Operation & maintenance manual

Original Instructions

004386
UNIT DTX II TRAILER

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Operation & maintenance manual for:

UNIT : UNIT DTX II TRAILER

ISSUE DATE : 16/09/14

AMENDMENTS

Change	Page(s) Amended	Date	Signature
1	New addition	16/09/14	SAS

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SECTION 1 - Introduction

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Read this manual before you operate, or carry out any maintenance on, the High Pressure Pumpset. Important safety information is highlighted as **WARNING** and ***CAUTION*** instructions. You must obey these instructions. The use of warnings and cautions is defined below:

WARNING

Warnings are given where failure to observe the instruction could result in injury or death to persons.

CAUTION

Cautions are given where a failure to observe the instruction could result in damage to the pump or to associated equipment.

NOTICE

Carefully read the notices of this manual because they give important information concerning safe installation, use and maintenance; familiarise yourself with the workings of the machine in order to rapidly switch it off and eliminate pressure.

This manual is an integral and essential part of the product; it will be consigned to the user in order to ensure the training/information for personnel.

The manufacturer does not assume responsibility for damage caused to persons, things or to the machine, in the case of improper use.
Carefully preserve this manual for any further consultation.

Identify the model of your machine by reading the details on the identification plate. Upon delivery, inspect the machine / accessories for any damage, which may occur during transport.

Follow the recommended operating procedures at all times, do not misuse the equipment as this could result in injury or mechanical breakdown.

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1 INTRODUCTION

1.1 Scope of this manual

This manual provides operation and maintenance instructions for the DTX2 trailer mobile water jetter.

Where the unit has been fitted with proprietary components, details of these are also included in this manual.

This manual is compiled to match the Scope of Supply detailed in Section 2. All specifications, descriptions and parts lists refer only to the components in the version of the unit detailed in this scope of supply. While a large proportion of the information is common to all versions, great care must be taken if this manual is used with versions not consistent with the scope of supply.

Maintenance instructions included in this manual include:

(1) Routine maintenance to be carried out at specific times.

(2) Maintenance of the high-pressure pump.

Repairs to the pump crankcase and gearbox components are not considered maintenance operations as these should be undertaken by FLOWPLANT**,** their approved agents or at least competent automotive engineers.

1.2 The DTX2 trailer

The DTX2 trailer is a highly versatile mobile high-pressure water jetting unit which offers the benefits of proven power pack and pump performance with a comprehensive range of easy to use accessories.

Developed for a wide range of water jetting applications, the unit has been meticulously designed for safe and efficient use.

One man remote operation ‘OMO’ is available to the customer if required.

1.3 Composition of this Manual

This manual comprises the following further sections:

Section 2 **Scope of Supply**

This section defines the scope of supply of the equipment in compliance with the sales order.

Section 3 **Technical Data**

This section contains technical information about the unit.

Section 4 **Health & Safety**

This section details health and safety considerations in general and specific to water jetting equipment.

Section 5 **Operation**

This section describes the recommended operating procedures for the unit.

Section 6 **Routine Maintenance**

This section details recommended routine maintenance requirements for the pump and unit.

Section 7 **Fault Finding**

Fault diagnosis tables for the pump, engine and ancillaries.

Section 8 **'P' Type Pump**

(Refer to the Harben 'P' TYPE service manual 061-352) .

Section 9 **Circuit diagrams**

This section includes the Hydraulic, Water and Electrical circuits including engine controller & wiring loom.

Section 10 **Industrial Diesel Engine**

This section provides part details of the industrial diesel engine.

Section 11 **Parts list / Spares / Auxiliary components.**

How to identify and order spares / auxiliary components.

Section 12 **Axle and Tow Coupling.**

Section 13 **Certification and Warranty**

This section provides details of warranty cover and declaration of conformity.

Section 14 Service Documents

This section contains the service checklist and the service log book. Please fill in your log book on service visits.

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SECTION 2 - Scope of Supply

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2 SCOPE OF SUPPLY

Unit:	DTX II TRAILER
Colour options:	Yellow, White
Machine Build Code:	004386

The Scope of Supply in compliance with the above order comprises the following items:

1. UNIT TRAILER – DTX II

2.1 Pump Assembly

The General Arrangement drawing No. 005-149/3, defines the components of the trailer mounted Pump Assembly as follows:

The Harben ‘P type’ pump assembly driven by a industrial diesel engine (See options).

The engine drives the pump via a Harben reduction type gearbox which reduces the engine rpm down to the correct pump shaft speed.

2.2 Detailed Drawings

Detailed drawings and parts lists for the above components are provided as follows:

The ‘P type’ pump is detailed in Section 8.

Details of other parts and assemblies are included at Section 11.

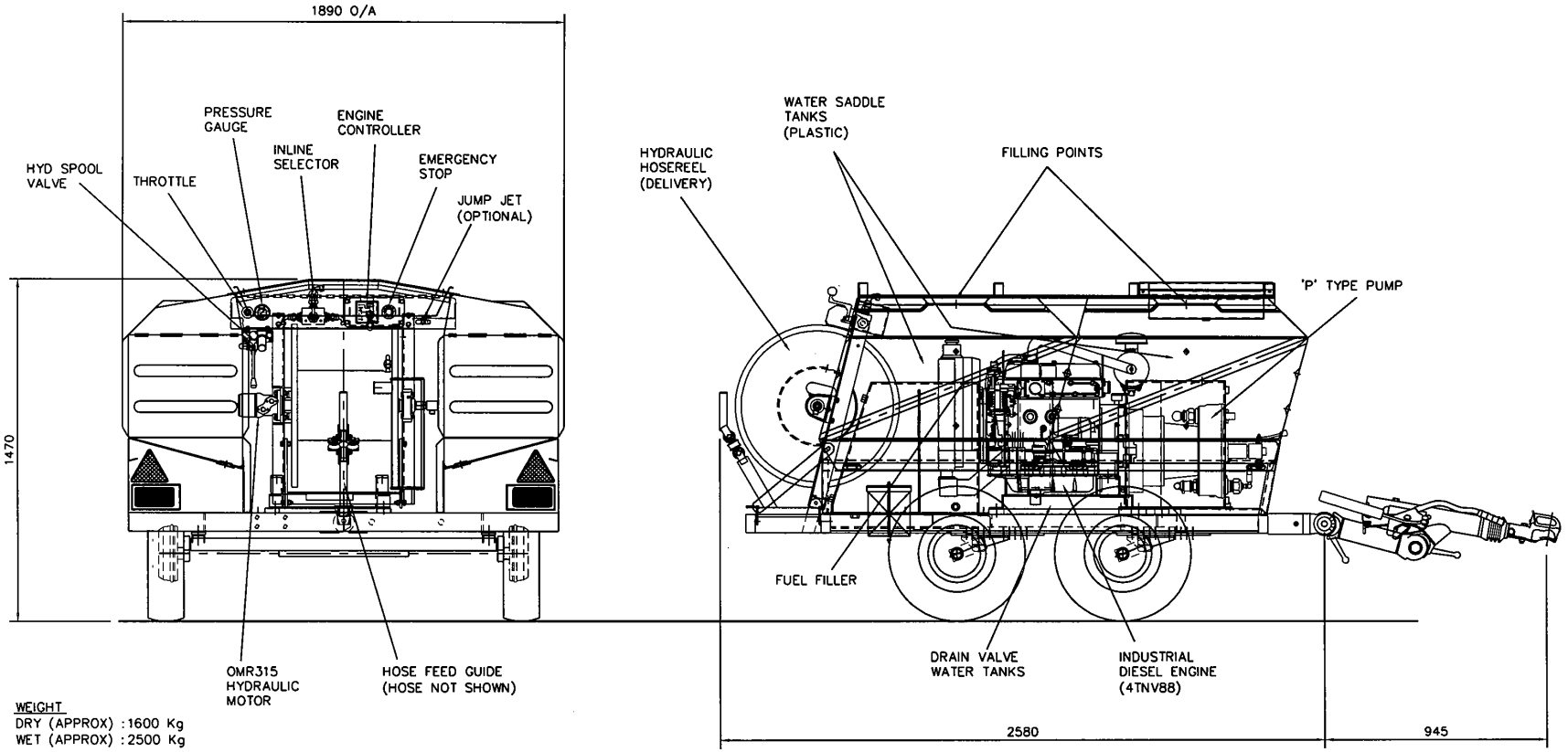
DO NOT SCALE, IF IN DOUBT ASK

MANUFACTURERS UNABLE TO COMPLY MAY SUBMIT ALTERNATIVES WHEN QUOTING.
ALL DRAWINGS NOT TO THE LATEST ISSUE ARE TO BE DESTROYED.

THIRD ANGLE PROJECTION

PARTS LIST

ITEM	PART NO.	DRG. NO.	QTY	DESCRIPTION	REMARKS



WEIGHT
DRY (APPROX) : 1600 Kg
WET (APPROX) : 2500 Kg

FLOWPLANT GROUP
LEADERS IN CLEANING TECHNOLOGY

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OVER	0	30	100	300	1000	2000
UP TO AND INCLUDING	30	100	300	1000	2000	
* DELETE ONE RANGE — * FINE MACHINING	± 0.1	± 0.15	± 0.2	± 0.3	± 0.5	± 0.8
* MEDIUM MACHINING	± 0.3	± 0.5	± 0.7	± 1.0	± 1.5	± 2.0
FABRICATION / UNMACHINED	± 0.5	± 1.0	± 1.5	± 2.0	± 3.0	± 3.0

ALL DIMENSIONS IN MILLIMETRES
GEOMETRICAL TOLERANCES TO BS 308
ANGULAR DIMS TO BE WITHIN— MACHINED ± 0.5° BENDING ± 2°
THREADS= BSP, TO MED. FIT. B.S. 2779
ISOMETRIC TO 6g / 6H

SURFACE ROUGHNESS: 1.6 MICRONS Ra
CONCENTRICITY TO WITHIN 0.2 T.I.R.
M/C RADII 1.5
DRILLED HOLES +0.13/-0.00
HOLE CENTRES TO BE ± 0.2
REMOVE ALL BURRS & SHARP EDGES.

TOLERANCES TO BE AS SPECIFIED ABOVE UNLESS OTHERWISE STATED

MATL.
SPEC/PT NO.
SIZE.
FINISH. SELF
HEAT TREATMENT.
SUPERSEDES/ SUPERSEDED BY

1	ISSUE	DRAWN RG	DATE 23-05-08	TITLE UNIT DTX2
23-05-08	DATE	APPROVED	DATE	
RG	DRN	CHECKED	DATE	
	CHK	SCALE	CALC	
NEW DRG	STATUS	WEIGHT Kg	TEST	DRG NO. 005-149/3.1
	PROTECTION			PART NO. 005149
	CALC:			

FLOWPLANT

SECTION 3 - Technical Data

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3 TECHNICAL DATA

3.1 DTB 500 TRAILER

Pump Type	'P' Type (See section 8)
Pump diameter	405 mm
Pump length	385 mm
Inlet	28.6 mm dia
Outlet	G1/2" (1/2" BSP)
Shaft dia	30mm
Shaft length	65mm
Cylinder options	3, 4, 6, & 8
Power rating (nominal)	< 31.5 kW
Piston diameters	18mm / 20mm / 22 mm
Shaft speed	1250 min^{-1}
Maximum pressure	22mm <280 bar / 20mm <350 bar / 18mm <420 bar
Nominal Flow rate	See section 8
Crankcase lubrication	Fully immersed.
Oil capacity (litres)	8 cyl, 5.0 / 6 cyl - 5.75 / 4 cyl, 6.0 / 3 cyl, 6.5
Weight (kg)	8 cyl, 80 / 6 cyl, 68 / 4 cyl, 58 / 3 cyl, 51
Max inlet pressure	0.5 bar (5.0 metre head)
Recommended crankcase oil	Shell Tellus 150 (Or alternative see section 6)
Max inlet temperature	25^{o}C *Note: Unless 70^{o}C hot water conv' kit is fitted 009001.*
Rotation	Either clockwise or anti-clockwise

Prime Mover options ENGINE YANMAR 4TNV88
(2190 cm^3 / 30.0 kW @ 2500 min^{-1})

Drive options 021-032 Harben type 2:1 reduction gearbox

Ancillaries

Water tanks	Capacity approximately 200 gals. (908 litres)
Supply Water Filter	N05105 Hypro line strainer / 80 micro mesh
Monitoring & Control	Standard WKS96 engine controller 021-059 Selector assembly Inline ½" Bsp.
Pressure Gauge	013-290 Gauge 700 bar
Safety relief	Burst Disc (See section 6.5)

Services required

Mains water supply	Positive head capable of delivering greater than 70 lpm. *Note: Water pH value of 5 to 9 is recommended.*

Ancillaries

Max Flow	55 litrres per minute
Max Pressure	4000psi

3.2 Technical Description

3.2.1 Primary components

The primary components of the DTX trailer are illustrated on dwg. 004-386 which are as follows:

1. A prime mover in the form of an industrial diesel engine which drives a Harben ‘P type’ radial piston diaphragm high-pressure pump.
2. The ‘P type’ pump is capable of producing high-pressure water.
   Note: See above or section 8 for performance options.
3. A Hydraulically or manual driven hose reel options c/w 91.44 m (300 ft) of 2 wire braid high-pressure hose with either a nozzle or gun attachment to deliver the high pressure water to the work application.
4. Plastic Polyethylene water saddle tanks, acting as a reservoir, also ensuring the water is settled and non turbulent, discharging a smooth uninterrupted supply, with a positive head of pressure to the inlet, maximising the full potential of the pump. The tank can be continuously refilled via a ¾” ball float valve by connecting to a mains inlet water supply

   Note: Turbulent water will cause the pump to run unevenly and cause excessive wear due to cavitation.
5. The Inline selector 021-059, allows water to be directed to either the high-pressure delivery hose or dumped back to the supply tanks.

   Note: This function can also be performed by an optional ‘hard-wire’ OMO kit.
6. The control panel which includes the WKS96 engine controller, the pressure gauge, the emergency stop button and the Vernier throttle control.
7. A Hypro 80 micro mesh inline strainer is fitted to the suction line between the tanks and the pump inlet.

   Note: This is a critical component which ensures that no contaminants are drawn into the pump inlet. This filter must be inspected and cleaned daily, if it becomes blocked it will cause the pump to cavitate)

3.2.2 Engine monitoring

Engine oil pressure and engine coolant temperature, together with alternator charge rate are continuously monitored. Activation of the engine oil pressure or coolant temperature switches will cause an engine shutdown and the respective ‘FAULT’ lamp to illuminate.

Alternator failure will cause the red ‘CHARGE’ light to illuminate.

3.2.3 Delivery hose reel

The hose reel drum on which the delivery hose is wound is driven on the hydraulically powered reels by a powerful OMR315 hydraulic motor directly coupled to the hose reel hub. Power is produced by a gear pump driven from the engine P.T.O. *(See below)*

Note: 069-363 Hydraulic gear pump - Yanmar 4TNV88 engine option only.

(6.5 cm^3/r, SAE Flange mounting 'A',16/32 Spline Pitch, 9 Teeth.)

The speed and direction of the reel is controlled by a manual lever controlled spool valve c/w safety relief and flow control, this is situated to the left of the hose reel.

3.3 Installation details

Installation Drawing No**.** 004-386/3 provides overall dimensions and weight for the DTX trailer together with inlet and outlet water connections.

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4. Section 4 – Health & Safety

4.1. Introduction

This section should be read in conjunction with the WARNING and *CAUTION* notices contained throughout this manual or any safety notices on any items of the equipment supplied.

The use of WARNINGS and *CAUTIONS* is defined below:

WARNING

Warnings are given where failure to observe the instruction could result in injury or death to persons

CAUTION

Cautions are given where a failure observe the instruction could result in damage to the pump or to associated equipment

All procedures and recommendations in this manual must be strictly adhered to by operators of the unit, or by any person passing within close proximity.

All Company Safety Regulations applicable must be adhered to at all times.

The following notes, and safety notices throughout this manual, are intended to guide the operator in the safe use and maintenance of the equipment. Whilst every effort has been made for completeness, these notes and notices must be supplemented by the knowledge, training and experience of persons carrying out their tasks.

4.2. Safety notes

Please see a list of safety notes which should be read and understood before operating the machine.

- Operating procedures throughout this manual must be adhered to. In the case of conflicting or ambiguous instructions, reference must be made to a Site Management or Safety Officer.
- Any person operating, working with, or passing near, the unit must wear the necessary Personal Protective Equipment (PPE).
- The Site Management should make available to operators or persons working with the unit, or part thereof, the appropriate technical documentation and should ensure such persons read and understand the documentation prior to commencing their duties.
- Special tools should be used where recommended in this manual.
- Prior to any maintenance or repair work being carried out, the unit, or part thereof, must be shut down and equipment isolated.
- Any maintenance requirements in this manual should be adhered to as minimum maintenance requirements. Maintenance records should be up to date at all times.
- Guards which are located within the unit must be fitted and secured in accordance with the drawings and must not be loosened or removed whilst the unit or part thereof, is operational. Should it be necessary to remove any guard for access prior to start-up of the unit, it must be re-fitted and secured before start up.
- Oils, lubricants, greases and fluids used within the unit must be in accordance with the recommendations given in this manual.
- Fully competent personnel must carry out coupling and uncoupling of the unit.

4.3. Water Jetting Equipment or High Pressure Equipment

WARNING

High-pressure jetting can be extremely dangerous if it is not properly controlled by fully trained personnel.

Operators, and the employers of operators, of water jetting equipment should be trained in accordance with and be fully conversant with the;

- **'Code of practice for the use of high pressure water jetting equipment' (Code of Practice)** - ***Issued by The Water Jetting Association (WJA)***

Copies of the Code of Practice are available from Flowplant Group Ltd.

Supervisors and Operators should at all times adhere to recommendations and instructions contained within the Code of Practice

The following Water Jetting Safety Instructions are based on the Code of Practice.

4.4. Water Jetting Safety Instructions

4.4.1. Training

All persons using high-pressure jetting equipment should be fully conversant with relevant operating instructions, safety notes and Codes of Practice. If in doubt, contact Flowplant Group Ltd for advice on operator training.

4.4.2. Supervision

All high-pressure water jetting operations should be under the control of a fully trained supervisor, who will be aware of the potential hazards to operators and passers-by.

4.4.3. Jetting Area

Warning notices, "DANGER - HIGH PRESSURE JETTING" should be displayed at all possible access points to the jetting area. Notices are available from Flowplant Group Ltd.

4.4.4. Before Starting

Before starting the unit, ensure that you, and anyone else who may be in control at any time, are fully aware of its controls and their function.

It is especially important that everyone knows how to stop the unit in case of an emergency.

Ensure that all the pre-operational checks have been completed, and that any necessary actions have been taken.

4.5. Personal Protective Equipment (PPE)

All persons using high-pressure water jetting equipment should use all necessary PPE suitable for the task being carried out. Please note PPE shown below can be supplied in various formats.

PPE for consideration: -

Please note, a site specific risk assessment must be complete to analyse which PPE must be worn.

A full range of PPE is available from Flowplant Group Ltd.

4.6. High Pressure Water Hoses

4.6.1. Standards

- BS EN 1829-2
- BS EN 853
- BS EN 854
- BS EN 855
- BS EN 856
- BS EN 857
- ISO 4413:2010

4.6.2. Hose checks

The following checks must be made at regular intervals during the unit's life span.

- High pressure jetting hoses must be checked along their entire length at the start of each shift to ensure that they are free from external damage. Hoses with exposed or broken reinforcing braid or damaged couplings and fittings may fail without warning and must be replaced immediately
- Before use check end fittings and couplings for damage to threads, sealing faces and rounding of connection nuts. Only use the correct size spanner to tighten the hose fitting. Stilsons or adjustable spanner type tools with serrated teeth must not be used.
- Hoses that have been used **must NOT be re-ended** under any circumstances - see ISO 4413:2010 section 5.4.6.5.1 section A for details.

4.6.3. Hose Markings

- All hoses shall be marked at a maximum spacing of 500mm with following information clearly marked: -
    - Hose manufacturers identification
    - Maximum allowable working pressure (in bar)
    - Nominal bore (eg DN12)
    - Quarter and last two digits of assembly date (e.g. 4Q09)
- In addition, all hose assemblies shall be marked with the following: -
    - Manufacturer's identification or part number
    - Maximum allowable working pressure (in bar)
    - Quarter and last two digits of assembly date (e.g. 4Q09)
    - Standard BS EN 1829-2 or the relevant British Standard.

4.6.4. Hose Use Limitations

The hoses intended use is water jetting, any other uses are strictly prohibited they include:-

- Using the hose for applications above the maximum working pressure.
- Using the hose as a towing aid
- Using the hose as a lifting or restraining device.

4.7. Reaction Forces (where applicable)

It is a mandatory requirement to carry out a risk assessment for each new application before commencing work. This must include calculating the reaction force created by the jet, taking into account; pressure, flow, nozzle coefficient of discharge and pressure drop through the hoses fittings and gun.

Should the calculation reveal a reaction force greater than 250N, for a hand held application, additional support must be provided in the form of a gimbal or similar device, otherwise the engine speed, water flow and reaction force must be reduced.

WARNING

250N is the maximum recommended reaction force by the Code of Practice for unsupported hand held jetting guns and lances. If the equipment is capable of creating a reaction force in excess of 250N additional support must be used or the engine speed/pump flow must be reduced.

4.8. Frosty Conditions (where applicable)

If frost has occurred there may be frozen water in the hose or pump which will cause a dangerous blockage. Ice bullets could be ejected from the end of an open hose at dangerously high speed capable of causing serious injury or death.

WARNING

Do not start the pump until the complete high-pressure system has completely thawed out

4.9. Safety Gun (where applicable)

When operating a high-pressure water gun follow these steps and make note of important warnings.

- Never point a gun or lance at anyone, even if switched off.
- When using the Gun, the jet should be fitted correctly before starting the unit. All other hose connections must be checked before attempting to start the unit.
- Do not allow children the opportunity to play with the equipment!

WARNING

High-pressure water jet! Grip lance with both hands. Never direct jet of water towards people or animals.

WARNING

High-pressure water can be extremely dangerous do not leave plant unattended!

The use of jetting guns with oscillating or rotating heads tend to produce higher hand arm vibration levels than simple fixed head jets. Emissions of hand-arm vibration can be high enough to generate exposures above the exposure action value in the Control of Vibration at Work Regulations 2005. Exposures above the exposure limit value are unlikely. Guidance on the Regulations can be found in HSE publication L.140'Hand Arm Vibration – The Control of

Vibration at Work Regulations 2005', also available as a download from the HSE website: www.hse.gov.uk. (see section 4.10 for information on Jump jet kits).

