements can be made for remedial work to be carried out if necessary.

Erisco-Bauder Limited,
Broughton House, Broughton Road,
Ipswich, Suffolk, IP1 3QR, England.
Telephone: 01473 257671
Fax: 01473 230761
E-mail: systems@erisco-bauder.co.uk
Web Site: www.erisco-bauder.com

Ref: PJF/RCW/SL/M767

4th July 2002

Personal Data Redacted

Unwin Jones Partnership
Bridge Lane Studio
Caldewgate
Carlisle
Cumbria

Dear Sir

RE - CAIRINGORM FUNICULAR RAILWAY

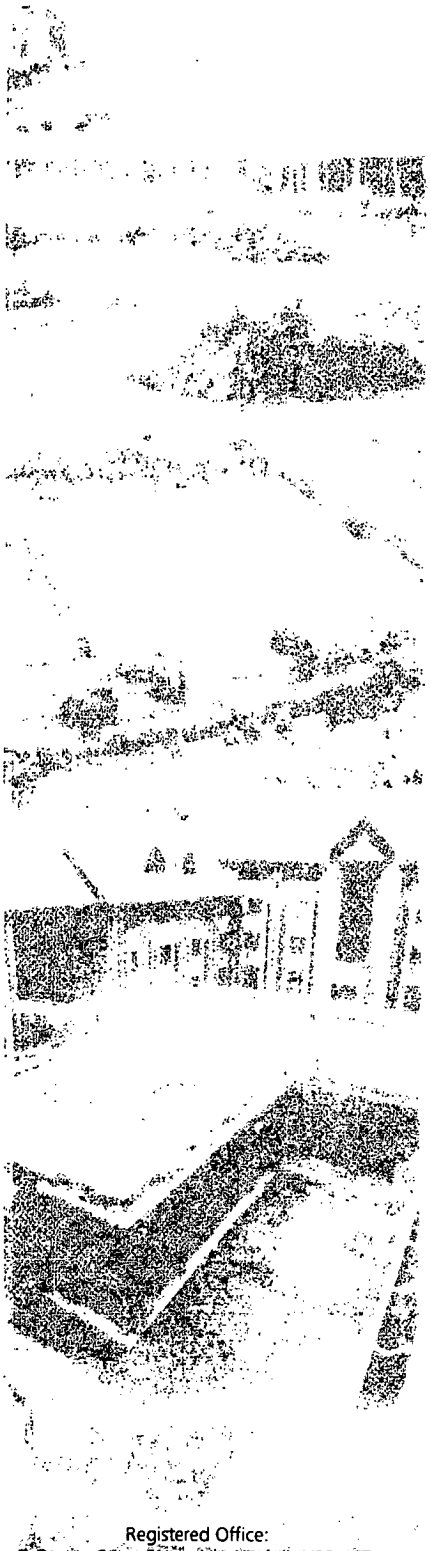
Please find enclosed our Bauder Total Roof System 20 year guarantee for the aforementioned project.

This certificate covers the system (product, product liability and workmanship) for a period of 20 years when installed in accordance with our written specification issued under reference number M767.

We also enclose a self adhesive notice which can be placed within the new roof area, which can help guard against violation of the terms of the guarantee in the future.

May we thank you for the favour of this specification. If we can be of any further assistance, please do not hesitate to contact us again.

Personal Data Redacted



THE BAUDER ROOF SYSTEM

CERTIFICATE OF *Guarantee*

Contract:	**Cairngorm Funicular Railway Cairngorm Aviemore Scotland**
Roof Area:	**Top Visitor Centre**
Beneficiary:	**Highlands & Island Enterprise**
Approved Installer:	**Pirie Roofing**
System:	**BAUDER TOTAL ROOF SYSTEM**
Vapour Barrier:	**VB4 -Expal**
Insulation:	**Eurotherm PUR V (E.F)**
Underlayer:	**G4E**
Capping Sheet:	**P5E**

We certify that the above contract, having fulfilled the guarantee criteria as laid down by ERISCO-BAUDER LIMITED, is guaranteed against product failure due to faulty manufacture and failure due to faulty workmanship for a period of twenty years from the date registered below.

Date: **31st October 2001**

Ref/Cert.No **M767**

Personal Data Redacted

Signature: [redacted]

ERISCO BAUDER
TECHNOLOGY AND SERVICE FIRST