4.10. During Operations

- If water appears from the hose, coupling or connector, often first sighted as a fine mist, then the hose is damaged and could burst or a joint is loose or defective. STOP THE UNIT IMMEDIATELY!
- No attempt should be made to adjust any hose, coupling or connector whilst that part of the system is under pressure.

4.11. During Maintenance

- A unit undergoing maintenance should be isolated from other plant or suitably identified to ensure that it is not used inadvertently.
- Maintenance must only be carried out by skilled personnel, who are conversant with the nature and dangers of high-pressure water, of jetting safety regulations and codes of practice.

4.12. Tools

- The correct tools of the right size for the job must always be used to avoid damaging the unit and possibly making it unsafe. Adjustable tools with serrated gripping jaws should not be used.

4.13. Replacement Parts

- Only replacement parts which have been obtained from or approved by Flowplant Group Ltd are to be used when undertaking maintenance. Using any other replacement parts will normally invalidate the warranty and could be dangerous.

4.14. Performance

- Never exceed the maximum rated pressure or engine speed.

Note: The maximum engine speed quoted refers to the “High Idle Speed” at no load condition i.e. at the lowest possible pressure.

4.15. Risk of Carbon Monoxide Poisoning (Trailer only)

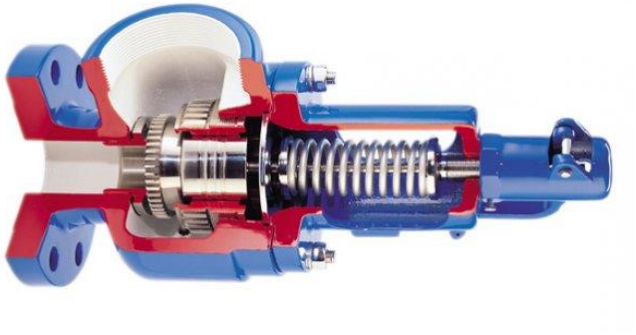
WARNING

The jetting unit uses a diesel engine that could cause build-up of carbon monoxide gases in the vehicles storage or cab area.

Ensure van cab is fully vented after using the jetting unit.

- The USER should have rear and side doors open when operating the machine.
- It is advisable to also carry a carbon monoxide monitor in the rear or the vehicle and the cab of the vehicle as an early warning of any potential risks.

4.16. Pressure Safety Device



- Pressure relief valves should be checked for functionality and certified by the manufacturer or their authorised representative at least every 6 months. Pressure discs should be replaced at least every 6 months to ensure continued safe operation and only manufacturer's original replacements should be used.

4.17. Exposure to Vibration

- Please see the following extract from "The Water Jetting Association Code of Practice for the Safe Working and Use of Water Jetting in Drains and Sewers"

New edition May 2013

"The use of 'Jump or Pulse Jets' in drain cleaning applications may expose the operator to vibration levels in excess of the exposure action value and exposure limit value if the jetting hose is handled. Water jetting hose should not be handled whilst the 'Jump or Pulse Jet' is in operation."

WARNING

Potential vibration level is 27m/s^2 RMS

Operators handling the jetting hose with the Jump Jet switched on for 4 minutes per day could reach the Exposure Action Valve (EAV). Further handling will reach the Exposure Limit Value (ELV) in approximately 16 minutes.

There are a number of recommendations that will reduce vibration levels and/or make operators less susceptible to HAV harm.

Do not touch the hose whilst the jump jet is in operation unless it is to avert a hazardous situation from arising.

Reducing the jetter engine speed from maximum to ½ or 2/3rd revs will decrease vibration levels.

Only use the jump jet as intended i.e. to facilitate blockage clearing or when extremely long pipe runs are encountered.

Maintain equipment in accordance with the manufacturers recommended maintenance schedule.

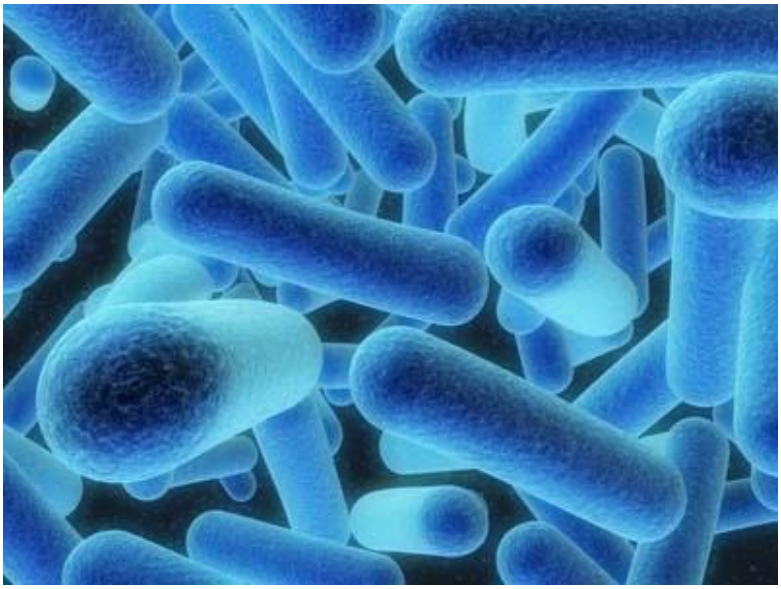
Always keep hands dry and warm at all times.

Consider wearing anti-vibration gloves in accordance with ISO 10819. (There is limited evidence that these gloves remove the harmful vibration at lower frequencies. Seek further advice from glove manufacturers)

Monitor the health of operators on a regular basis and maintain records of machine usage.

When employing any method for reducing vibration levels always conduct a risk assessment for your specific application.

4.18. Legionnaire's Disease



- The bacteria are common and are found naturally in water, usually in low numbers. The bacteria do not seem to multiply below 20°C and will not survive above 60°C; water temperatures between 20°C and 45°C being optimum for growth. The bacteria may remain dormant in water temperatures between 6°C and 20°C, multiplying when water temperatures reach a suitable level.
- The bacteria also require food to multiply such as algae, amoebae and other bacteria. The presence of scale, sediment, sludge and other material within the system may be important in creating favourable conditions for the growth of bacteria as are biofilms (a thin layer of micro-organisms which may form slime on the surfaces in contact with the water).
- As the tanks of the unit are required to be emptied after the completion of jetting operations, so that the daily checks required by the Operation & maintenance manual can be carried out, each jetting operation will be commenced with fresh water.
- In the event that the operations manual is ignored and the tanks not emptied, the risk of bacterial growth within the system would increase but the ambient temperature of the water in the tanks is likely to reach 20°C, and be maintained at that level, only in exceptional circumstances.
- To prevent a build-up of scale, sediment, sludge and other materials and reduce and associated hose and pipe work be thoroughly cleaned and flushed through at least every six months (preferably with hot water in excess of 70°C).

SECTION 5 - Operation

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SAFETY AWARENESS SHEET 061-577

GENERAL H/P JETTING EQUIPMENT

LEADERS IN CLEANING TECHNOLOGY

Warning this equipment may constitute a potential hazard

This equipment is designed for use in High Pressure Water Jetting and could cause serious injury or death if incorrectly used.

Before commencing the use of this equipment answer the following questions.

(a) Have you been fully trained by a qualified instructor ?
(b) Have you read the manual ?
(c) Do you understand the Water Jetting Association Code of Practice ?
(d) Have you been equipped with the correct Personal Protective Equipment ?
(e) Do you fully understand all of the equipment being used in connection with this item?
(f) Has a risk assessment for this task been carried out ?
(g) Is the equipment suitable for the task in hand ?
(h) Has the working area been isolated and warning signs erected ?

If you answer **NO** to any of the above, **or do not understand any question**, you may be in breach of Health and Safety Guidelines.
Do not proceed without consulting your Health and Safety Representative.

Flowplant Group Ltd. do not accept responsibility for any event arising from incorrect or mis-use of the equipment.

Technical information, warning signs, personal protective equipment and training by qualified instructors are available from:-

Flowplant Group Ltd., Gemini House, Brunel Rd., Churchfields, Salisbury Wilts. SP2 7PU. Tel. 01722 325424, Fax 01722 411329

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5 OPERATION

5.1 Operating Conditions

Operators of water jetting equipment should be fully conversant with the 'CODE OF PRACTICE FOR THE USE OF HIGH PRESSURE WATER JETTING EQUIPMENT', hereafter referred to as 'The Code of Practice'.

A copy of The Code of Practice is available upon request.

Section 4 - Health & Safety in this manual includes a synopsis of the relevant parts of The Code of Practice, which pertain to this equipment and specifically to Single Person Operation.

5.2 Daily Checks

Carry out all daily checks.

All checks which should be carried out each day before operating the equipment are detailed in **Section 6 - Routine Maintenance.**

They are:
‘P’ PUMP - OIL LEVEL
WATER FILTER - CLEANLINESS
DIESEL ENGINE - OIL LEVEL
DIESEL ENGINE - COOLING WATER LEVEL
RESERVOIR TANKS - WATER LEVEL

Remember, if the unit has previously been in operation for more than 100 hours, other routine maintenance checks may need to be carried out. **Refer to Section 6.**

5.3 Pre-start checks & procedures

1. Ensure the towing vehicle and trailer hand brakes are applied.
2. Connect the incoming water supply.
   The water will fill the tank via a float valve allowing a constant water feed (if available). It is suggested that the inlet hose (if not supplied by Flowplant) is fitted with a check valve (Non-return valve) to assist in the prevention of back feed into the water mains.
3. Feed the end of the high-pressure hose through the hose trace on the swinging arm in front of the hose reel. Do not fit the nozzle or gun at this point!

5.4 Starting the engine and setting the operating pressure

Tank water level

The unit will continue to run if there is a low level of water in the tanks, however it advantageous to have a full tank of water and provide the pump with a good positive head.

WARNING! DO NOT REMOVE THE FILTER MESH AND ALLOW UN FILTERED WATER INTO THE PUMP.

EMERGENCY SHUTDOWN

At any time during the starting procedure, or during normal jetting operations, an emergency shutdown can be achieved by depressing the emergency STOP button on the Control Panel. **(See fig. 1)**

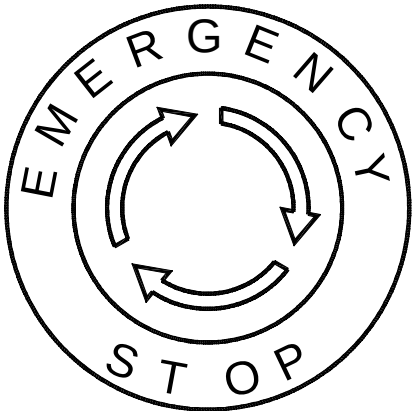


Fig. 1 (**E-STOP twist to release)**

5.5 Normal 'Local' operation starting procedure

5.5.1 Starting the engine

Pre start checks

a) *Ensure the Inline selector (021-059) is in the 'dump' or return to tank position.*
b) *Ensure the open ended, high-pressure hose is in a safe position, preferably within sight of the operator at the control panel.*
c) *Ensure the initial engine speed is set to idle by pushing the vernier throttle control fully inwards.*
d) *Ensure the local emergency STOP button on the control panel is unlatched, i.e. in the 'Out' position. (Hold and turn Clockwise)*

Indirect Injection Diesel Engine Key Start Module-Operating Procedure.

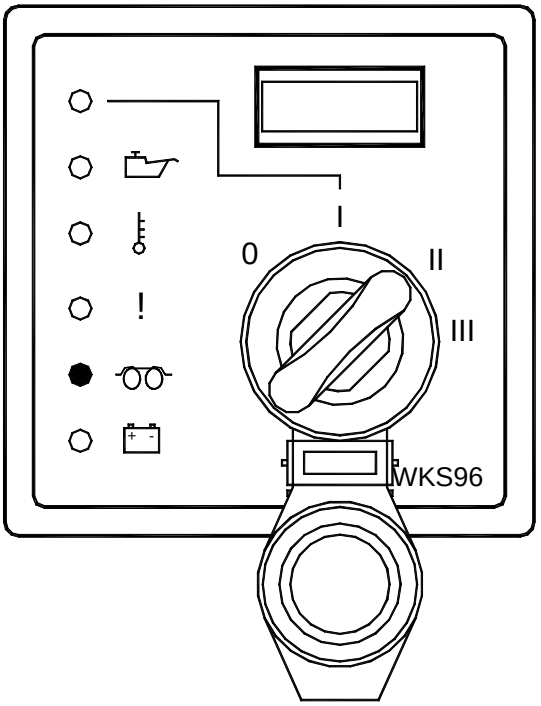


Fig. 2
(WKS96 type engine controller)

1. Key switch in stop position (0)
2. Turn Key to position (1) auxiliary circuits energized, LED illuminated.
3. For cold starting only, turn and hold the key in position (2) for 20 seconds, pre-heat circuit energized, LED illuminated. (See fig. 2)
3. Turn Key to position (3) to crank the engine (starter motor actuation).
4. Release the key immediately when the engine starts, it will return to position one (1) automatically.
5. Failure to adequately pre-heat the engine prior to starting may cause excessive wear or premature starter failure due to over cranking and a flat battery.

   Note: The system shutdowns are automatically overridden in the start sequence to allow to engine oil pressure to settle.

7. When the engine has started the CHARGE light (Battery symbol) on the engine controller should go out indicating that the alternator charge output is satisfactory (+12V min).

8. Water should now be circulating through the pump and be diverted back to the header tank, with the engine running at slow speed.
   Note: Allow the engine approximately 5 minutes to warm up.

9. To divert water to the high-pressure hose, move the Inline selector to the pressure position.
   Note: The engine speed can be finely adjusted by twisting the vernier throttle control 'anticlockwise' to increase and 'clockwise' to decrease.

10. To shut down the system, move the inline selector (021-059) to the ‘dump’ or return to tank position then turn the keyswitch on the engine controller to the (0) position. *Note: In emergency situations punch in the emergency stop button.*

5.5.2 Setting the operating pressure with a nozzle fitted

1. Fit the required nozzle to the high-pressure hose.
2. Ensure the nozzle is secured in a safe position, preferably within sight of the operator at the control panel.
2. Move the Inline selector over to the pressure position.
3. Observe the pressure gauge mounted on the control panel (See fig. 3). Adjust the engine speed, gradually until the required operational pressure is reached.

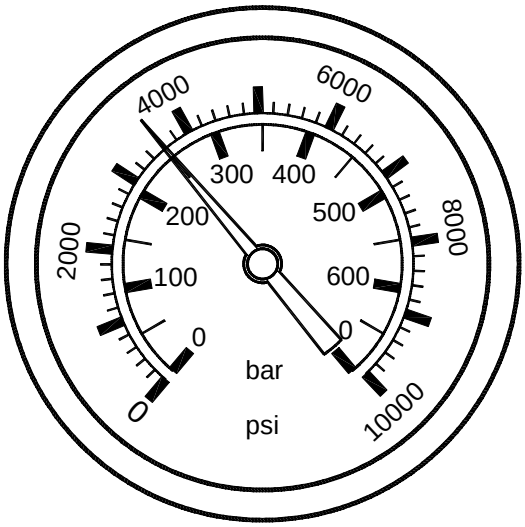


Fig. 3 (Pressure gauge dial)

Do not exceed either the maximum operating pressure or the maximum engine speed!

5.5.3 Setting the operating pressure with a gun fitted

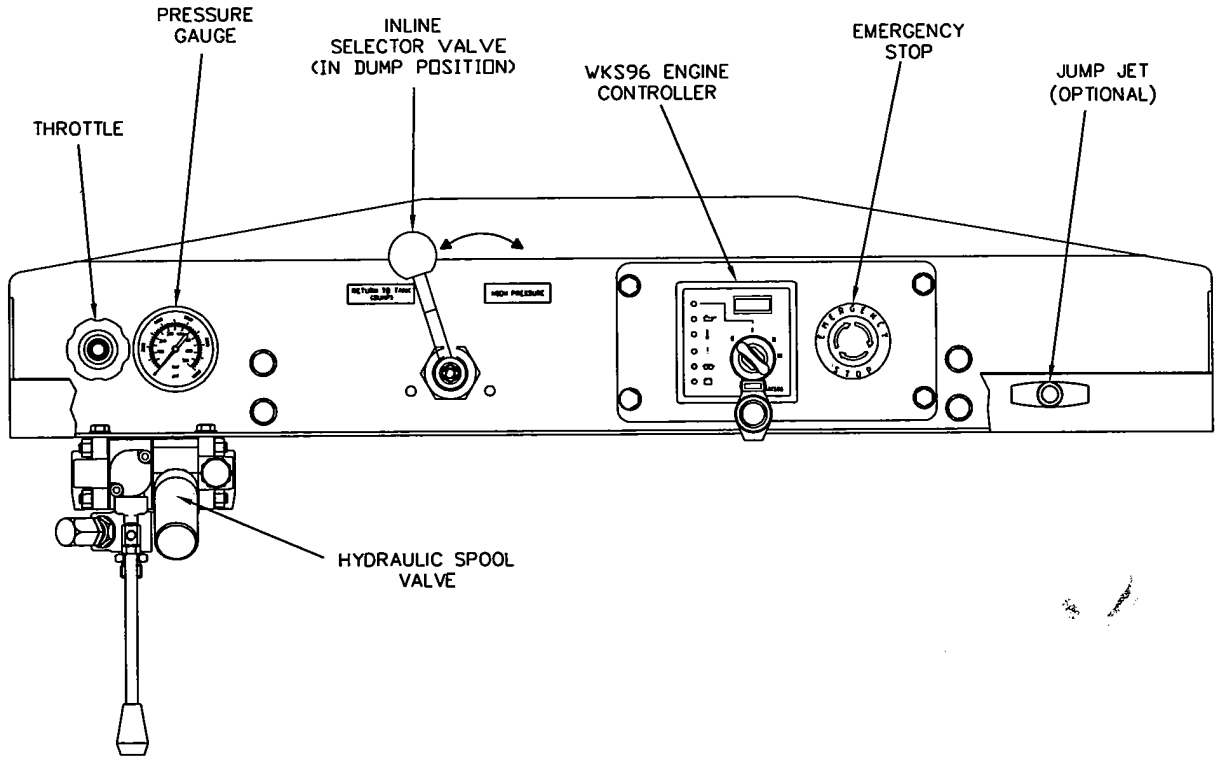
1. Fit the gun to the high-pressure hose.
2. Ensure the gun is held firmly held in the hand.
3. Move the Inline selector over to the pressure position.
4. Pull the gun trigger to commence jetting. If the pressure needs to be increased, release the trigger and increase the engine speed slightly.
   Pull the trigger again to check the increased pressure.
   In this manner, while observing the pressure gauge at the control panel gradually increase the engine speed until the required pressure is achieved. (See fig. 4).

   Do not exceed either the maximum operating pressure or the maximum engine speed!

Fig 4. (Control panel)

FLOWPLANT

Note: the layout may vary, depending upon the exact model of trailer.



JUMP JET (Optional - 057023, 057022)

This device enables the hose to travel further through pipes than with conventional jetting methods by creating a pulse in the water pressure. During normal drain cleaning, when the retro action of the jets can no longer pull the hose through the drain, reduce the engine speed, select jump jet and increase the engine speed to full.

5.7 Rapid shutdown

Should any unforeseen circumstances arise, including any signs of a leak, the jetting operation should be terminated immediately and the equipment shut down.

Depress the emergency STOP button on the foot switch or at the Control Panel.

Either will stop the engine. The depressed STOP button will latch in the OFF position.

To unlatch (and reset) the Stop button, twist clockwise and pull it out.

Automatic shutdown

The engine will shut down automatically if the monitoring and control system detects a malfunction.
Possible reasons for an automatic shutdown are detailed in Section 7 - Fault Finding.

5.8 Hose reel winding & unwinding

The high-pressure hose can be manually or hydraulically unwound and hydraulically wound by a powerful OMR315 hydraulic motor, which is driven by a gear pump from the engine PTO,
The motor is fitted to the hub of the hose reel. The motor speed and direction is controlled via a manually actuated spool valve.
(018-005 'Hydraulic Directional Control Valve' CV1185 c/w 110 bar relief and flow control)

The hose reel motor speed can be adjusted up and down by a flow control knob.

Pushing the lever inwards towards the pump set will wind the hose reel in, pulling the lever outwards will wind the hose reel outwards.

The normal practice is to unwind the hose by hand, only drawing off the required length of hose to reach the work site and then to wind the hose back in using the hydraulic motor.
It should be remembered that the hose cannot be wound using the hydraulic motor unless the engine is running.

Therefore - when a jetting operation is finished, wind in the hose before shutting down the engine.

- Wind in the hose before you intend to empty the water tanks.

5.9 Frost Precautions

During periods when there is a risk of freezing the following precautions should be taken:

Before a frost

1. Prepare 30 - 50% anti-freeze solution.
   Note: Depending on the severity of the weather conditions.

2. Remove nozzle or gun attachments from the delivery hose.

3. Lower the water level in the tanks using the drain valve imediately to right of the o/s wheel.

4. Pour anti-freeze solution into the water tanks.

5. Restart the engine and run at idle, pump anti-freeze solution through the high-pressure line and return line as required.

After a frost.

DO NOT ATTEMPT TO JET ANY REMAINING ANTI-FREEZE SOLUTION INTO A CONTAINER

Either;

Consider the antifreeze solution as expendable and merely refill the tank for the next jetting operation.

Or

With the engine switched off, drain the pump suction line into a container by unrscrewing the inline strainer bowl to the bottom left side of the pump.
Note: refer to section 8, for recommendations on bleeding the pump inlet.

SO YOU FORGOT TO TAKE PRECAUTIONS!

IF THE PUMP IS FROZEN UP - IT SHOULD ON NO ACCOUNT BE STARTED

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SECTION 7 – Fault finding

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7 Fault finding

Most of the problems experienced during jetting operations are likely to be caused by the pump or the associated hoses.
These types of problems are covered in the pump fault finding chart, which is repeated at 7.3 overleaf for convenience.

Also covered at 7.3 overleaf is a diagnosis of selector valve problems.

7.1 Shutdown problems

Most problems which can cause the unit to shutdown will be indicated by one of the fault lamps on the engine controller See fig.1 as follows:

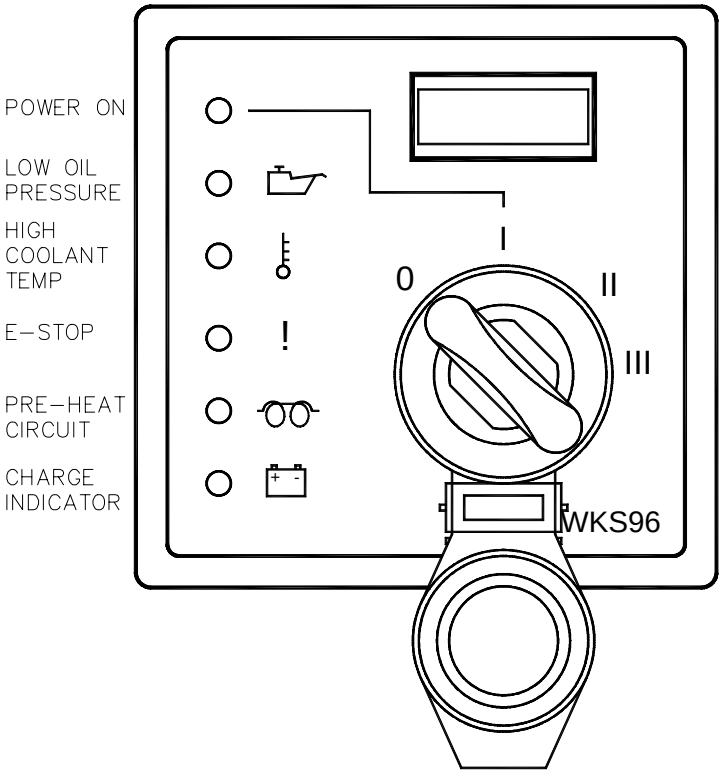
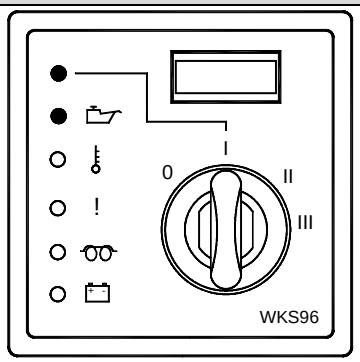
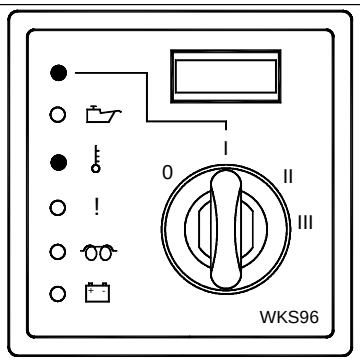
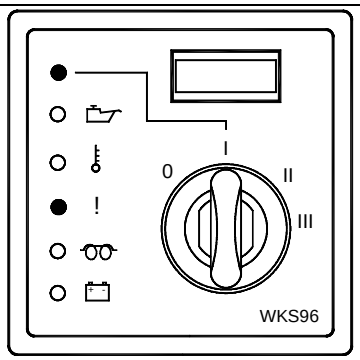
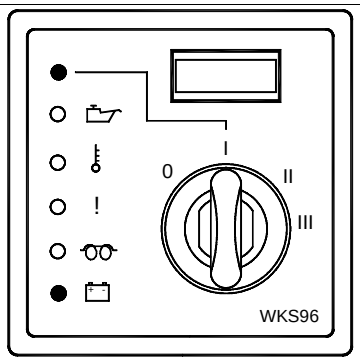


Fig. 1
WKS96 type engine controller
Note: shown in the 'OFF' position.

Note: The table below indicates potential problems and suggests an appropriate course of action.

Lamps	Condition	Solution
	Low oil pressure shutdown.	Check and replace switch if faulty. Check the oil pressure with a gauge, if the pressure is below the recommended guidelines, refer to the engine handbook for further advice.
	Water/coolant temperature shutdown.	Check and replace switch if faulty. Check the water temp in the radiator, if the temp is above the recommended guidelines, refer to the engine handbook for further advice.
	Emergency stop button in	Twist to release the button. *Note: Do not try to start or crank the engine in this position!*
	Charge warning indication, normal when engine is not running.	Check the alternator ‘V’ belt tension, tighten the belt if it is slack and slipping. Check the connecting terminals to the alternator. Check the engine idle speed, reset if necessary. Refer to engine handbook for further advice.

7.2 Equipment Fault Finding.

Problem	Possible Cause	Recommended Action
Low system pressure	1 Worn or incorrect size of cutting nozzle.	Replace the old jetting Nozzle with a new one.
	2 Engine speed slow.	Adjust to correct speed.
	3 Leaks from hose. Pipes and connections.	Check the connections for tightness, replace if needed
	4 Blocked inlet filter.	Clean or replace element.
	5 Inlet hose to long.	Shorten hose length.
	6 Loss of water through dump line of selector valve or gun when high-pressure selected.	Check seats and seals.
	7 Loss of water through dump line of remote control kit, if fitted.	Check seats and seals.
High System Pressure	1 Blocked nozzle, selector valve or gun.	Clean the items and flush out the delivery line.
	2 Incorrect nozzle size.	Replace the nozzle.
	3 Incorrect bore size.	Replace the hose.
	4 Engine speed high.	Adjust to correct speed.
	5 Crushed delivery hose.	Replace if necessary.
	6 Two gun choke left in gun when operating as single gun unit.	Replace with standard choke.
Low Water Level	1 Blocked or dirty pre-filters.	Clean or replace elements.
	2 Faulty ball valve assembly.	Replace if necessary.
	3 Wrong seat in ball valve assembly.	Replace the seat if necessary.
	4 Low inlet pressure.	Increase pressure.
Pump Not Running Evenly (also refer to pump faults).	1 Air in water.	Water bleed pump.
	2 Air in crankcase oil.	Oil bleed pump.
	3 Worn drive coupling.	Replace flexible elements and examine coupling.
	4 Faulty inlet or delivery valve.	Check valve condition.
	5 Valve nut over tightened.	Check tightness of inlet & delivery nut
Burst Disc failure or Safety Relief Valve Operating (also refer to high system pressure problem).	1 Incorrect burst disc.	Replace with correct disc.
	2 Incorrect valve setting.	Check certificate/setting.
	3 Faulty Valve.	Repair or replace if required.
	4 Faulty or fatigued burst disc.	Replace with new disc.

7.3 Pump Fault Finding.

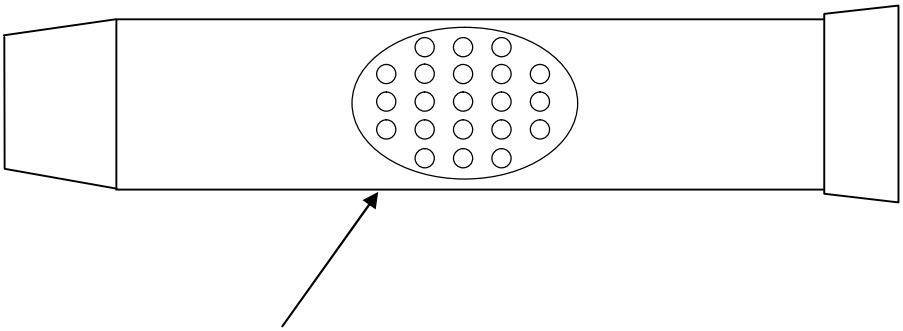
Problem	Possible Cause	Recommended Action
1 Mixing of Oil and Water in crankcase 2 Loss of pressure 3 Pump not running evenly	1 Worn or damaged delivery valves. 2 Damaged filter element allowing debris to jam delivery valve.	1 Check all delivery valves – replace as necessary. 2 Check all diaphragms – replace as necessary. 3 Replace oil. 4 Check filters – replace as necessary.
1 Loss of crankcase oil through high pressure hose 2 Loss of pump pressure 3 Pump not running evenly	1 Inlet restriction may have been caused through; a. Blocked filters b. Kinked inlet hose c. Worn or damaged inlet valves d. Excessive inlet hose length 2 Pump has been frozen	1 Clear restriction. 2 Check inlet valves – replace as necessary. 3 Check diaphragms – replace as necessary. 4 Replenish oil.
1 Mixing of Oil and Water in Crankcase	1 Diaphragm failure (may have been through fatigue from excessive running hours).	1 Check all diaphragms – replace as necessary.

PRESSURE DISC FAILURE CAN BE DUE TO:-

1. Blocked or partially obstructed jet. Remove jet and examine for obstruction. Take care when cleaning jets not to damage the edges of the hole.
2. Wrong jet fitted. Check the nozzle is sized correctly.
3. Wrong disc fitted. Check that the correct colour code disc is fitted. See section 6.5
4. Obstruction in selector, delivery line or gun. Strip and inspect parts as necessary.
5. Two gun dump choke left in gun when operating as a single gun unit. See section 11.8
6. When operating in hot climates a pressure disc rated one colour above may need to be fitted. Refer to FLOWPLANT.

DISTINGUISHING FEATURE OF FAILURE ON DIAPHRAGM

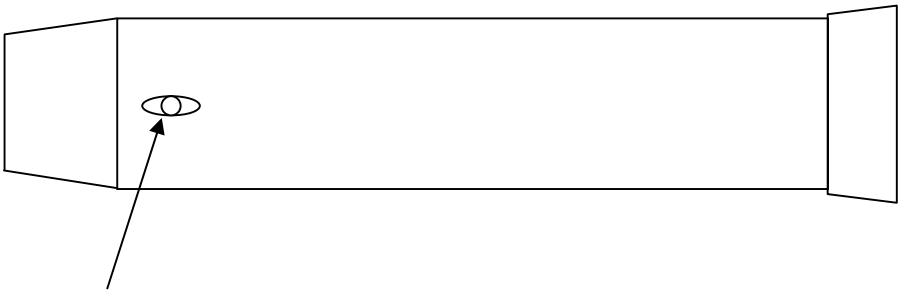
A



Impression of the baffle on diaphragm
Reason: It has been inflated

DISTINGUISHING FEATURE OF FAILURE ON DIAPHRAGM

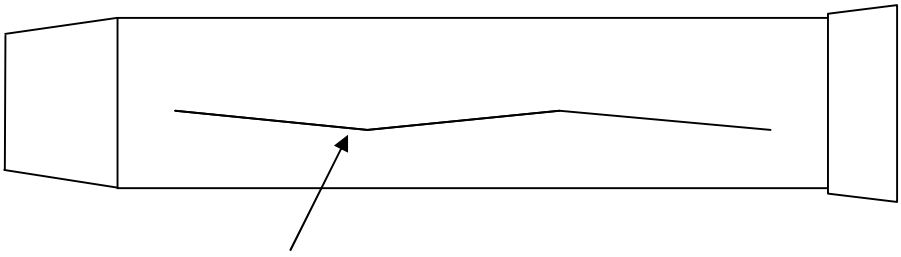
B



4 small impressions, cause more damage on the inside, than on the outside.
Reason: the diaphragm has pumped through mandrel delivery holes.

DISTINGUISHING FEATURE OF FAILURE ON DIAPHRAGM

C



SHEAR THROUGH WALL OF DIAPHRAGM

7.4 Inline selector - Fault Finding (See section 11.7)

Selector problem	Cause	Action
Loss of pressure and flow is down.	Water leaking through the worn seat back to tank.	Replace the seats and the plug if also damaged.
If water leaks along spindle and past lever.	O-ring and back up ring failure along shaft.	Replace O-ring and back up ring 013-021 & 023-001.
Water leaking along the gland nut thread.	Leaking selector seal.	Replace seal 012-095.

SECTION 8 – 'P' TYPE PUMP

Refer to the 'P' Type Pump service Manual Pt No. 061-352
Included with the unit.
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Section 9 – Circuit Diagrams

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The following circuit diagrams are included in this section:

9.1 Hydraulic circuit

This provides details of the units hydraulic circuit, the function of which is to power a hydraulic motor driven hose reel, winding high-pressure hose in or out whilst carrying out drain cleaning or other high pressure water jetting applications.

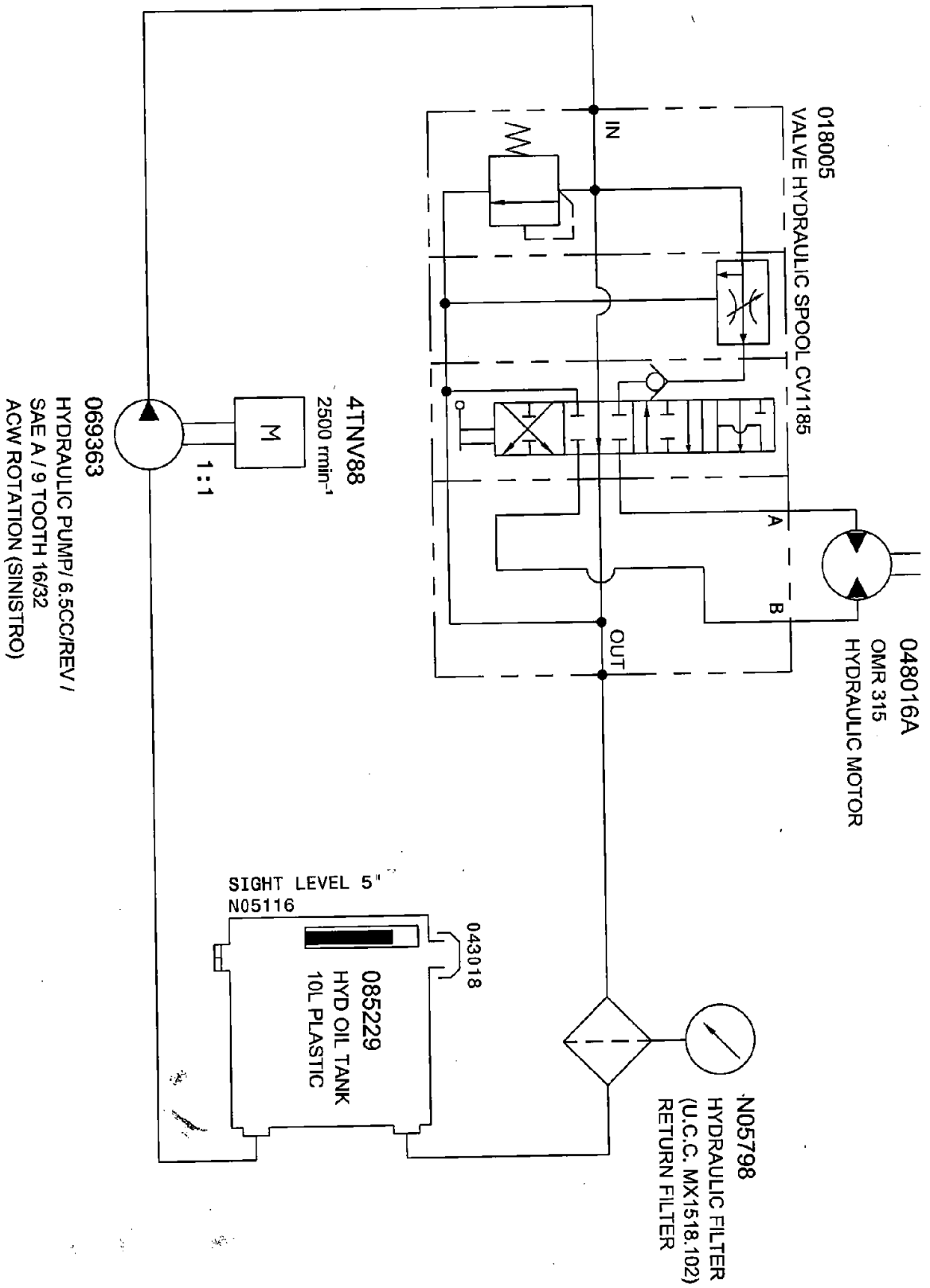
9.2 Water Circuit

This provides details of the water circuit, starting with the supply and ending with the delivery to the jetting application.

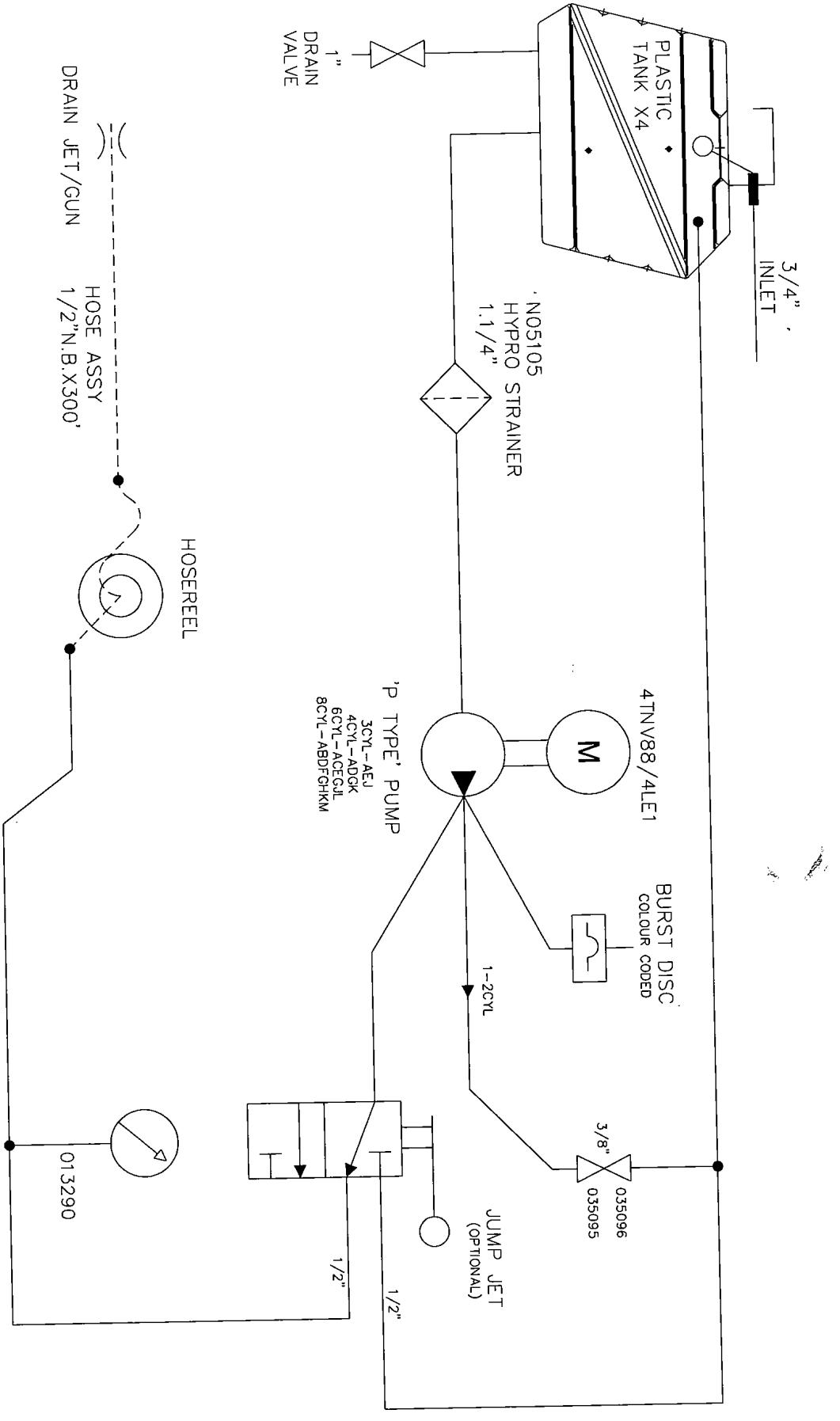
9.3 Wiring Diagram For Yanmar 4TNV88 Engine

This provides details of the wiring for the Yanmar TNV series engine and WKS 96 engine controller.

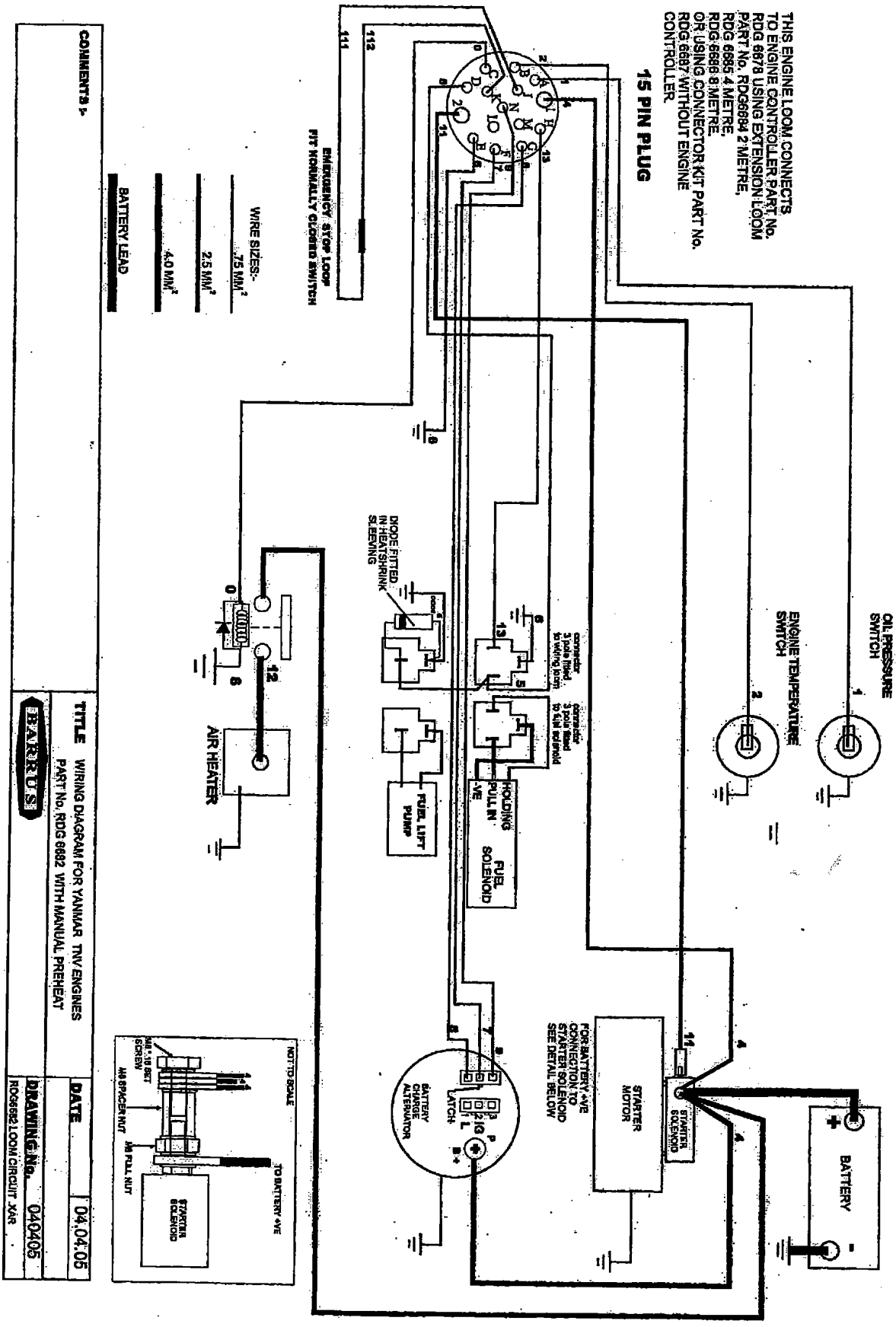
9.I Hydraulic circuit



9.2 Water Circuit



9.3 Wiring Diagrams



Section 10 – Diesel Engine

A copy of the Diesel Engine Manufacturer's Operators Handbook is supplied with this equipment
The information contained within this section is only designed to complement the handbook and is for general use only.

This page is intentionally blank.

If you require any further help with service or parts information, please contact the relevant department. **See below**

It is recommended that the user records the engine serial number in the box below at the earliest opportunity.
This will provide assistance in identifying the correct spare or replacement parts for this specific engine.

Engine Serial no:	

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Section 11
Parts lists / Spares

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11. SPARES ORDERING & RECOMMENDED SERVICE KITS

11.1 Introduction

This section includes advice on obtaining spare parts.

To identify consumable items and service kits you require you should use the information in this section. To identify components for the pump or engine etc, refer to the relevant parts in this manual.

11.2 Ordering spare parts

Order spare parts from:

Flowplant Group Ltd

Gemini house, Brunel Road,
Churchfields Industrial Estate,
Salisbury, Wiltshire, UK.
SP2 7PU.
Contact: *Eric Moore* (UK Spares)
Tel : +44 (0)1722 325424
Fax : +44 (0)1722 411329
Email : info@flowplant.com

FLOWPLANT GROUP
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Come visit our website:

WEB Site flowplant.com

HARBEN High Pressure Water Technology

AQUA hydraulics - the power of water

NEOLITH

When ordering, please state for each part required:

Assembly No. (See section 2, Scope of supply)
Part number and description of part required.
Drawing No. & parts list item number (If applicable)
Quantity required.

11.3 Routine Maintenance / Consumable items.

For routine maintenance the following will be required:

PUMP LUBRICATING OIL: SHELL TELLUS 150

Note: See section 8 for alternative manufacturers.

11.4 Consumable Components

Pt No.	Description
N06021	MESH 80 MICRON FOR LINE STRAINER N05105
	PRESSURE DISC (See section 6.5)

11.5 Accessories

Ancilliary Equipment

Pt No.	Description
055-021	HOSE ASSY 1/2" 91.44 M (300') STR/STR 1/2"BSPF

Guns/Lance

Pt No.	Description
031-040	GUN MARK 2 SAFETY 6000 psi (OPTIONAL)

Jet Inserts

Pt No.	Description
056-026	JET HIGH VELOCITY 2.1mm
056-180	JET FAN 15 DEG 15125 1/4" NPT S/S

General Accessories

Pt No.	Description
056-097	JET DRAIN 1/2"BSP 3 x 1.0mm @ 30 DEG
056-413	JET DRAIN 1/2"BSP 3R x 1FWD DIAMETER 1.0 at 30 deg
056-584	JET DRAIN 1/2" BSPM 6R x 0.8mm @ 30 deg HARBEN
013-290	PRESSURE GAUGE 10,000 psi
055-093	HOSE ASSY LEADER 1/2"BSPM 1/2"BSPF 3.05 M
023-227	MINI JET KIT 20' COMPLETE MAX. W.P. 6000 psi
060-133	JET DRAIN H/E 6 x 0.8mm REAR
056-671	JET HE 1/2" 3 REAR x 0.8, 0.9 FWD
057-041	KIT JUMP JET 6 & 8 CYL PUMPS `P'TYPE

11.6 021-059 Inline Selector ½" BSP

Item	Part No.	Description	Quantity
1	012095	SEAL SELECTOR GLAND	1
2	013021	O RING BS111/90	1
3	013039	ADAPTOR 1/2'BSP M/M 415BAR	1
4	013140	PLUG BLANKING 1/4"BSP	1
5	013389	WASHER PLAIN M6 FORM A M/S ZN	1
6	021001	SUPPORT FOR SELECTOR	1
7	021003	GLAND NUT	1
8	021016	SEAT SELECTOR	2
9	022007	LEVER SELECTOR	1
10	022008	FITTING SELECTOR BRASS	2
11	022009	GUIDE SELECTOR	2
12	022016	PLUG SELECTOR	1
13	022017	SPINDLE ECCENTRIC	1
14	023001	BACK UP RING BS111 SOLID	1
15	023002	KNOB PLASTIC 1032 M8 (SELECTOR LEVER)	1
16	023004	NUT NYLOC M6-1.0 6H HT 8.0 ZN	1
17	033010	SEAL BONDED 1/2" BSP 400-825-4490-41 448	1
18	033012	SEAL BONDED 1/4" BSP 400-821-4490-41 616	1
19	033027	BODY INLINE SELECTOR	1

RECOMMENDED TOOLS

Part Number	**Description**
054-041	Grease

SERVICE KITS

Overhaul: Spindle Assembly **(024-037)**

Part Number	**Description**	**Quantity**
022-016	Plug	1
021-016	Seat	2
013-021	O-ring	1
023-001	Back Up Ring	1
054-041	Grease	1

With different parts, the selector is used as the standard Hoverclean selector, the Inline Selector or the Manifold selector. Before attempting to overhaul the selector, the machine must be switched off and the hoses to the selector disconnected.

TO DISMANTLE

1. Unscrew and remove GLAND NUT (7). The SHAFT ASSEMBLY will be removed with the GLAND NUT (7).
2. Unscrew and remove SELECTOR FITTINGS (10) with SEATS (8) fitted.
3. Remove PLUG (12) and both GUIDES (11).
4. To inspect O-ring (2) and BACK-UP-RING (14); unscrew NUT (16) and remove with WASHER (5).
5. Pull SPINDLE (13) out of GLAND NUT (7).
6. Remove SEAL (1), SUPPORT (6), O-ring (2) and BACK-UP-RING (14).
7. Inspect all items for wear or damage, replace as necessary.

TO ASSEMBLE

1. Place the support (6) and SEAL (1) over the SPINDLE (2) as shown on drawing.
2. Insert BACK-UP RING (14) and O-ring (2) into GLAND NUT (7) as shown on drawing.
3. Insert SPINDLE (13) into GLAND NUT (7).
4. Place LEVER (9) over the protruding end of the SPINDLE (13).
5. Replace WASHER (5) and NUT (16) .
6. Press GUIDES (11) into BODY (19).
7. Insert PLUG (12) into BODY, taking care to align it correctly.
8. Grease threads of SELECTOR FITTINGS (10) and replace with SEATS (8) fitted, into BODY (19). *Note: Torque to 39Nm*
9. Insert SPINDLE ASSEMBLY into the BODY (19), when the SPINDLE eccentric is properly located into PLUG (12) the GLAND NUT (7) may be tightened. Check the LEVER (9) moves freely.
   IMPORTANT
10. The LEVER must be checked in the ‘pressure’ and recycle (dump) modes.
11. Reconnect hoses.

FAULT FINDING

If there is a loss of pressure and flow is down check SEATS (8) as they may be worn.

The PLUG (12) may also be damaged and need replacing.
If water leaks along GLAND NUT (7) thread, check selector SEAL (1) and replace.

If water leaks along SPINDLE (13) and past LEVER (9), inspect and replace O-ring (2) and BACK-UP RING (14)

ASSEMBLY NOTE: USE PERMA BOND 113 GRADE A TO RETAIN KNOB (15) ON LEVER

FLOWPLANT

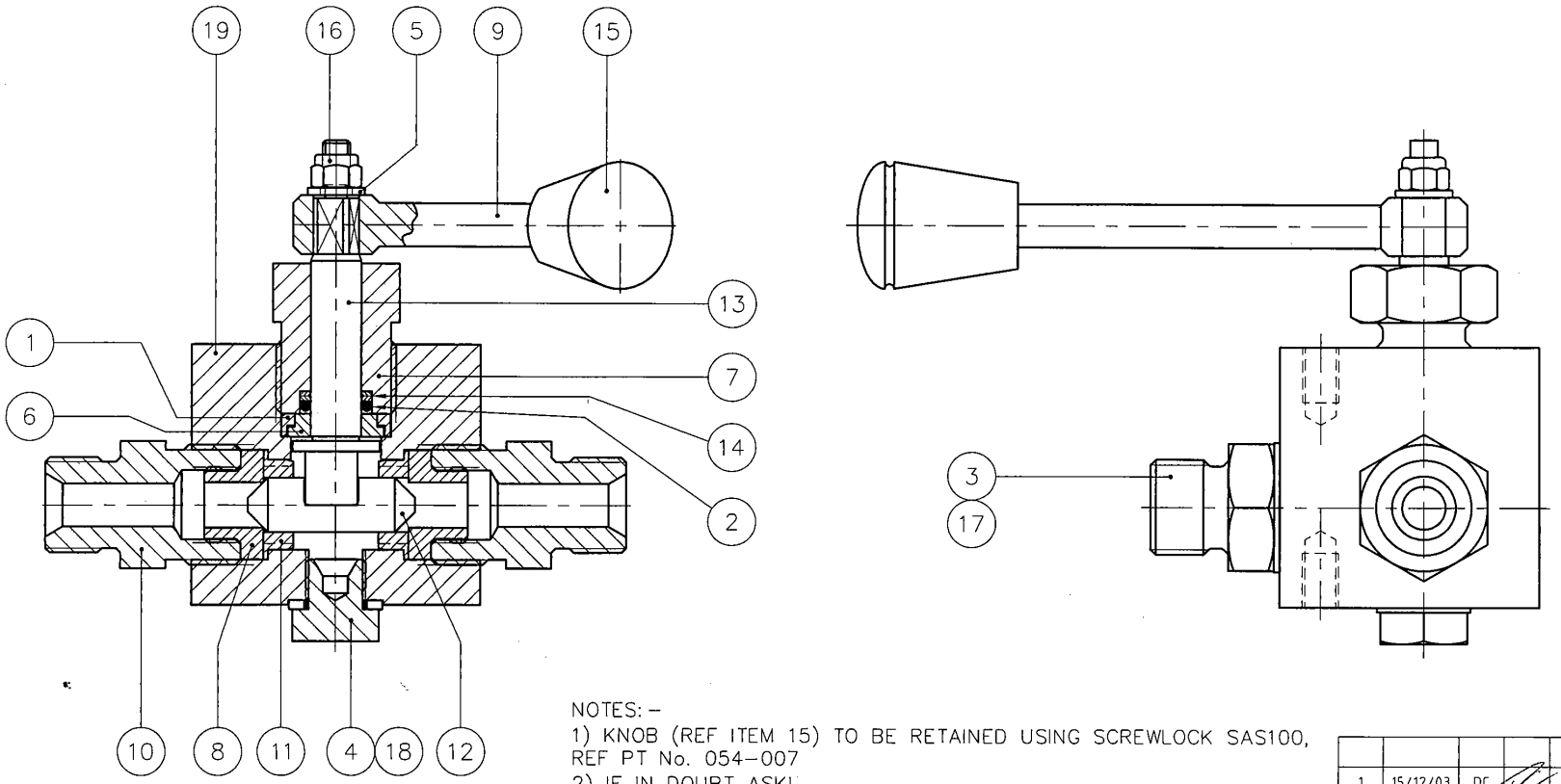
DO NOT SCALE
IF IN DOUBT ASK !

MANUFACTURERS UNABLE TO COMPLY MAY SUBMIT ALTERNATIVES WHEN QUOTING.

ALL DRAWINGS NOT TO THE LATEST ISSUE ARE TO BE DESTROYED.

PARTS LIST

ITEM	PART NO.	DRG. NO.	QTY	DESCRIPTION	REMARKS



NOTES: –
1) KNOB (REF ITEM 15) TO BE RETAINED USING SCREWLOCK SAS100, REF PT No. 054–007
2) IF IN DOUBT ASK!

ISSUE	DATE	DRN	CHK	STATUS
1	15/12/03	DC		NEW DRG

FLOWPLANT GROUP
LEADERS IN CLEANING TECHNOLOGY

Flowplant Manufacturing Ltd.
Watt Road, Churchfields, Salisbury, Wiltshire. SP2 7UD
England.
Tel: (01722) 325424 Fax: 01722 411329

TOLERANCES TO BE AS SPECIFIED BELOW UNLESS OTHERWISE STATED

OVER	0	30	100	300	1000	2000
UP TO AND INCLUDING	30	100	300	1000	2000	

* DELETE ONE RANGE: * FINE MACHINING / * MEDIUM MACHINING

FABRICATION / UNMACHINED

ALL DIMENSIONS IN MILLIMETRES
GEOMETRICAL TOLERANCES TO BS 308
ANGULAR DIMS TO BE WITHIN:-
MACHINED ± 0.5° BENDING ± 2°
THREADS: BSP: TO MED. FIT. B.S. 2779
ISOMETRIC TO 6g / 6H

SURFACE ROUGHNESS: 1.6 MICRONS Ra
CONCENTRICITY TO WITHIN 0.2 T.I.R.
M/C RADII 1.5
DRILLED HOLES +0.13/-0.00
HOLE CENTRES TO BE ± 0.2
REMOVE ALL BURRS & SHARP EDGES.

SUPERSEDES/
SUPERSEDED BY

CALC

MATL.

SPEC / PART NO.

SIZE.

FINISH. SPEC OOR:
[SELF FINISH]

HEAT TREATMENT.

DRAWN D CLARK	DATE 15/12/03	TITLE	SELECTOR ASSY INLINE 1/2" BSP
APPROVED	DATE		
CHECKED	DATE 13/6/06		
SCALE 1 : 1	CALC		
WEIGHT N/A Kg	TEST	DRG NO.	021-059/3.1
PROTECTION		PART NO.	021059

7001915 Frame and Chassis Assembly		
Component	**Description**	**Qty .**
013349	CLIP "R"	3
023569	PIN CANOPY RETAINER	3
028038	LABEL SET -----ALL UNITS	1
041029	GROMMET 25.4M/M BLACK PVC BLANK	2
041033	STUDDING M8 ZINC PLATED [PER METRE]	2
043079	SUPPORT STAY 6529 - PROP ROD FOR DTX2 CANOPY	1
043139	GROMMET BLACK RIBBED 80 x 40	4
047213	WHEEL 5.50x14 / 5 STUD 152.4 M12 TYRE 185R14 C 8PR	4
044215	CHASSIS TRAILER DTX2	1
081174	T BAR SINGLE HEIGHT DOUBLE AXLE ASSEMBLY 3000KG CAPACITY (KIT) DTXII	1
089086	FRAME CANOPY 'R CLIP TYPE CANOPY' DTX2	1
089087	CANOPY 'R CLIP TYPE' ROOF DTX 2	1
061730	LABEL WARNING TRAILER MAINTENANCE' DTXII/DT8150	1
061488	LABEL SOUND POWER LEVEL 114 DBA	1
061352	MANUAL P-PUMP/ HI LIFT	1
061635	LABEL WARNING! MACHINE OPERATION	1
061093	LABEL "DANGER" TRI LINGUAL	1
061703	LABEL 'MANUFACTURED BY FLOWPLANT GROUP LTD'	1
0422487	BRACKET DTB500 NUMBER PLATE	1
082143	NUMBER PLATE MOUNTING BRACKET	1
7001914 - Pressure Assembly		
Component	Description	Qty .
049016	HOSE FEED GUIDE ASSEMBLY DTX MK2	1
013039	ADAPTOR 1/2" BSP M x 1/2" BSP M 415 BAR C-TXT	5
013290	GAUGE PRESSURE 10000 PSI C/W RESTRICTOR	1
021087	ADAPTOR 1/4" PRESSURE GAUGE STAINLESS STEEL 700 BAR	1
023011	ANGLE SWIVEL JOINT 90 DEG 1/2" BSP M/M 415BAR	1
032194	ADAPTOR 3/4"BSP M x 1/2"BSP F FIXED 900BAR S/S	1
048110	HOSEREEL DRUM P TYPE BOLTED FLANGE	1
048005	BEARING HOSE REEL HYD P TYPE	1
048103	TUBE WATER OUTLET FOR HYDRAULIC HOSE REEL N15-142 AND 048-110	1
061067	WASHER SEATING FOR 1/4"BSP GAUGE	1
085013	TUBE DELIVERY DTX MK2	1
078773	OUTER FLANGE HOSE REEL	1
048010	SPACER 30MM LG HOSE FEED GUIDE HYD REEL P TYPE	1
013014	ADAPTOR 1/4" BSP M x 1/4" BSP M 415 BAR	1
061107	CLAMP HOSE 16MM 3016 PP HEAVY DUTY	4
048038	STAY HOSE REEL FRAME DTX MK2	2
048036	FRAME HOSE REEL HYDRAULIC DTX MK2	1
011046	PRESSURE DISC WHITE 4000 PSI	11

7001913 - Miscellaneous Assembly		
Component	**Description**	**Qty .**
023362	ADAPTOR 1/2"BSP M x 7/8"-14 JIC M 415BAR	3
033005	ADAPTOR 3/8" BSP M x 3/8" BSP M 415 BAR	5
033006	ADAPTOR 1/2" BSP M x 3/8" BSP M 415 BAR ZN	8
033010	SEAL BONDED 1/2" BSP 400-825-4490-41 448 BAR SELF CENTRALISING	20
033013	SEAL BONDED 3/8" BSP 400-823-4490-41 492 BAR SELF CENTRALISING	9
033069	HOSE ASSY 1/2" 00.64M STR/ELB 1/2"BSPF SAE100R2AT	1
055109	HOSE 2" RUBBER DH531-51B [PER METRE]	0.5
055175	HOSE ASSY 3/8" 00.38M STR/ELB 3/8"BSPF EN 853 2SN	2
055290	ELBOW 90 DEG 1 1/2" BORE RUBBER	8
055293	HOSE ASSY 1/2"1.05M STR/ELB 1/2" BSPF EN 853 2SN	1
055335	HOSE ASSY 3/8" 1.75M ELB/ELB 3/8"BSPF EN 853 2SN	1
055336	HOSE ASSY 1/2" 0.57M STR/ELB EN 853 2SN	1
061106	CLAMP HOSE 25MM HEAVY DUTY	1
061033	SPACER PACKING D.T.T.	6
N05386	LINK HOSE E 1/4" R2AT X 8 1/2" COMPACT ELB/ELB	1
033014	SEAL BONDED 3/4" BSP 400-827-4490-41 420 BAR SELF CENTRALISING	4
078417	EXTENDED HEX NUT M8	1
014041	CHAIN JACK PER METRE	0.9
055288	HOSE ASSY 3/8" 0.60m ELB/ELB 3/8" BSPF EN 853 2SN	1
055293	HOSE ASSY 1/2"1.05M STR/ELB 1/2" BSPF EN 853 2SN	1
023363	ADAPTOR 3/4"BSP M x 7/8"-14JIC M 345 BAR	1
012061	PLUG BRASS FLANGED 1/2" BSP	2
7001912 - Hydraulic Assembly		
Component	Description	Qty .
018005	VALVE SPOOL HYD FLOW CONTROL CV1185 (SEE NOTES)	1
048016A	MOTOR HYDRAULIC DANFOSS OMR 315	1
048037	TANK HYDRAULIC OIL DTX MK2	1
069363	HYDRAULIC PUMP/ 6.5CC/REV /SAE A/ 9 TOOTH 16/32	1
106024	FILTER OIL RETURN UCC/UC/A.611 101 341	1
7001911 - Tank Assembly		
Component	Description	Qty .
012011	LOCKNUT 1 1/2"BSP BRASS	8
013193	O RING BS231/70	8
028109	COVER WATER TANK YELLOW	3
035077A	POLY FLOAT 6" X 5/16"	1
035210	VALVE BALL FLOAT VALVE 3/4" HP 300 PSI	1
042363	TANK WATER N/SIDE YELLOW DTX MK2	2
042364	TANK WATER O/SIDE YELLOW DTX MK2	2
043281	FITTING BRASS WATER TANK DTX MK2	6

085012	STIFFENER WATER TANK DTX MK2	8
085021	MOUNT BALLCOCK DTX MK2 DTW & DTV	1
058162	PIPE 1.1/4" N.B. x SCH40 1.1/4" BSP M/M x 330 LG	1
035072	VALVE 1 1/4"BSP T PORT 500PSI FIG 2000 S/R TYPE 98 ALBION	1
013054	HOSE CLIP DIA 30-50 JCS HI-TORQUE S/S	17
013316	HOSE CLIP DIA 44-64 JCS HI-TORQUE S/S	2
035102	VALVE BALL 1 1/4" X 1 1/4" PORTS L.P.	1
0781017	BLANKING PLUG DTXII TANK INSERT	2
061278	CLAMP DIA28 STAUFF TYPE (SUP. CODE 428 PP)	4
033103	ADAPTOR 1"BSPM X 1"BSPM 210BAR (SAME AS N01-570)	4
0422692	SPACER 28MM PIPE CLAMP STAUFF 10MM THK TO SUIT 061278	8
035298	BALL VALVE 1" BSPP 316 STAIN.S FULL BORE LOW PRESSURE (PN63)	2
0231511	INSERT HOSE 90DEG 1 1/2" BSP FEMALE SWIVEL	4
0231198	ADAPTOR 1 1/2" BSPM x 1" BSPM 316 STAIN.S 210 BAR WP	4
0231445	ADAPTOR GEBERIT UNION 1" BSPF TO 28MM FEMALE PIPE STAIN.S 316 16 BAR 35353 CIIR O-RING	4
058231	TUBING GEBERIT 28MM OD STAIN.S 316 39205 CUT METER LENGTHS	1.5
033015	SEAL BONDED 1.0" BSP 400-830-4490-41 312 BAR SELF CENTRALISING	12
A041282	SEAL BONDED (DOWTY) 1 1/2" I/D BSP SELF CENTRALISING	4
7001910 - Supply/Return Assembly		
Component	**Description**	**Qty.**
011156	ELBOW INLET MANIFOLD (1 1/4" INLET)	1
011157	TUBE SUPPORT 1 1/4" INLET HOSE P PUMP	1
013046	ADAPTOR 3/4" BSP M x 1/2" BSP M 345 BAR	1
013266	SEAL DOWTY 1 1/4"BSP SELF CENTERING	12
023025	INSERT FOR HOSE SWAGED 1/2"BSP FEM	2
023041	O CLIP 3/4"	2
023047	HOSE CLIP DIA 30-40 JCS HI-GRIP S/S	2
N01518	INSERT 1/2"BSP F 90 DEG COMPACT (PUSH IN) ZINC 415 BAR	2
023379	ADAPTOR BHEAD 1 1/4" BSPM x 1 1/4" BSPM 210 BAR C/W NUT	1
035102	VALVE BALL 1 1/4" X 1 1/4" PORTS L.P.	1
0422682	BRACKET HYPRO STRAINER SUPPORT YANMAR DTXII MK2	1
043196	ELBOW 90 DEG. THREADED 1 1/4" BSPF UPVC	2
043222	INSERT HOSE 1 1/4"BSPM X 32 MM DIA HOSETAIL UPVC	3
043235	ADAPTOR FLANGED 1 1/4"BSPM X 1 1/4" BSPM UPVC	2
055024	HOSE 1/2" P.V.C. CLEAR BRAIDED [PER METRE] HDPVC12	3
055063	HOSE 1 1/4" HELIFLEX [PER METRE]	2
N05105	LINE STRAINER 1 1/4" (HYPRO)	1
013375	LOCKNUT 1 1/4"BSP UPVC	1
021063	ADAPTOR 1 1/4"BSP M x 1 1/4"BSP M 210BAR	2
N01282	ELBOW 1 1/4 BSP MXF MALLEABLE GALV	1
013224	ADAPTOR BHEAD 1/2" BSPM x1/2"BSPM 415BAR C/W LNUT	1
023847	ADAPTOR 1.1/4" BSP M/F SWIV 2B/20	1

021071	TEE 1" BSF F FIX GALV	2
7001909 - Anti-Freeze Assembly		
Component	Description	Qty .
085331	TANK ANTI-FREEZE DTXII - POLYPROPYLENE	1
N01810	DRAIN PLUG 1/2 BSP MAGNETIC	1
043018	CAP HYD/FUEL TANK	1
033010	SEAL BONDED 1/2" BSP 400-825-4490-41 448 BAR SELF CENTRALISING	4
013039	ADAPTOR 1/2" BSP M x 1/2" BSP M 415 BAR C-TXT	3
090028	STRAINER "Y"-BRANCH 1/2" BSPT BRONZE	1
0231063	1/2"BSP MALE X 1/2" HOSE INSERT	2
055024	HOSE 1/2" P.V.C. CLEAR BRAIDED [PER METRE] HDPVC12	2
023025	INSERT FOR HOSE SWAGED 1/2"BSP FEM	2
023041	O CLIP 3/4"	2
0231060	1/2"BSP X 1 1/4BSPT MALE/MALE 215 BAR	1
043075	VALVE 1/2"BSP SHUT OFF 250PSI TYPE 750 R751T	1
0422691	COVER ANTI FREEZE TANK DTXII MK2	1
7001908 - Electrical Assembly		
Component	Description	Qty .
042727	PANEL INSTRUMENT YANMAR DTX2	1
051557	THROTTLE CABLE/TWIST LOCK/6 FT/RDB/ BPP 1004/6'0"	1
061434	LABEL "E-STOP" SELF ADHESIVE	1
071001	BATTERY 12V HEAVY DUTY TYPE 644	1
071367	E-STOP TWIST TO RELEASE including NC ACTUATOR.	1
089040	PANEL REAR, CONTROLS DTX2	1
104115	BRACKET BATTERY DV UNIT	1
071141	LEAD BATTERY 610mm NEGATIVE 12v	1
0421743	THROTTLE BRACKET FOR YANMAR TNV ENGINE	1
0422678	DTXII LIGHT PACKER LHS (OPP HAND)	1
0422679	DTXII EXHAUST CLAMP	1
0711033	LIGHT REVERSE LED 12/24VDC 81WM	1
0711021	13 PIN PLUG ADAPTOR, 13 PIN TRAILER 7 PIN CAR 0-695-69	1
071988	PLUG 13 PIN TRAILER P13PN	1
0711036	LIGHT/REFLECTOR FRONT LED 12/24VDC 44WME	2
0711032	LIGHT FOG LED 12/24VDC 81FM	1
071008	REFLECTOR TRIANGLE	2
0711029	LIGHT REAR COMBINATION INDICATOR/TAIL/STOP 151BAR	2
0711031	LIGHT REGISTRATION LED 12V BRITAX L868.00LDV	2
014153	REFLECTOR SIDE MARKER(EEC APPROVED)SCREW ON TYPE	4
0422677	DTXII LIGHT PACKER LHS (AS DRAWN)	1
7001907 - Tank Assembly		
Component	Description	Qty .
0421545	FILLER FLANGE - 2" O.D. DTX2 FUEL TANK	1
0421546	FILLER BRACKET FOR CAP DTX2 PLASTIC FUEL TANK	1
043018	CAP HYD/FUEL TANK	1

043073	FITTING SIGHT TUBE 1/4"BSP	1
043022	CORK GASKET TO SUIT 043018 FUEL CAP	1
085210	TANK FUEL REAR PLASTIC FOR DTX2	1
0421873	FUEL PUMP/RELAY SUPPORT DTB 500	1
023082	INSERT HOSE 3/8" BSP 90 DEG FEMALE	2
033006	ADAPTOR 1/2" BSP M x 3/8" BSP M 415 BAR ZN	2
033010	SEAL BONDED 1/2" BSP 400-825-4490-41 448 BAR SELF CENTRALISING	3
053175	HOSE FUEL 8MM ID	4
043071	TUBE SIGHT 1/2"O/D POLYCARBONATE 6FT LENGTH NB. DO NOT CUT THIS ITEM ANY SHORTER THAN 6FT.	1
043061	HOSE CLIP DIA 9.5-12 JCS HI-GRIP S/S	8
N01810	DRAIN PLUG 1/2 BSP MAGNETIC	1
7001906 - Pump and Engine Assembly		
Component	Description	Qty .
020020AAB	PUMP BARE SHAFT P 8 X 22 EN57 4000PSI	1
021032	GEARBOX HARBEN 2.0:1	1
021059	SELECTOR ASSEMBLY INLINE 1/2"BSP	1
071026	LEAD BATTERY 1070mm POSITIVE 12v	1
071218	JUMP LEAD ASSEMBLY DTX 2	1
012184	ADAPTOR PLATE SAE4-SAE5 HATZ, YANMAR, ISUZU	1
021020	BELL HOUSING PERKINS MACHINED	1
028098A	SILENCER PERKINS 3152 DTW SELF COLOUR	1
052312	ENGINE YANMAR 4TNV88-DSA	1
053002	EXHAUST CLAMP 1 7/8"	2
053155	EXHAUST TAILPIPE	1
044101	SUBFRAME ENGINE YANMAR DTX2	1
0421856	SUPPORT BRACKET EXHAUST 4TNV	1
016136	COUPLING E140 PT10 YANMAR 3TNE78/4TNE78 7.5" SAE	1
023093	COUPLING PART 4 B140 BORE 30MM KEY 8MM MACHINED	2
023088	COUPLING Pt1 B140 O'SIZE FLEX BORE 30 KEY 8	1
028202	FLANGE ADAPTOR EXHAUST DTB YANMAR C-TXT	1
A0300352	FASTENER EXHAUST CLAMP 2.1/8	2
0422199	ENGINE FOOT FRONT YANMAR 4TNV88 DTX 2 TRAILER	2
0422200	ENGINE FOOT REAR YANMAR 4TNV88 DTX 2 TRAILER	2

MK2 SAFETY GUN

The Flowplant Mk2 Safety gun is suitable for most types of cleaning tasks and benefits from:

- A well balanced design
- Fail safe characteristics
- Low trigger loads
- Multi-gun operation capability
- Ease of maintenance
- Proven reliability
- Shoulder stock available

MK2 SAFETY GUN - Part No. 031-040

Max working pressure - 420 bar (6000 psi)

Max Flow - 60 lpm (13 igpm)

Weight (approx) - 3.9 kg (exc. shoulder stock)

Max Water Temp - 45° C

Note this temperature can be increased to 70°C with the addition of a special hot water conversion kit: 024-012. Always wear suitable protective clothing when handling hot surfaces.

Safe Working Reference Chart

The chart on page 2 highlights the safe working pressures of typical jet sizes in relation to working pressure and flow.

For applications where the reaction force of the gun is greater than 150N, as indicated by the shaded area on the graph, a shoulder stock kit (700-1931, *see page 3*) shall be used and can be supplied with the gun, or separately to be retro-fitted.

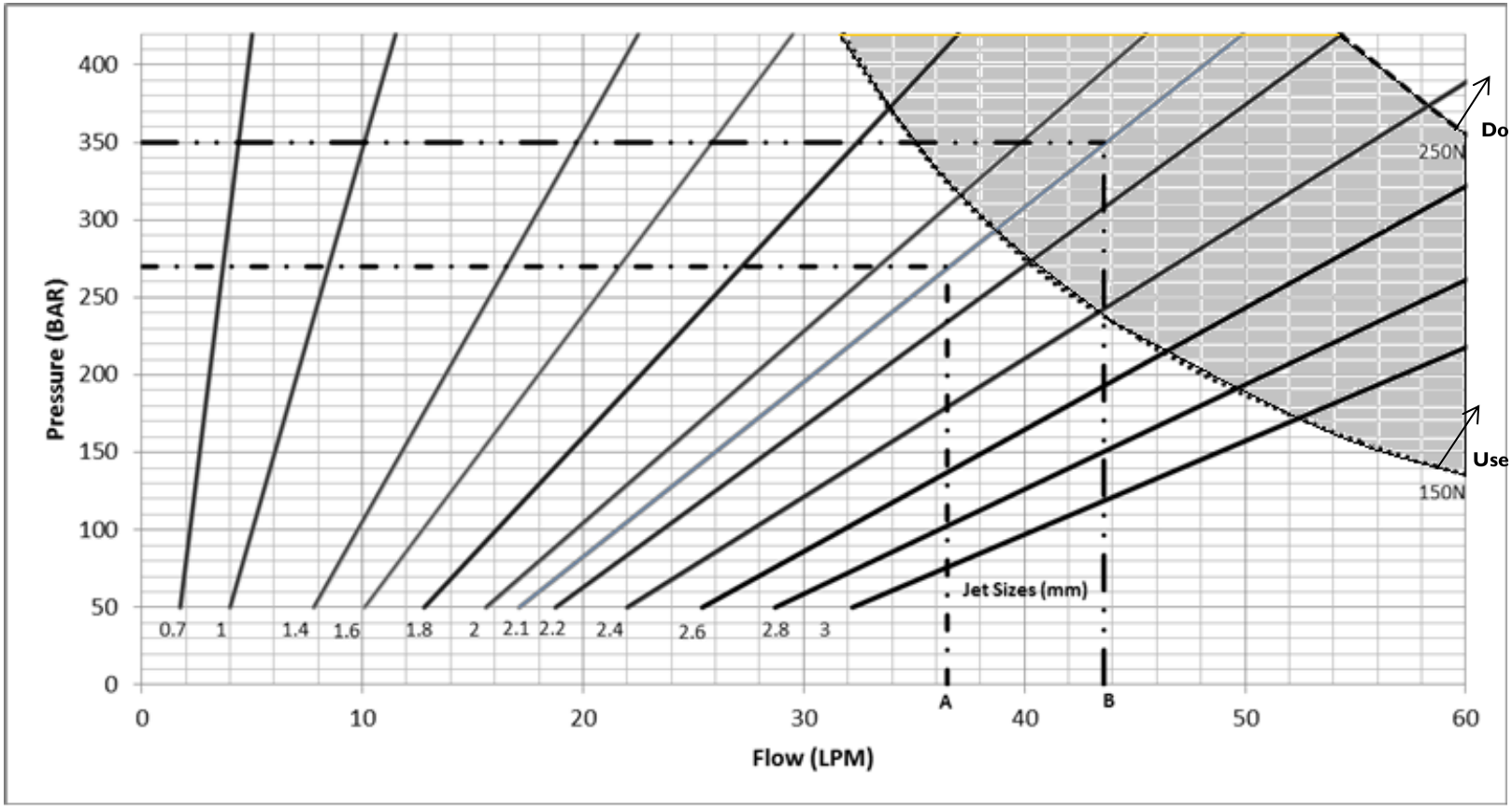
For applications where the reaction force of the gun is greater than 250N, as indicated on the graph, the gun must not be used.

IMPORTANT: This chart is to be used as a guide. If you have any queries or are unsure of the performance of your unit please contact Flowplant on the details below.

IMPORTANT! Before using this equipment; please ensure that you have undertaken the proper training and are fully conversant in the use of high-pressure water jetting equipment. You must follow the 'SAFETY CODE OF PRACTICE' at all times, failure to do so could result in injury or death to persons. You must also read and adhere to the safety awareness sheet 061-577 supplied with this equipment Copies of the code of practice and specialist training are available from:

Flowplant Group Ltd, Brunel Rd., Churchfields, Salisbury, Wilts. SP2 7PU
Tel: (0) 1722 325 424

Safe Working Reference Chart



Examples

A – Running a 2.1mm jet @270 BAR gives a reaction force less than 150N and uses 36 l/min

B – Running a 2.1 mm jet @ 350 bar gives a reaction force greater than 150N and uses 44 l/min

Gun Shoulder Stock *700-1931*

The Flowplant Gun Shoulder Stock connects to Flowplant MkII guns and offers a system which allows the operator to work for longer by spreading the reaction force of the gun to the shoulders as well as the arms.

It provides a cost effective solution in a neatly engineered package.

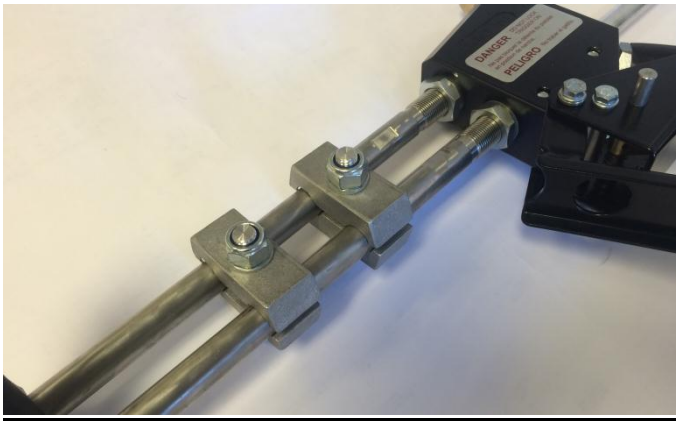
According to BS EN 1829-1:2010 section 5.3.2.2, a shoulder stock shall be used with a high pressure water jetting gun where the reaction force is greater than 150N.
Use the chart on page 2 as a reference to determine whether or not a stock should be used.

Function & Fitting

The gun safety shroud is manufactured from aluminium tubing, giving it strength whilst adding minimal weight.

The stock is fabricated with two M10 studs, and secured to the barrels of the gun using twin aluminium clamps. The position of the stock can be adjusted to give the operator a comfortable fit.

To adjust, loosen the M10 nyloc nuts, slide the stock to the correct position, tighten the nuts.



Using the gun

- It is strongly recommended that a Flowplant hose safety shroud (part no. 7001679) is permanently connected to the gun inlet. See end of data sheet for details. The jetting unit main hose can then be connected to the hose safety shroud via the ½" BSP male connector provided.
- If an alternative hose shroud is being used make sure that it covers the hose ferrule and doesn't interfere with the gun trigger assembly.
- Select PPE as required by your risk assessment and WJA code of practice.
- Clean all connections and make sure that no grit or debris has entered the gun inlet tube/hose shroud inlet as this may cause the gun to malfunction and the trigger to jam. Check that the gun trigger assembly operates freely and that the trigger guard has not been bent or damaged. Check that both barrels are straight and free from faults.
- Make sure that all connections are tightened sufficiently using the correct sized spanner. Never use serrated jaw wrenches as these can seriously damage the ferrule nut which can lead to premature failure.
- Check that the correct nozzles are connected to the gun high pressure & dump barrels and use the safe working reference chart to determine if a shoulder stock is recommended.
- Start the jetting machine and operate the gun at low pressure checking that the gun trigger assembly is working correctly and the gun cycles correctly between dump and high pressure. If the gun jams it will be necessary for it to be serviced by a competent person before it can be used.
- Increase the operating pressure gradually checking that no leaks occur at the connection points. If a leak appears stop the jetting machine and switch it off. When all system pressure has been released retighten the leaking connections and repeat the start-up process.
- When working pressure has been reached check that the gun operator is comfortable with the level of reaction force and that it can be safely controlled.

DO NOT EXCEED THE MAXIMUM WORKING PRESSURE

UNDER NO CIRCUMSTANCES SHOULD THIS SAFETY GUN BE MODIFIED. HIGH PRESSURE BARRELS MUST BE A MINIMUM OF 1.1M LONG AS DEFINED IN THE WATER JETTING ASSOCIATION CODE OF PRACTICE. WHERE FITTED AS PART OF THE ORIGINAL DESIGN HANDLES MUST BE USED AT ALL TIMES

SHOULDER STOCK TO BE USED WHERE APPLICABLE

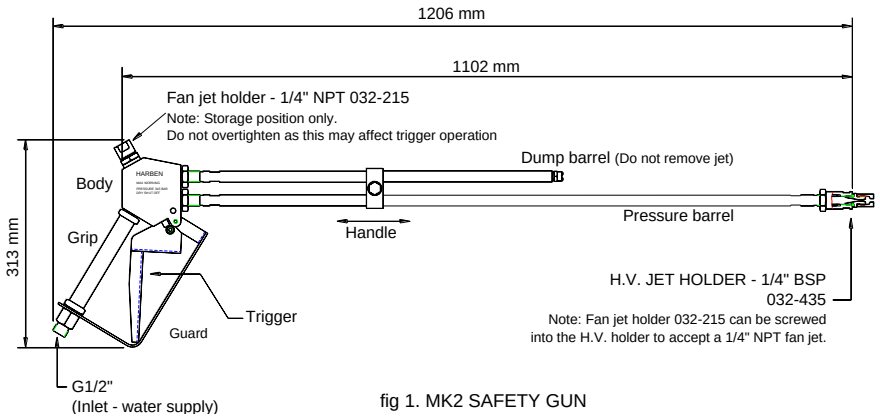


fig 1. MK2 SAFETY GUN

MATERIAL LIST

INFORMATION FOR ESTIMATION OF WEIGHT AND COST ONLY

ITEM	PART NO.	MATERIAL	SPEC	SIZE	WT Kg/M	LENGTH mm	QTY.	TOTAL WT Kg

A B C D E F G H J K L M N P R S T U V W X Y Z

DO NOT SCALE
IF IN DOUBT ASK !

MANUFACTURERS UNABLE TO COMPLY MAY SUBMIT ALTERNATIVES WHEN QUOTING.

ALL DRAWINGS NOT TO THE LATEST ISSUE ARE TO BE DESTROYED.

Third angle projection

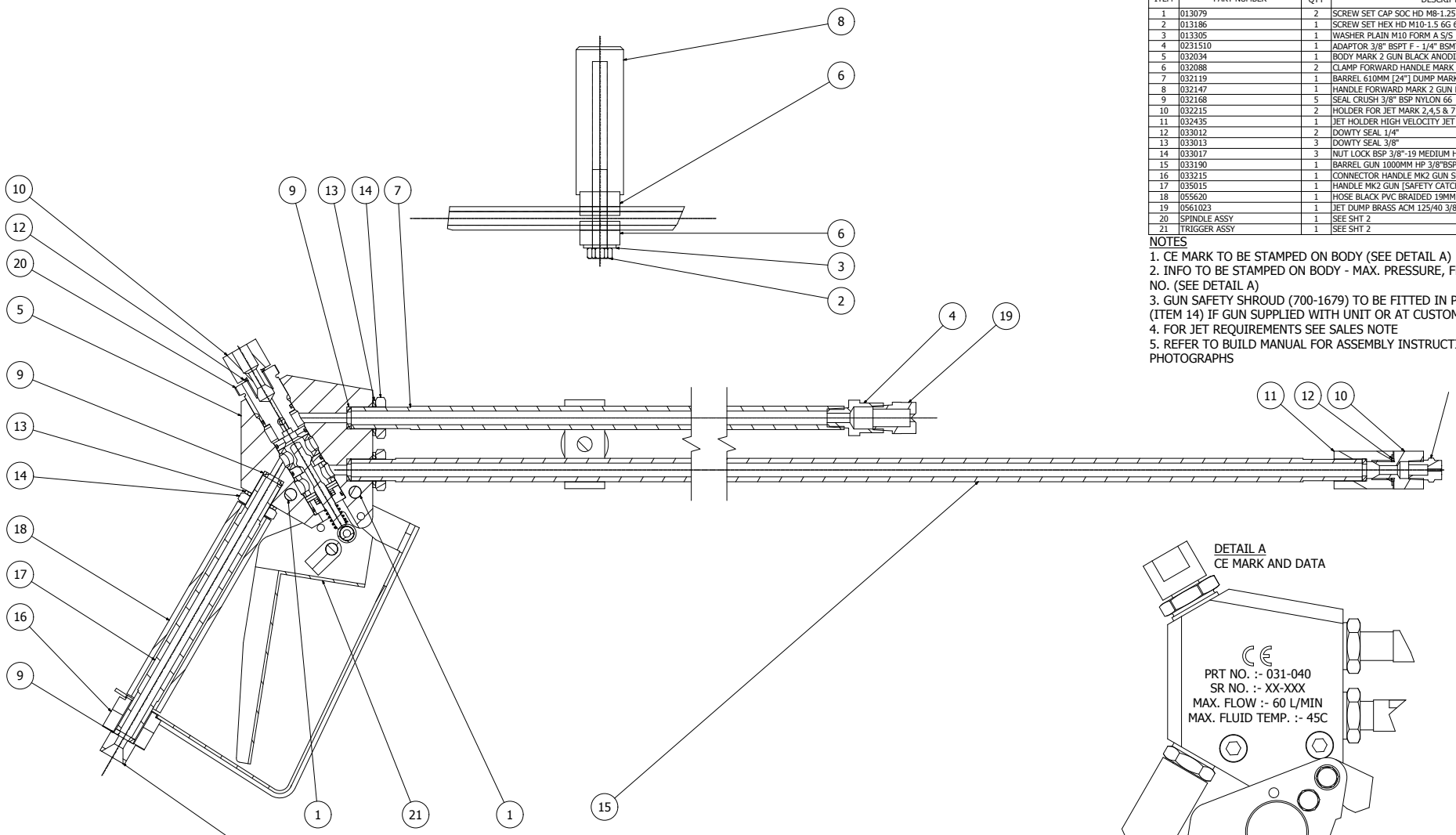
PARTS LIST

ITEM	PART No.	DRG. No	QTY	DESCRIPTION	REMARKS

PARTS LIST

ITEM	PART NUMBER	QTY	DESCRIPTION
1	013079	2	SCREW SET CAP SOC HD M8-1.25 6G 30 LG HT 8.8 ZN
2	013186	1	SCREW SET HEX HD M10-1.5 6G 60 LG S/S A2
3	013305	1	WASHER PLAIN M10 FORM A S/S
4	0231510	1	ADAPTOR 3/8" BSPT F - 1/4" BSMT M FIXED
5	032034	1	BODY MARK 2 GUN BLACK ANODIZED
6	032088	2	CLAMP FORWARD HANDLE MARK 2 GUN MACHINED
7	032119	1	BARREL 610MM [24"] DUMP MARK 2 GUN
8	032147	1	HANDLE FORWARD MARK 2 GUN NYLON
9	032168	5	SEAL CRUSH 3/8" BSP NYLON 66
10	032215	2	HOLDER FOR JET MARK 2,4,5 & 7 GUNS [TAPER FAN JET]
11	032435	1	JET HOLDER HIGH VELOCITY JET
12	033012	2	DOWTY SEAL 1/4"
13	033013	3	DOWTY SEAL 3/8"
14	033017	3	NUT LOCK BSP 3/8"-19 MEDIUM HT 8.0 ZINC PLATED
15	033190	1	BARREL GUN 1000MM HP 3/8"BSP THRD ROLLED MK2
16	033215	1	CONNECTOR HANDLE MK2 GUN SELF
17	035015	1	HANDLE MK2 GUN [SAFETY CATCH MODEL]
18	055620	1	HOSE BLACK PVC BRAIDED 19MM ID X 26MM OD 41022
19	0561023	1	JET DUMP BRASS ACM 125/40 3/8"BSPT
20	SPINDLE ASSY	1	SEE SHT 2
21	TRIGGER ASSY	1	SEE SHT 2

NOTES
1. CE MARK TO BE STAMPED ON BODY (SEE DETAIL A)
2. INFO TO BE STAMPED ON BODY - MAX. PRESSURE, FLOW, TEMP, PART NO. (SEE DETAIL A)
3. GUN SAFETY SHROUD (700-1679) TO BE FITTED IN PLACE OF 033-215 (ITEM 14) IF GUN SUPPLIED WITH UNIT OR AT CUSTOMER REQUEST
4. FOR JET REQUIREMENTS SEE SALES NOTE
5. REFER TO BUILD MANUAL FOR ASSEMBLY INSTRUCTIONS AND PHOTOGRAPHS



DETAIL A
CE MARK AND DATA

LEADERS IN CLEANING TECHNOLOGY

Flowplant Group Ltd.
Gemini House, Brunel Rd, Churchfields,
Salisbury, Wiltshire, England. SP2 7PU
Tel: (01722) 325424 Fax: 01722 411329

TOLERANCES TO BE AS SPECIFIED BELOW UNLESS OTHERWISE STATED							
OVER		0	30	100	300	1000	2000
UP TO AND INCLUDING		30	100	300	1000	2000	
* DELETE ONE RANGE	* FINE MACHINING	± 0.1	± 0.15	± 0.2	± 0.3	± 0.5	± 0.8
	* MEDIUM MACHINING	± 0.3	± 0.5	± 0.7	± 1.0	± 1.5	± 2.0
FABRICATION / UNMACHINED		± 0.5	± 1.0	± 1.5	± 2.0	± 3.0	± 3.0

ALL DIMENSIONS IN MILLIMETRES
GEOMETRICAL TOLERANCES TO BS 308
ANGULAR DIMS TO BE WITHIN:- MACHINED ± 0.5°, BENDING ± 2°
THREADS: BSP, TO MED. FIT. B.S. 2779
ISOMETRIC TO 6g / 6H

SURFACE ROUGHNESS: 1.6 MICRONS Ra
CONCENTRICITY TO WITHIN 0.2 T.I.R.
M/C RADII 1.5
DRILLED HOLES +0.13/-0.00
HOLE CENTRES TO BE ± 0.2
REMOVE ALL BURRS & SHARP EDGES.

	4	3	2	1
ISSUE				
DATE	15/07/14	28/07/10	22/01/07	01/05/05
DRAWN	TWC	DGW	PJ	DC
CHECKED				
STATUS	150714/A	280710/A	22/01/07/B	NEW DRG

HEAT TREATMENT
PROTECTION
USED ON JIG & TOOL
FINISH:
SUPERSEDES/SUPERSEDED BY

DRAWN DC DATE 01/05/05
CHECKED DATE
APPROVED DATE
SCALE CALC
WEIGHT Kg TEST
EXPOSED AREA M²

TITLE
Mk II GUN
SHT 1 OF 2
DRG NO 031-040/3-4
PART NO 031040

MATERIAL LIST

INFORMATION FOR ESTIMATION OF WEIGHT AND COST ONLY

ITEM	PART NO.	MATERIAL	SPEC	SIZE	WT Kg/M	LENGTH mm	QTY.	TOTAL WT Kg

A B C D E F G H J K L M N P R S T U V W X Y Z

DO NOT SCALE
IF IN DOUBT ASK !

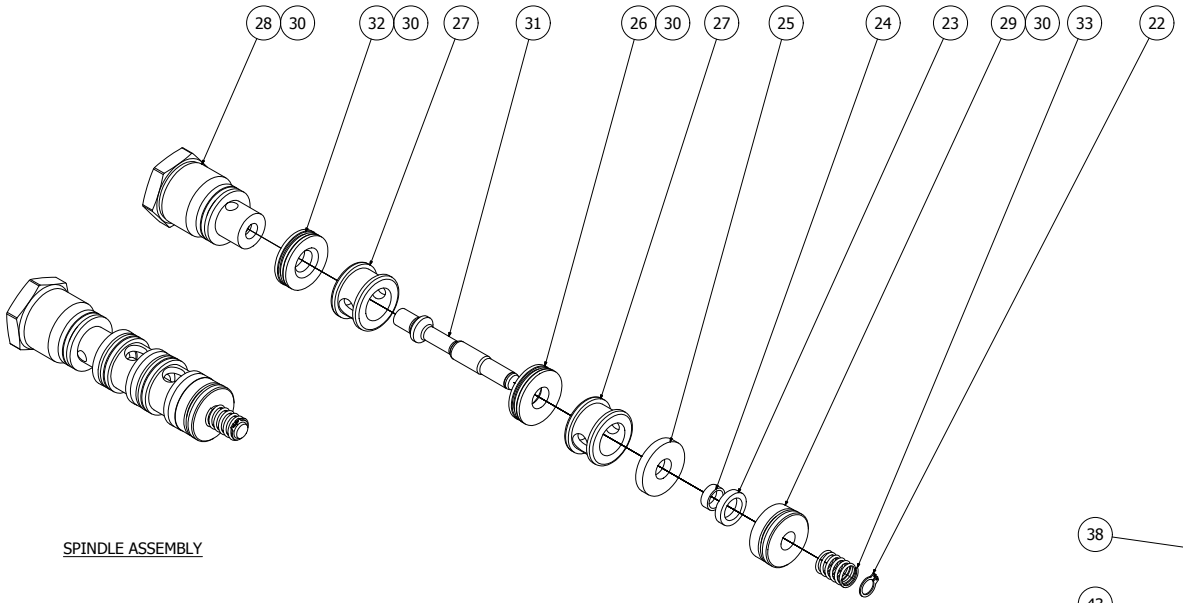
MANUFACTURERS UNABLE TO COMPLY MAY SUBMIT ALTERNATIVES WHEN QUOTING.

ALL DRAWINGS NOT TO THE LATEST ISSUE ARE TO BE DESTROYED.

Third angle projection

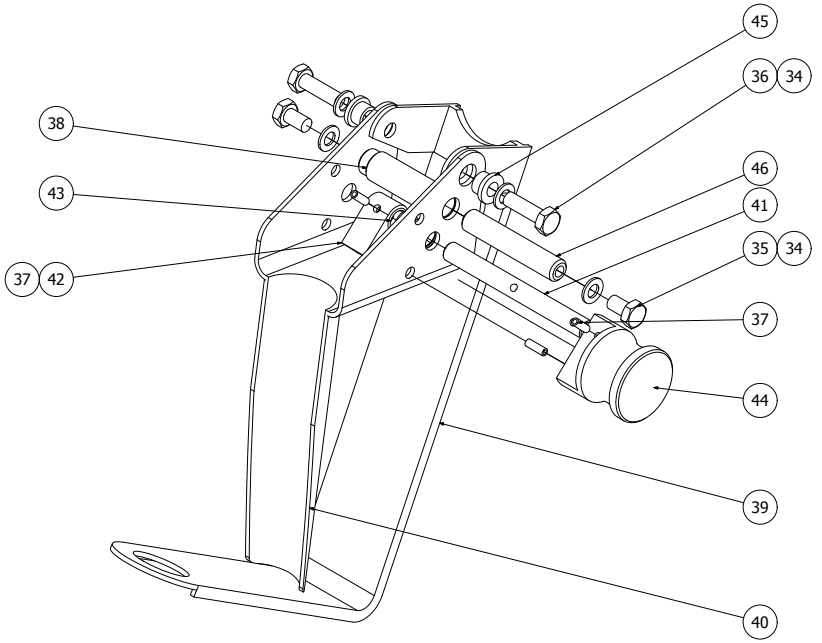
PARTS LIST

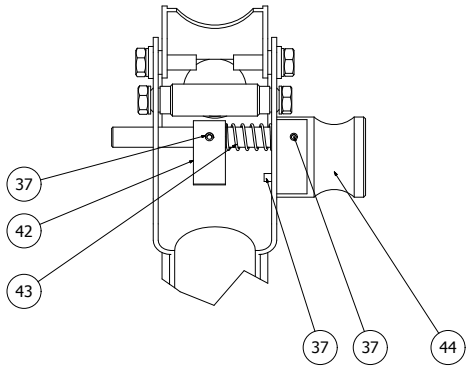
ITEM	PART No.	DRG. No	QTY	DESCRIPTION	REMARKS
ITEM	PART NUMBER		QTY	DESCRIPTION	
22	014216		1	CIRCLIP D1400-0070	
23	032005		1	SEAL	
24	032005		2	ENERGISER	
25	032022		1	SEAL SUPPORT MARK 2 GUN DELRIN	
26	032023		1	SEAT DELRIN MARK 2 GUN	
27	032025		2	COLLAR MARK 2 GUN	
28	032026		1	NUT MARK 2 GUN	
29	032027		1	GLAND MARK 2 GUN	
30	033044		4	O RING BS019/70	
31	033184		1	SPINDLE MK2 GUN (LOW TRIGGER LOAD)	
32	033185		1	SEAT MK2 GUN (LOW TRIGGER LOAD)	
33	037119		1	SPRING COMPRESSION LC-047EF-5M	
ITEM	PART NUMBER		QTY	DESCRIPTION	
34	013071		4	WASHER PLAIN M6 FORM A S/S	
35	013078		2	SCREW SET HEX HD M6-1.0 6G 10 LG S/S A2	
36	013175		2	SCREW SET HEX HD M6-1.0 6G 20 LG S/S A2	
37	033018		3	PIN ROLL TYPE 1/8" DIA X 3/8" LG STAINLESS STEEL	
38	033173		1	SPACER TUBE MK2 GUN PRESSURE BAR	
39	035005		1	GUARD TRIGGER MARK 2 GUN COATED [BLACK]	
40	035006		1	TRIGGER MARK 2 GUN	
41	035008		1	SHAFT SAFETY CATCH MARK 2 GUN	
42	035009		1	BAR LOCK MARK 2 GUN SAFETY CATCH	
43	035010		1	SPRING SAFETY CATCH MARK 2 GUN	
44	035011		1	KNOB SAFETY CATCH MARK 2 GUN	
45	035016		2	BUSH MARK 2 GUN	
46	035017		1	PRESSURE BAR MARK 2 GUN	



SPINDLE ASSEMBLY

TRIGGER ASSEMBLY





LEADERS IN CLEANING TECHNOLOGY

Flowplant Group Ltd.
Gemini House, Brunel Rd, Churchfields,
Salisbury, Wiltshire, England. SP2 7PU
Tel: (01722) 325424 Fax: 01722 411329

TOLERANCES TO BE AS SPECIFIED BELOW UNLESS OTHERWISE STATED							
OVER		0	30	100	300	1000	2000
UP TO AND INCLUDING		30	100	300	1000	2000	
* DELETE ONE RANGE	* FINE MACHINING	± 0.1	± 0.15	± 0.2	± 0.3	± 0.5	± 0.8
	* MEDIUM MACHINING	± 0.3	± 0.5	± 0.7	± 1.0	± 1.5	± 2.0
FABRICATION / UNMACHINED		± 0.5	± 1.0	± 1.5	± 2.0	± 3.0	± 3.0

ALL DIMENSIONS IN MILLIMETRES
GEOMETRICAL TOLERANCES TO BS 308
ANGULAR DIMS TO BE WITHIN:-
MACHINED ± 0.5°, BENDING ± 2°
THREADS: BSP, TO MED. FIT. B.S. 2779
ISOMETRIC TO 6g / 6H

SURFACE ROUGHNESS: 1.6 MICRONS Ra
CONCENTRICITY TO WITHIN 0.2 T.I.R.
M/C RADII 1.5
DRILLED HOLES +0.13/-0.00
HOLE CENTRES TO BE ± 0.2
REMOVE ALL BURRS & SHARP EDGES.

	4	3	2	1
ISSUE				
DATE	15/07/14	28/07/10	22/01/07	01/05/05
DRAWN	TWC	DGW	PJ	DC
CHECKED				
STATUS	150714/A	280710/A	22/01/07/B	NEW DRG

HEAT TREATMENT
PROTECTION
USED ON JIG & TOOL
FINISH:
SUPERSEDES/SUPERSEDED BY

DRAWN DC DATE 01/05/05
CHECKED DATE
APPROVED DATE
SCALE CALC
WEIGHT Kg TEST
EXPOSED AREA M²

TITLE
Mk II GUN

SHT 2 OF 2

DRG NO 031-040/3-4
PART NO 031040

INSTRUCTION / DATA SHEET 061780

GUN SAFETY SHROUD

The Flowplant gun safety shroud connects to Flowplant MkII guns and offers enhanced protection from pinhole occurrences near the operator. It provides a cost effective solution in a neatly engineered package.

- Highly burst resistant
- Highly abrasion resistant
- Highly chemical resistant
- Connects permanently to gun
- Adaptors can be provided to suit alternative gun designs
- Enhanced safety

GUN SAFETY SHROUD	**- Part No. 700-1679**	
Max working pressure (refers to hose assy)	- 420 bar	(6000 psi)
Max Flow	- 60 lpm	(13 igpm)
Weight (approx)	- 2.8 kg	
Length	- 3m	
Inlet connection	- $^1/_2$" BSPM	
Gun connection	- 3/8" BSPF crush seal	

FUNCTION & FITTING

The gun safety shroud can be retro-fitted to all Flowplant MkII guns (part no. 031-040). It is manufactured from twin sleeve super de-aerated Polyamide 6. The sleeve material has been tested and approved to international standards and has been found to be very effective in reducing the concentrated stream of pinhole leaks.

When retrofitting it will be necessary to remove the original $^1/_2$" BSPM inlet water supply boss from the gun inlet tube and replace it with the complete gun safety shroud. This should be tightened until the crush seal seats firmly onto the gun inlet tube.

IMPORTANT! Before commencing please ensure that you have undertaken the proper training and are fully conversant in the use of high-pressure water jetting equipment. You must follow the Water Jetting Association 'SAFETY CODE OF PRACTICE' at all times, failure to do so could result in injury or death to persons. Copies of the code of practice and specialist training are available from:

Flowplant Group Ltd, Gemini House, Churchfields, Salisbury, Wilts. SP2 7PU Tel: 00 44 (0)1722 325 424

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Section 12 Axle and Tow Coupling

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TECHNOLOGY • PRODUCTS • SERVICE…

KNOTT-AVONRIDE LIMITED

TRAILER SERVICE, MAINTENANCE & REPAIR HANDBOOK

…THE COMPLETE PACKAGE!

INTRODUCTION

COMPONENTS

MAINTENANCE

TECHNICAL

Company Profile

Knott-Avonride Ltd was established in the UK in 1983 for the manufacture and supply of brakes, couplings, brake cables and jockey wheels for trailers, caravans and off-road vehicles. Since then we have expanded our range of products and services to suit individual customer requirements.

We take pride in being reliable and friendly in day-to-day dealings; we know that it is important to develop a good working relationship with our customers in order to discuss and develop their requirements.

The company is ISO 9001:2008 certified and committed to the introduction of new technology and techniques that will enable us to be more efficient, develop the product range, and address legislative requirements in Europe and Worldwide.

Quality Policy

It is the policy of Knott-Avonride Ltd to provide its customers with high quality products, complying with regulations, on time delivery, and ever improving levels of satisfaction. Knott-Avonride Ltd is committed to comply with requirements of its QMS through the continual improvement of its products, services, and the company itself, by process control, employee involvement and management commitment.

If you have any thoughts, recommendations or suggestions as to how we can improve our products and services, please do not hesitate to contact us.

Burton

Maesteg

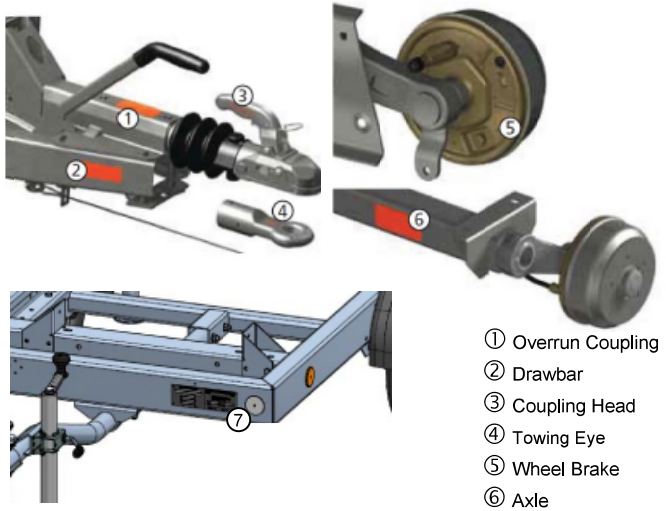
INFORMATION

All Knott-Avonride Ltd's products are designed for a long service life, which will be enhanced by taking good care of them and ensuring that maintenance is carried out to the highest standard. This handbook covers most actions needed to maintain our products and maximise the lifespan.

All of our complete chassis frames are type approved in accordance with European Community Whole Vehicle Type Approval (or in rare cases Individual Type Approval). This imposes strict constraints on the design and build of them and, in order not to compromise compliance with the legislation, we recommend the use of only Genuine Knott-Avonride replacement parts.

Parts Identification

When servicing your chassis, in order to ensure that you are supplied with the correct replacement part, it is important that you identify the component. You will find data plates on the major items.



① Overrun Coupling
② Drawbar
③ Coupling Head
④ Towing Eye
⑤ Wheel Brake
⑥ Axle
⑦ Trailer Data (VIN) Plate

Technical Support

Contact our offices and we will be happy to assist you. For e-mail enquiries made out of hours, we endeavour to reply during the next working day.

+44 (0) 1283 531541

technical@knottuk.com

Our "Complete Package" catalogue contains the wide range of products that we have to offer - new and existing.

It incorporates part numbers, descriptions and technical data in order to assist you in identifying and/or ordering any products that you may require.

The updated catalogue is available either as a printed document or can be downloaded from our website. If you require a printed version, please contact our offices and we will be happy to post a copy out to you.

INFORMATION

Spare Parts, Service, Maintenance, Repair

Knott-Avonride Ltd is committed to ensuring that our equipment is easily maintained and offer a range of methods to ensure that you can maintain your chassis to the highest standard with the least difficulty. You can order by:-

Burton		Maesteg
+44 (0) 1283 531541		+44 (0) 1656 739111
+44 (0) 1283 534840		+44 (0) 1656 737677
sales@knottuk.com		maestegsales@knottuk.com
www.knottuk.com		www.knottuk.com

Knott-Avonride Ltd has in excess of **80 dealerships** covering the whole of the UK and Ireland so whether you are sourcing spare parts or looking for a complete service, help is never far away.

If you require details of your nearest Centre please contact us. Support is also available across the whole of Continental Europe – details of the contacts in each country can be found on our website.

Stay Legal Stay Safe

Trailers are subject to the same requirements as motor vehicles, even in the absence of MOT testing in the UK, The Road Vehicle - Construction and Use Regulations place an obligation on users to maintain any vehicle used on the highway in a safe manner.

Following the instructions in this handbook and applying a strict maintenance and recording regime will help to ensure that you always stay within the law and operate legally.

Operator Compliance

Whilst it is the individual operators responsibility to ensure that any vehicle is operated in compliance with the law we should point out these key areas for attention:

- Tachograph requirements
- Vehicle Insurance
- Operators Licence
- Materials & Goods Insurance
- Driving Licence Towing Entitlement
- Breakdown Insurance

Permitted Weights:

Tow Vehicle

- Gross weight
- Gross train weight
- Gross trailer weight
- Individual axle weights

Trailers

- Gross weight
- Coupling vertical load
- Individual axle weights

PRECAUTIONS

The correct assembly and adjustment of all equipment is critical to the safe operation of the trailer. Therefore the procedures must only be carried out by competent persons. If you have any doubts about your ability to complete the procedure, we recommend this task is performed by your local service centre.

You are advised to wear suitable protective equipment such as safety glasses, gloves and face mask. In addition be aware of the hazards associated with handling workshop materials such as chemicals, oils and greases which may be flammable and can prove to be irritants.

It is recommended that the opportunity is taken to inspect associated items for wear or damage and replace if necessary, they can be obtained through your local stockist.

All procedures should be carried out with the trailer on level ground with either the parking brake applied or wheel chocks front and rear. In addition the drawbar should be supported with the trailer horizontal. Where required consult your trailer handbook for the recommended jacking points and positions for stands.

The components are used in a wide variety of trailers and reference to the trailer manufacturer's manual must always be made for procedures and data relevant to the particular unit.

The instructions relate to:

1. ALL Knott-Avonride Ltd overrun couplings including KFG 13, 20, 27, 30, 35, KF 7.5, 13, 17, 20, 27, and KRV 7.5, 13, 17, 20, 30.
2. Spreadlever brakes 160 x 35, 200 x 50, 203.2 x 40, 250 x 40, 300 x 60
3. Prop stand brackets Ø35, Ø42 and Ø48.

We have used "Plain English" descriptions throughout this text. If you are unsure of the meaning, if the procedure is unclear or you require any further information, please use the contact details indicated on page 2.

IF IN DOUBT ASK

USE ONLY KNOTT ORIGINAL REPLACEMENT PARTS

The text includes guidance to assist in the safe execution of the procedures:

WARNING!	**Risk of Injury**
CAUTION!	**Risk of damage to equipment**
NOTE.	**Safety requirement**

SAFETY – WORKING PRACTICE

- Always work in a clean area, tidying up as you go. Be especially diligent to clear spills and ensure that oils and greases do not contaminate linings and rubber bushes, suspension elements, or tyres. Remember some chemicals (brake fluid) can damage cosmetic finishes (car paint) and plastics.
- Always work on a level, firm hard-standing ground - not muddy, slippery or soft ground.
- Allow sufficient time to carry out the task.
- Do not rush or take shortcuts which could endanger you during the work and put a potentially dangerous trailer on the road.
- Do not allow animals, pets or children in, around or under the trailer whilst it is being worked on.
- As a minimum have basic safety equipment available such as fire extinguishers and first aid kit and familiarise yourself with what to do in an emergency.
- Be honest with yourself and do not embark on tasks outside your capability. If you get stuck enlist help.
- Do not attempt to undo high torque fasteners with the trailer on a jack in case the force applied pulls the trailer over.
- Ensure that spanners are the correct size, are in good condition and are suitable for the task. Never use ill fitting spanners.
- Refer to recommended bolt torques and use a torque wrench.
- Always replace brake shoes in axle sets and preferably all wheels on a tandem trailer at the same time.
- Do not skimp on spare parts. If there is any doubt replace an item, most trailer parts are fairly low cost.
- Use only original equipment parts approved by the trailer manufacturer.
- Always use new self locking nuts (nylon insert type or deformed metal). Knott hub bearing centre nuts are suitable for use twice only so if the history of the trailer is unknown play safe by replacing with new. Refer to the trailer manufacturer's recommendations for their specific hub data.
- Accident damaged components are potentially very dangerous. Wherever any doubt exists replace outright in preference to repairing.
- Always ensure bolts are of sufficient length, the correct grade and use new locking nuts every time. Ensure tapered washers or shaped washers are used on any surfaces not flat.
- Always fit new split pins of the correct length and diameter.
- Double check that all fasteners are tight as each item is fitted.
- Never weld near rubber bushes or rubber suspension elements or tyres as the heat soak will damage the rubber. Protect adjacent areas from weld spatter.
- Discard of old brake shoes and dust in a sealed bag.

PERSONAL SAFETY

- Do not rely on a jack when working underneath a trailer, always use a reliable secondary means of support such as axle stands.
- Always ensure that supports have wide bases so they cannot "topple" and that they are placed on firm and level ground.
- Always use the correct jacking points as stated by the trailer manufacturer, in particular avoid jacking in the middle of an axle. Additional care is needed if the trailer is loaded, take due note of the weight and its distribution. Wherever possible unload prior to jacking up.
- Always ensure that jacks and stands are of sufficient load capacity for the task.
- Always ensure that wheels are chocked prior to carrying out any work, never rely on the handbrake alone.
- Trailers and components can be heavy. Do not try lifting heavy items - get help or use appropriate lifting aids.
- Remove jewellery. Particularly metal banded wrist watches (these present a special hazard when working on electrics) and rings (easily snagged and are a major problem to remove if there is an injury to a finger).
- Do not inhale brake lining dust. Whilst all brakes have non asbestos linings it is recommended that a face mask is worn and dust is carefully brushed away, or use a proprietary brake cleaning fluid. Do not use an air line to blow out brakes or drums as the dispersed powder takes a long time to settle.
- Wear eye protection when using power tools or working underneath a trailer.
- Wear barrier creams or disposable gloves as a precaution and wash hands as soon as practical after completing the work.
- Look out for trailing items which can be trapped in rotating machinery. Ties, loose wrist cuffs and long hair are always vulnerable.
- Never work alone. Always ensure that someone is in the vicinity.
- Do not eat, drink or smoke whilst working. Smoking can be especially dangerous as there may be chemicals in the air which become dangerous in the presence of heat. There is also the risk of fire or, worse still, explosion.
- Beware of fumes from chemicals, cleaners, solvents, glues and paints. Ensure the work area is ventilated and instructions on the can are followed.
- Do not store fluids in unmarked containers.

GLOSSARY

GLOSSARY OF TERMS COMMONLY USED IN THE TRAILER INDUSTRY:

Unladen Weight (UW):	The weight of the trailer (or towing vehicle) less removable optional equipment and load
Gross Vehicle Weight (GVW):	The total weight of the trailer (or towing vehicle) and load
Maximum Gross Weight (MGW):	The maximum figure set by the manufacturer for the gross weight. This will normally be the technically permissible maximum based on the carrying capacity of the tyres, axles, coupling, suspension and chassis but may have been adjusted downwards for commercial reasons
Technically Permissible Maximum Weight:	The technically permissible maximum based on the capacity of the tyres, axles, coupling, suspension and chassis
Maximum Authorised Mass (MAM)	As maximum gross weight above. The latest EC term as used in the Driver Licensing Regulations
Gross Train Weight/ GTW:	The maximum allowable combined weight (combined MAM) of the towing vehicle and trailer as specified by the towing vehicle manufacturer
Payload:	The difference between the gross weight of the trailer and its unladen weight, i.e. the load carrying capacity
Kerb Weight	The weight of the towing vehicle (without payload), including all fluids required for operation / driver & nominal luggage
Nose Load:	The weight imposed on the towball or eye by the trailer coupling
Over-run Braking System:	A trailer braking system operated by the action of the trailer acting on the towing vehicle under deceleration
Power Operated Braking System:	A trailer braking system which is operated directly by the action of the foot brake on the towing vehicle
Wheel Track:	Horizontal distance between the centre lines of the wheels across the width of the vehicle or trailer
Wheel Base:	Horizontal distance between the centre lines of the wheels of multi-axle vehicles or trailers along the length of the vehicle, also includes the distance from coupling point to front axle

COUPLING/DE-COUPLING PROCEDURE

⚠ PRIOR TO CARRYING OUT THESE TASKS PLEASE REFER TO PRECAUTIONS ⚠

COUPLING TRAILER TO TOW VEHICLE

1. Wherever possible trailers should only be coupled and uncoupled on level ground.
2. Wherever possible couple with the trailer un-laden, particularly where livestock/horses are concerned.
3. Ensure that the trailer handbrake is firmly applied or chocks prevent movement of the trailer.
4. Check that the coupling head and towing vehicle ball are lubricated and free from grit and contamination. Where an eye and jaw is used check for wear.
5. Use the jockey wheel or propstand to raise the coupling head above the height of the towing vehicle ball.
6. Position the towing vehicle such that the ball is directly below the coupling head or the eye is within the towing vehicle jaw. Ensure that the tow vehicle is parked with engine off, in gear and handbrake applied.
7. Check the condition of the break-away cable (braked trailers). Ensure it passes through its guide at the front of the drawbar and secure to the tow vehicle in the approved manner. Where a secondary coupling (unbraked trailers) is used connect it.
8. Operate the coupling head mechanism and lift the handle to give clearance for the ball and lower the jockey wheel to engage. Release the handle and check to see that the coupling head is securely engaged on the ball and that any wear indicator shows that the engagement is correct. Where an eye is fitted ensure that the tow vehicle jaw is compatible with the trailer eye and that the pin and securing mechanism is correctly retained in accordance with the jaw manufacturer's recommendations.
9. Retract the jockey until it is fully wound up and release the clamp and lift the whole assembly to its highest position and re-clamp.
10. Make the electrical connections to the towing vehicle and confirm that lights function correctly. **NOTE.** When loading ensure that the noseweight on the trailer is within the limits defined by the towing vehicle, towbar, and trailer manufacturers.
11. Ensure that the nominal heights of the ball on the towing vehicle and the coupling head (or eye and jaw) on the trailer are compatible. Where possible adjust the ball height to ensure that the trailer is towed level.
12. Release the trailer handbrake. **NOTE.** Whenever possible have a driver in the towing vehicle applying the footbrake, this is particularly important when releasing a trailer handbrake on an incline.

PARKING AND UNCOUPLING

1. Wherever possible trailers should only be coupled and uncoupled on level ground.
2. Wherever possible uncouple with the trailer un-laden, particularly where livestock/horses are concerned.
3. When parking on a public road be aware of the highway regulations particularly regarding lighting, direction of travel and any local restrictions. Avoid leaving a parked trailer on public highways.
4. Always be alert to the possibility of individuals tampering with a parked trailer and the safety implications.
5. Avoid uncoupling a trailer on busy roads.
6. Note for added safety it is good practice when leaving the vehicle to take the ignition keys with you. Ensure that other people around you are aware of what you are doing and do not attempt to move the vehicle.
7. Always ensure that if some unexpected movement occurs that it will not cause personal injury.

Level Ground

1. Apply the towing vehicle handbrake, turn the engine off and leave in gear.
2. Release the jockey wheel clamp and re-clamp lower down. Wind out the jockey until it just touches the ground. Where a propstand is fitted clamp it in contact with the ground.
3. Apply the trailer handbrake (where fitted) taking note that over-centre handbrakes need to be "pulled" on to achieve optimum effectiveness.
4. Release the handle on the coupling head and continue to wind the jockey wheel lifting the head clear of the towing vehicle ball. Where a towing eye is fitted raise the eye to the middle of the jaw and remove the pin. If a propstand only is fitted lift the drawbar but be extra careful to ensure that there is not an excessive weight on the drawbar.

Level Ground (continued)

5. Disconnect the electrical connection and the break-away cable (braked trailers) or secondary coupling (unbraked trailers).
6. Move the towing vehicle clear and lower the jockey wheel until the trailer is horizontal. This avoids leaving extra load on the tyres and jockeys for extended periods. Lightweight unloaded trailers can usually be easily pushed clear depending upon the state of the ground.
7. As a safeguard the trailer wheels should be chocked. If the trailer is to remain in position for some time the recommendation is to use chocks and release the handbrake to minimise the risk of brakes sticking, cables stretching and someone inadvertently releasing the handbrake.

Facing Uphill

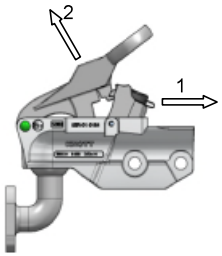
1. Apply the towing vehicle handbrake, turn the engine off and leave in gear. If there is any doubt that the towing vehicle handbrake will hold because the trailer is heavily laden or the hill is very steep keep the engine running and apply the handbrake and footbrake as an alternative (assistant required).
2. Braked trailers only: apply trailer handbrake, with everyone clear start the towing vehicle engine, hold the vehicle on the foot brake, release the towing vehicle handbrake and gently release the footbrake allowing the trailer and tow vehicle to move back slowly as the trailer brakes move into auto-reverse, this can be observed as additional movement of the handbrake lever. Re-apply the tow vehicle handbrake, stop the engine and engage gear.
3. Place chocks behind one wheel on each side of the trailer.
4. Release the jockey wheel clamp and re-clamp lower down. Wind out the jockey until it just touches the ground. Where a propstand is fitted clamp it in contact with the ground.
5. Release the handle on the coupling head and continue to wind the jockey wheel lifting the head clear of the tow vehicle ball coupling. Where a towing eye is fitted raise the eye to the middle of the jaw and remove the pin. If a propstand only is fitted lift the drawbar but be extra careful to ensure that there is not an excessive weight on the drawbar. **NOTE.** The front of the trailer may be light or there may be a negative noseweight due to the angle of the hill forcing the centre of gravity behind the axle. This is particularly noticeable with single axle trailers.
6. Disconnect the electrical connection and the break-away cable (braked trailers) or secondary coupling (unbraked trailers).
7. Move the towing vehicle clear and lower the jockey wheel until the trailer is parallel to the ground. This avoids leaving extra loads on the tyres and jockeys for extended periods.
8. We do not recommend leaving a trailer unattended on a steep hill.

Facing Downhill

1. Apply the towing vehicle handbrake, turn the engine off and leave in gear. If there is any doubt that the tow vehicle handbrake will hold because the trailer is heavily laden or the hill is very steep keep the engine running and apply the handbrake and footbrake as an alternative (assistant required).
2. Place chocks in front of one wheel on each side of the trailer.
3. Apply the trailer handbrake (where fitted) taking note that over-centre handbrakes need to be "pulled" on to achieve optimum effectiveness.
4. Release the jockey wheel clamp and re-clamp lower down. Wind out the jockey until it just touches the ground. Where a propstand is fitted clamp it in contact with the ground.
5. Release the handle on the coupling head and continue to wind the jockey wheel lifting the head clear of the tow vehicle ball coupling. Where a towing eye is fitted raise the eye to the middle of the jaw and remove the pin. If a propstand only is fitted lift the drawbar.

   CAUTION! Be extra careful to ensure that there is not an excessive weight on the front of the trailer, more so than on level ground as the hill will tend to increase the drawbar noseweight, this is particularly noticeable with single axle trailers.
6. Disconnect the electrical connection and the break-away cable (braked trailers) or secondary coupling (unbraked trailers).
7. Move the tow vehicle clear and lower the jockey wheel until the trailer is parallel to the ground. This avoids leaving extra loads on the tyres and jockeys for extended periods.

OPERATION OF THE KNOTT-AVONRIDE CAST COUPLING HEAD



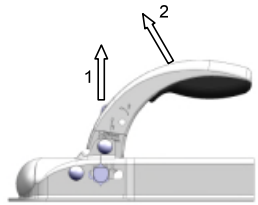
1. Ensure the key (if fitted) is in the unlock position.
2. Move the thumb catch (arrow 1) rearward and hold in place.
3. Pull the handle upward (arrow 2).
4. Lower the coupling head onto the towball.
5. Release the handle and thumb catch.

   NOTE. Always ensure the coupling head and towball are engaged.
6. To remove move the thumb catch (arrow 1) rearward and hold in place.
7. Pull the handle upward (arrow 2) and raise the coupling head clear of the ball.

KNOTT-AVONRIDE CAST COUPLING HEAD WEAR INDICATOR

1. When the coupling head is not fitted to the towball check and record dimension "A" indicated in the adjacent view. This dimension should always be greater when fitted to the towball.
2. Re-check dimension "A" at regular intervals. If the dimension is identical when not fitted and fitted to the towball then either the ball or head is worn or a combination of both. Action must be taken to replace either ball and/or head. **WARNING!** Do not drive in this condition.

OPERATION OF THE KNOTT GROUP PRESSED STEEL COUPLING HEAD



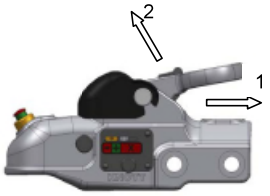
1. Firstly, pull the handle upward (arrow 1) and then in the direction of arrow 2, the handle will now lock in the open position.
2. Lower the coupling head onto the towball.

   NOTE. Care should be taken to remove hands away from the handle, the head will automatically engage. Always ensure the coupling head and towball are engaged.
3. To remove, pull the handle upward (arrow 1) and then in the direction of arrow 2 then raise the coupling head clear of the ball.

KNOTT GROUP HEAD COUPLING WEAR INDICATOR

x	Coupling head is open. **WARNING!** Do not drive in this condition.
+	Coupling is engaged and no wear is indicated.
-	Incorrect engagement or worn towball or ball cup. **WARNING!** Do not drive in this condition.

OPERATION OF THE KNOTT GROUP CAST COUPLING HEAD



1. Ensure the key is in the unlock position.
2. Move the thumb catch (arrow 1) rearward and hold in place.
3. Pull the handle upward (arrow 2), the handle will lock in the open position.
4. Lower the coupling head onto the towball.

   NOTE. Care should be taken to remove hands away from the handle, the head will automatically engage. Always ensure the coupling head and towball are engaged. The engagement indicator (where fitted) will show green, if only red is seen then the ball and coupler are not engaged **WARNING!** Do not drive in this condition.
5. To remove move the thumb catch (arrow 1) rearward and hold in place.
6. Pull the handle upward (arrow 2) and raise the coupling head clear of the ball

If in doubt seek professional advice

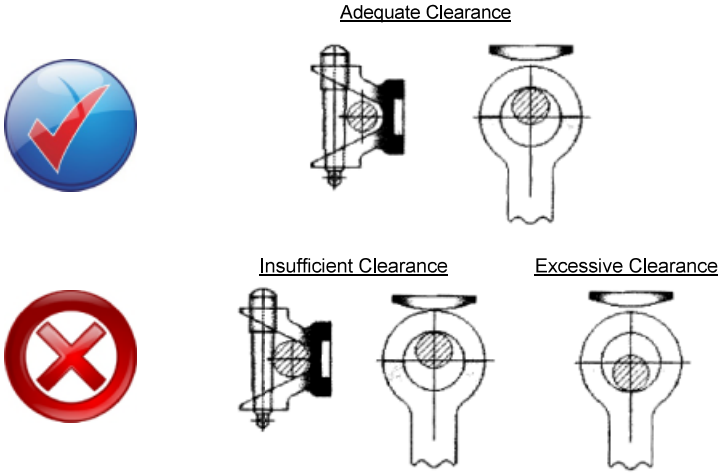
TOWING JAWS & HOOKS

⚠ PRIOR TO CARRYING OUT THESE TASKS PLEASE REFER TO PRECAUTIONS ⚠

British standards require that there should be sufficient room behind the pin of any towing jaw to ensure adequate articulation of the eyeshaft in both vertical and horizontal planes. It is also important that this gap is not too great, thus allowing the back of the eye to hit the front of the pin before the front of the eye contacts the throat of the jaw.

A jaw opening that does not comply with the standards and therefore restricts articulation upwards and downwards, is likely to bring about stress fractures on either the coupling or the trailer chassis drawbar.

The above standards also apply to the jaw on a combination jaw and towball unit. This type of product provides the flexibility of being able to tow trailers fitted with either an eye or 50mm coupling head, without having to change the fittings on the tow vehicle.



European legislation has for many years specified the use of a 50mm towball which ensures compatibility between the tow vehicle and trailers.

WARNING! There are towballs and hitches from America in $1^{7}/_{8}$" (47.6mm), 2" (50.8mm) and $2^{5}/_{16}$" (58.7mm). These must never be used in conjunction with European 50mm components as the coupling head will either not engage or the ball will be excessively loose inside the coupling head.

Tow eyes are available in British Standard, DIN (usually DIN 40), NATO (usually 76mm) and French (68mm). Knott-Avonride Ltd supply all of these on request including British Standard eyes in 30mm, 40mm and 50mm diameters.

DIN and NATO eyes are intended to work with specially designed tow jaws.

British Standard eyes must be used with compatible jaws but are also the preferred option for site tow.

WHEELS & TYRES

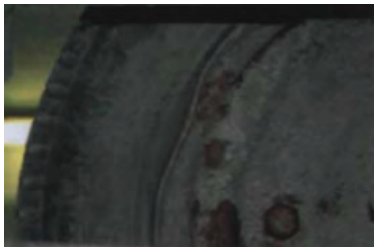
⚠ PRIOR TO CARRYING OUT THESE TASKS PLEASE REFER TO PRECAUTIONS ⚠

WHEELS

Damage and Cracks : Check the wheels visually for damage or cracks. Cracks can be detected by rust showing through paint and by air loss if in the rim. Pay particular attention to the rim, around the wheel bolt and valve holes and at the ends of welds.

There must be no dents or gouges in the tyre seating area. The wheel shown left must be replaced. If any such defects are present, the wheel must be replaced.

A severe blowout can cause distortion to the inner rim which may be difficult to see when on the trailer. Damage less severe than that shown left can cause sealing problems between the damaged rim and the replacement tyre.



NOTE. It is important to use wheels with the correct load rating and this is not usually marked on the wheel itself.

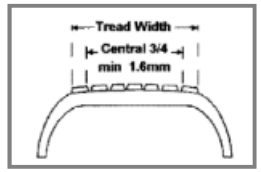
Runout : Rotate each wheel. There should be no visible runout on the vertical face of the bead seating well. If unsure, measure using a dial test indicator. Make sure that there is no load on the wheel and bearing float is not included in the measurement. Total runout should not exceed 2mm. As a guide, this should be visible to the naked eye.

Valve : Valve body rubber should show no cracks and a dust cap should be fitted.

TYRES

Size & Load/Speed Index
Check that the size and load/speed index are correct for the application.
NOTE. Car and trailer tyres are often the same size but have a different index.
WARNING! Use of a car tyre with a lower load/speed index is dangerous and illegal.

Tread
Check the tread depth. The moulded 1.6mm tread depth indicator blocks must be below the level of the tread surface all the way around the tyre in the central 75% of the tread width. The tread pattern should be visible on the remaining portion.



Ageing
In many trailer applications, tyres last a long time and may require replacement because of surface crazing or cracks between the tread blocks or in the sidewall rather than tread wear.

Cuts
Cuts should not be longer than 25mm or penetrate to the underlying reinforcement. Water ingress through the reinforcement can cause delamination.

- There should be no lumps or bulges in tread or sidewall.
- Check for foreign bodies embedded in the tyre.
- Check tyre pressures.

If in any doubt, refer to a tyre supplier.

JOCKEY WHEELS

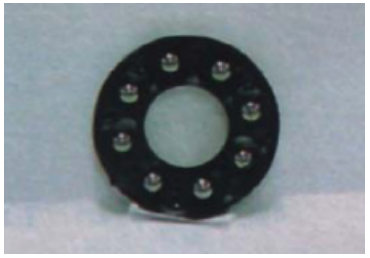
⚠ PRIOR TO CARRYING OUT THESE TASKS PLEASE REFER TO PRECAUTIONS ⚠

SERVICING

1. Service requirements for jockey wheels are limited to greasing the main threaded rod. To lubricate the thread, wind open the jockey wheel until the top and bottom sections disengage. Apply grease generously over as much of the threaded rod as can be reached. Grease the female thread in the bottom section. Grease will be carried throughout the length of the rod when the jockey wheel is next retracted.

2. The jockey wheel clamp handle cannot be withdrawn directly. Remove the jockey and screw the handle in far enough to release the clamp pad. If the handle is bent, cut it off, leaving enough to cut a screwdriver slot.

THRUST WASHER/BEARING



1. The thrust washer/bearing can be inspected if a problem is suspected.

2. Remove the handle from the upper section of the jockey wheel by driving out the roll pin that secures it. The threaded rod and thrust washer/bearing can then be withdrawn and greased.

3. This is not a recommended service procedure unless a problem has been identified in which case the unit is probably an economic write off.

   NOTE. The handle and threaded rod are drilled together and must be re-assembled in the same relative position.

WHEEL

The wheel unit itself needs no lubrication.

If the plastic bush/bearing or tyre are damaged or worn, replace the wheel by removing the split pin which will release the axle. NOTE. Heavy-duty wheels have steel needle rollers in a plastic bearing cage.

REPLACEMENT

There have been many changes in specification and compatibility between different upper and lower sections cannot be guaranteed. Jockey wheels are therefore sold only as complete assemblies.

PROBLEMS

1. **Bent Tube** : This is normally caused by forgetting to retract the jockey wheel before driving off, resulting in the wheel hitting the road and the lower tube (occasionally the upper) being bent. Look for obvious damage or signs of the inner section rubbing inside the upper.

   The unit is beyond repair and must be replaced.

2. **Damage to the Thread** : The usual causes of failure are overloading and raising the jockey under load to the point where the threaded rod disengages from the lower section. WARNING! In extreme cases, the jockey wheel may collapse so keep clear of the trailer when checking this issue.

   Again, the unit is beyond repair and must be replaced.

PROPSTAND / JOCKEY BRACKET

⚠ PRIOR TO CARRYING OUT THESE TASKS PLEASE REFER TO PRECAUTIONS ⚠

REPLACING BRACKET

Support the trailer adjacent to the stand bracket leaving a clear working area around the bracket mounting.

1. Remove the jockey wheel or propstand from the bracket and inspect it for damage.

2. Remove the fasteners securing the bracket, noting the orientation of the clamping mechanism. See Figs. A & B.

3. Fit the new bracket with the correct bolts.

4. Trial fit the jockey wheel or prop-stand to ensure that it clamps securely.
   WARNING! Do not allow any weight to be placed on the support until adjustment is completed and you are confident that the parts clamp properly.

Fig. A

Fig. B

ADJUSTMENT

Split Clamp Only:-

Adjust the locking nut so that there is the same clearance at both sides of the clamp body when the clamp handle is tightened.

WARNING! If the two halves of the body touch the assembly will not support the weight when tightened.

JOCKEY WHEEL CLAMP HANDLE & PAD

1. Screw clamp handle into jockey wheel clamp housing (located on the side of the coupling) until formed end protrudes through.

2. Locate keyway in clamp pad to formed end of clamp handle.

3. Unscrew clamp handle until pad is secure with the clamp housing.

NOTE. Do not attempt to remove the handle without first removing the pad.

⚠ PRIOR TO CARRYING OUT THESE TASKS PLEASE REFER TO PRECAUTIONS ⚠

REPLACING BRAKE ASSEMBLY COMPLETE

It is recommended that the brake assemblies are replaced in axle sets.

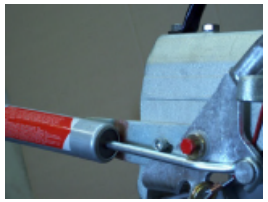
1. Follow the procedure for Replacing Brake Shoes items (1) to (7) inclusive taking due note of the introductory warnings.
2. The brake assemblies are handed, check the new assembly against the one fitted noting the position of the brake cable attachment. Remove the four bolts securing the backplate to the axle, remove the old assembly and fit the new one in accordance with the torque figures specified in the trailer manufacturer's handbook.
3. Continue with the procedure for Replacing Brake Shoes commencing at item (18).
4. Follow the Adjustment procedure below.

REPLACING BRAKE SHOES

Place the trailer on stands with all wheels free. **WARNING!** The handbrake should be released and the handbrake locking bolt fitted.

See Fig. A. Some couplings do not have provision for the locking bolt. In this case or if a bolt cannot be used the handbrake lever should be secured in the off position to prevent the handbrake lever operating. It is recommended that the brake shoes are replaced in axle sets.

Fig. A



1. Remove the wheels.
2. Remove the hub cap.
3. Slacken off the brake adjuster bolt until free. Some brake assemblies have a ratchet accessible through an aperture in the backplate instead of the bolt.
4. Remove the axle nut, this may be a castellated nut retained with a split pin or alternatively it may be a locknut.
5. Remove the brake drum (hub puller may be required) taking care not to displace the bearings. **WARNING!** Avoid inhaling brake dust. Do not use an airline to clean the drum. Carefully remove the dust using a small brush.
6. Check the condition of the brake drum, replace the drum if deep score-marks are visible.
7. Undo the locknut on the brake rod (front to rear) adjacent to the compensator. Slacken the second nut on the brake rod. Remove the half shell from the backplate and detach brake cable.
8. **NOTE.** Record the orientation of the brake shoes and springs on the backplate to ensure that the new shoes and springs are replaced in the same position as the old. See Fig. B (left hand) and C (right hand) for reference to Knott 200x50 brake (others similar).
9. With care and using a suitable lever, lift the sliding shoe carrier away from the expander. Extract expander and retain.
10. Remove brake shoe retaining spring taking care to retain the spring. Keep plate or pin at the rear of the backplate where fitted.
11. Lift off whole brake shoe assembly from backplate. Take care not to lose the two adjuster wedges.
12. Examine the components and springs, replace any damaged parts. Clean the mechanism and ensure that all parts are free to move.

    NOTE. Do not lubricate.

Fig. B

Fig. C

13. Re-fit springs to new shoes.
14. Locate shoes onto the backplate and position onto the adjuster wedges or cam block.
15. Re-fit retaining springs.
16. Locate expander into position on fixed shoe.
17. With care, and using a suitable lever, position the expander between the shoes and release the lever.
18. Attach brake cable and refit the half shell. **NOTE.** Always replace the brake cables if they show sign of wear, stiffness, damage or fraying.
19. Re-fit the drum and bearing. **CAUTION!** Refer to the axle manufacturer or trailer manufacturer's instruction. Replace the split pin or lock nut dependent on which type of nut is used. Generally speaking if a split pin and castellated nut is fitted the axle nut must be adjusted to allow the correct bearing clearance. When the locknut is used it is normally tightened to a pre-determined torque.
20. Refit the hub cap.
21. Repeat the procedure on the other drum(s).
22. Replace wheels securing wheel nuts, as specified in the trailer manufacturer's handbook.
23. Follow the adjustment procedure below.

ADJUSTMENT

NOTE. When adjusting the brake drum only turn the wheel in the direction of forward rotation.

Ensure that the coupling drawtube is fully extended and that there is no tension in the brake rod or cables.

1. Turn each wheel in the direction of forward rotation. Turn the brake adjuster bolt clockwise until some resistance is felt as the brake shoes begin to grip the drum, then slowly turn the brake adjuster bolt anticlockwise until the wheel begins to rotate freely again. Alternatively advance the adjuster using a screwdriver through the backplate hole until resistance is felt, then turn back by a few clicks until the wheel begins to rotate freely again.
2. Turn the nut on the brake rod until the nut is in contact with the compensator. **CAUTION!** Do not over-tighten as this will cause the brakes to drag and overheat.
3. **WARNING!** Double check that everything has been re-assembled with all fasteners secure. Remove the handbrake locking bolt and operate the handbrake several times to ensure that the compensators are seated. Check the travel of the individual brake cables. This should be 2-5mm. If not re-adjust the brake as appropriate.
4. With the handbrake engaged, turn each wheel in the reverse direction. They should turn a little and then lock as the auto-reverse mechanism operates. **NOTE.** As each wheel is turned there will be a rearward movement of the handbrake lever as the energy store operates. This action should occur once on the rearward turn of each wheel. If any wheel fails to lock there is too much slack in the system.
5. Check the compensators are at 90° to the brake rod with the brakes applied in forward and reverse. Misalignment can be corrected through adjustment of the cable locking nuts. This is particularly important if a new cable has been fitted.
6. Operate handbrake and leave on. Lower the trailer to the floor and recheck the torque of the wheel nuts.
7. Please note the brakes will not be 100% effective until the new linings have bedded in.

THE BRAKE ADJUSTMENT SHOULD BE RECHECKED AFTER A SHORT JOURNEY.

WARNING! THE DRUMS MAY BE HOT.

BRAKING – HINTS & TIPS

⚠ PRIOR TO CARRYING OUT THESE TASKS PLEASE REFER TO PRECAUTIONS ⚠

FORCE REQUIRED TO ENTER REVERSE MODE

There is a small "nib" at the front of the ramp on the brake shoe intended to prevent the shoe inadvertently entering reverse mode. There needs to be enough slack in the system to allow the shoe to ride over this before fully entering auto reverse mode. If the brakes are adjusted very tightly, this will not happen and the brakes will stay on when reversing.

Slippery surfaces such as mud or wet grass sometimes do not provide enough friction to turn the wheels into reverse mode. The trailer will slide backwards rather than roll.

RESIDUAL BRAKING

The system is kept in auto-reverse mode by friction between the shoe and the brake drum therefore there is always a small amount of braking effect when reversing.

HANDBRAKE LEVER MOVEMENT

If the brakes enter reverse mode while the handbrake is on (e.g., when uncoupling while facing up a slope) the lever can move sharply and unexpectedly upwards under the force of the energy store spring. The trailer will also roll backwards a few inches as this happens. Allow room for this when parking.

BRAKES LOCK ON

Under certain circumstances e.g. on uneven ground, twin axle trailers can sometimes lock their brakes and refuse to reverse. This is caused by two wheels entering auto reverse mode while the other two are still in forward mode. The compensator transmits only half the normal amount of slack to the coupling which is then still able to apply all four brakes. There are two methods of dealing with this:

a. If possible, begin the reversing manoeuvre on adjacent level ground so that all wheels enter reverse mode simultaneously.

b. Manually turn the other two wheels backwards to engage auto-reverse mode

STICKING BRAKES

It is most prevalent on new trailers stored with the handbrake on, especially during the winter.

For an immediate fix, tap the brake drum (not the backplate) with a hammer. This works in most instances.

In the long term, chock the wheels and leave the handbrake off when leaving the trailer, particularly if it is new and the weather tends to heavy dew.

Trailers become far less prone to this condition after the brakes are bedded in. Some trailer owners (horsebox users in particular) drive so gently that the brakes never bed in. A solution can be achieved by loading the trailer securely and deliberately bedding them by heavy use. Be careful not to endanger or inconvenience other road users with unexpected heavy braking.

BOWDEN CABLE

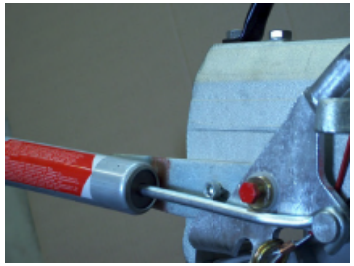
⚠ PRIOR TO CARRYING OUT THESE TASKS PLEASE REFER TO PRECAUTIONS ⚠

REMOVAL & REPLACEMENT OF BOWDEN CABLE

Place the trailer on stands with all wheels free.
WARNING! The handbrake should be released and the handbrake locking bolt fitted.

See Fig. A. Some couplings do not have provision for the locking bolt. In this case or if a bolt cannot be used the handbrake lever should be secured in the off position to prevent the handbrake lever operating.

Fig. A



1. Undo the locknut on the brake rod (front to rear) adjacent to the compensator. Slacken the second nut on the brake rod.

2. All cables up to mid 2012 had threaded fittings which passed through the compensator and either a domed nut and locknut or domed washer and locknut were fitted. In which case remove the nut from the cable inner and the nut retaining the outer to the bracket. Take note of any washers and orientation of domed nuts. Remove the half shell from the backplate and detach brake cable. Withdraw the cable assembly.

3. Attach the new brake cable to the expander in the hub and refit the half shell.

4. Thread the new cable into position, secure the outer with its nut and thread the nut on the inner to approximately the position noted on the old cable.

   NOTE. This procedure covers just the Bowden cable replacement, we would always recommend that a full brake adjustment is carried out including hub adjustment.

5. From mid 2012 fixed length (Pronto Fit) cables were introduced which have a domed mushroom head. These are used with a compensator with slotted pivot points to enable the cable to be assembled to the unit.

6. Follow the adjustment procedure under SPREADLEVER BRAKES starting at item 2.

BREAKAWAY CABLE

⚠ PRIOR TO CARRYING OUT THESE TASKS PLEASE REFER TO PRECAUTIONS ⚠

REMOVAL

It is important to ensure that the handbrake lever is prevented from operating.

WARNING! The handbrake should be released and the handbrake locking bolt fitted. See Fig. A. Some couplings do not have provision for the locking bolt. In this case or if a bolt cannot be used the handbrake lever should be secured in the off position to prevent the handbrake lever operating.

Fig. A

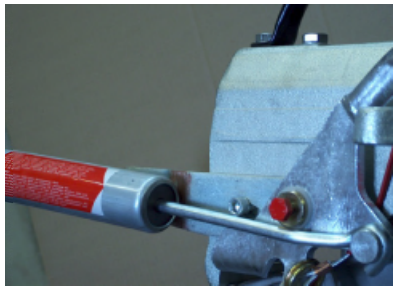
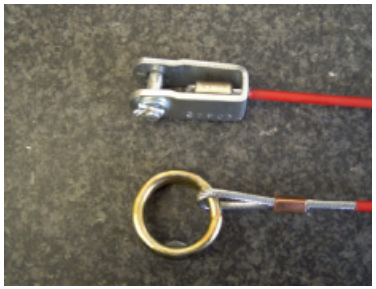


Fig. B



1. Remove the existing cable from any guides taking note of the route.
2. Where a coil fitting is used on the handbrake, use pliers and a screwdriver to prise the coils of the retention ring apart and remove the ring from the handbrake lever. See Fig.B.
3. Where a clevis and pin fitting is used on the handbrake remove the split pin and withdraw the clevis pin. See Fig.B.

REFITTING

WARNING! Always use the correct replacement from the manufacturer as an incompatible cable will fail to operate the handbrake mechanism correctly.

NOTE. The two different styles are interchangeable providing that the complete cable and fittings are changed.

1. For the coil fitting use pliers and a screwdriver to prise the coils apart and fit the ring to the handbrake lever. Check that the cable is free to move on the ring.
2. For the clevis fitting insert the clevis pin and retain it with the split pin provided.
3. In all cases thread the cable through the guides.

OPERATION

1. Ensure that the cable passes through the guides provided. This is important to ensure that the cable operates under the widest range of circumstances.
2. Check that there is no damage or fraying prior to use.
3. Secure the cable to a suitable point on the tow vehicle, refer to the vehicle or tow bar manufacturers specifications for the location.
4. Ensure that the cable is not pulled tight during articulation of the trailer and remains clear of the ground.

COUPLING HEADS / TOWING EYES / BELLOWS

⚠ PRIOR TO CARRYING OUT THESE TASKS PLEASE REFER TO PRECAUTIONS ⚠

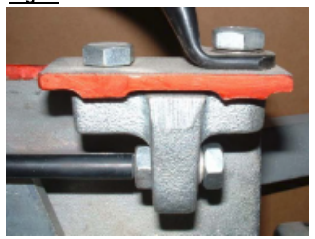
REPLACING COUPLING HEADS / TOWING EYES

Prior to proceeding it is essential to confirm the condition of the damper. Carry out a damper reaction test. Pull the handbrake lever on as far as possible. Push the ball coupling as far back into the overrunning hitch as it will go. This requires force to compress and should extend smoothly when released. If the draw tube is impossible to compress, compresses with just spring force and no damping resistance, or the extension is very rapid the damper must be replaced by carefully following the DAMPERS instructions. If completely satisfied that the damper is in good condition proceed as follows:

1. Follow the procedure for DAMPERS up to and including point (4).
2. If you have been able to remove the coupling head / eye as instructed in DAMPERS point (4) go straight to instruction (5) below, otherwise continue.
3. The damper will now be retained between the front coupling / eye bolt and the rear damper bracket. It is now necessary to remove the damper without destroying it. **WARNING!** Proceed with extreme caution. The most efficient method is to remove the rear damper mounting bracket but depending upon the coupling there may still be tension in the damper.
4. Place a lever against the rear damper in such a manner that once the mounting bracket bolts are removed the tension can be released slowly. Take the tension and remove the mounting bracket bolts, release the tension in the damper.
5. Inspect the shaft for damage, dress burrs and clean any dirt as the new coupling will be a close fit on the shaft.
6. If a new bellows is to be fitted cut the tie-wrap and discard the old one, fit the new and secure with a tie-wrap.
7. Trial fit the new coupling, it should slide into place without any undue force. DO NOT hammer the coupling into place, this can damage the coupling itself or the over-run mechanism. If it proves to be tight remove it, and thoroughly clean the shaft, inspecting for burrs.
8. Fit the bolts, washers and secure with NEW locking nuts. DO NOT re-use the old nuts as this is safety critical. Torque to the figure in the table below. Fit the plastic nut covers. Where the damper has been removed ensure that the coupling head rear bolt passes through the hole in the damper body. **NOTE.** If you have any doubts about the condition of the damper a new one must be fitted.
9. If the damper has been released the rear mounting bracket will need to be re-fitted. This means that the damper needs to be compressed such that the bolts can be located.

   WARNING! Proceed with extreme caution. Compress the damper with the lever and secure the mounting bracket bolts, as shown in Fig. A.
10. Re-fit the bellows with the coupling / eye horizontal taking care not to tear or damage the material.

Fig. A



Where the replacement coupling / eye is a different part to the original:

- Always ensure that the corresponding length bolts are used.
- Always ensure that the compatible bellows is used.
- Always ensure that the hole sizes in the coupling and draw-bar tube match and that the correct sized bolts are employed.

ADJUSTMENT

It is not necessary to make any adjustments, simply rotate the coupling / eye to its limits to ensure that the natural position of the bellows is with the head horizontal.

DAMPERS

PRIOR TO CARRYING OUT THESE TASKS PLEASE REFER TO PRECAUTIONS

SAFE REMOVAL AND DISPOSAL OF DAMPERS

The dampers assembled within overrun couplings are pressurised. During assembly the damper is preloaded and compressed in order that the coupling operates correctly. Care must therefore also be exercised when working on, handling and disposing of the coupling / damper. This is especially important if any damage or misuse of the coupling has occurred. This procedure will ensure that the damper is removed and disposed of safely. **WARNING!** Do not position anything or stand immediately to the front or rear of the coupling assembly in case a damper fails during the process.

REMOVAL

1. Pull back the bellows from the coupling / eye to expose the two securing bolts, see Fig. A.
2. Undo the self locking nut from the rear bolt of the coupling / eye, as shown in Fig. A.
3. Remove the rear bolt - force may be required as the damper may still be preloaded. Raise the coupling / eye operating handle in order to fully remove the bolt if needed.
4. When the rear bolt is removed the damper will move forward to rest upon the front bolt. **NOTE.** In some instances a retaining pin is fitted, (located between the bolt holes). This pin will hold the damper in its original position and will therefore need to be removed in the following manner: Undo the self locking nut from the front bolt, extract the bolt and remove the head. Replace both bolts in drawtube and finger- tighten the nuts. Knock out the retaining pin and remove the rear bolt, this will allow the damper to move forward and contact the front bolt. This position is shown in Fig. B. on the cut away photograph.
5. From underneath, through the bolt hole in the drawtube, drill a 3mm diameter hole into damper body to a depth of 8mm. **WARNING!** 1. Observe normal safety procedures for the use of hand tools. 2. Wear safety glasses. 3. Do not lie immediately underneath the bolt hole when drilling. 4. When the drill penetrates the damper body gas will be allowed to escape.
6. The pressure in the damper should now have been discharged. Remove the self locking nut on the front bolt of the coupling head. Remove the bolt and the coupling head. If the bolt is difficult to remove it indicates that there is still residual force in the damper and so section (5) above should be repeated.
7. Remove the rear damper bracket retaining bolts. Also remove the nuts and spring washer from the rear of the damper, as shown in Fig. C. on the cut away photograph.
8. The de-pressurised damper can now be removed by sliding the damper forward through the drawtube and be disposed of as per the DISPOSAL instructions below.

Fig. A

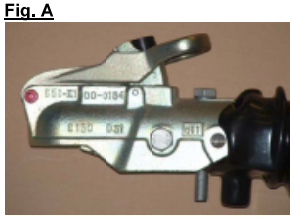


Fig. B

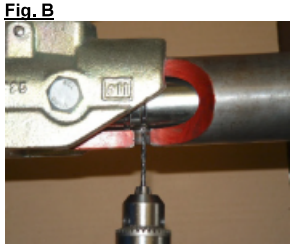
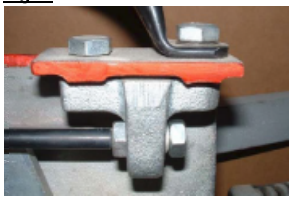


Fig. C



REPLACEMENT

1. Fit the rear damper mounting to the new damper, see Fig. C. and slide the damper loosely into position.
2. Follow the procedure for COUPLING HEADS / TOWING EYES / BELLOWS, section (5) onwards.

DISPOSAL

WARNING! This operation should only be carried out if the gas pressure has been discharged. Prior to disposing of the damper it is recommended that the oil remaining in the damper is drained away and disposed of in an appropriate manner. This can be achieved by drilling a 3mm hole in the damper body 60mm from the rod end of the damper.

DRAWTUBE

PRIOR TO CARRYING OUT THESE TASKS PLEASE REFER TO PRECAUTIONS

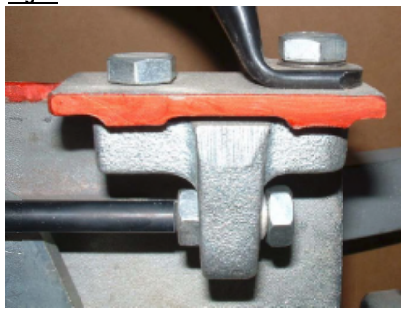
REMOVAL

1. Follow the instructions for DAMPERS (section 1 to 8) taking due note of the introductory notes.
2. Once the damper is removed the lever which transmits the force from the drawtube to the brake rod can be rotated to allow the drawtube to be removed rearwards.
3. If the drawtube has been bent it will prevent removal so the front portion must be sawn off and the remainder removed from the rear of the coupling housing. Once sawn, all burrs must be removed and care exercised to prevent swarf being trapped such that it will jam the mechanism.
4. Clean the bearing surfaces inside the housing.

REPLACEMENT

1. Lubricate the drawtube and insert it into the housing ensuring that it is free to slide and that there is not excess clearance between the tube and bearing surfaces.
2. Fit the damper mounting to the new damper and slide it loosely into position.
3. Place bellows on to the drawtube, place coupling into position. Fit the bolts, washers and secure with new locking nuts. DO NOT re-use the old nuts as this is safety *critical*. Torque to the figures as shown below.
4. Compress the damper and fit the rear mounting bracket bolts.
   WARNING! Proceed with extreme caution. Compress the damper with a lever and secure the mounting bracket bolts as shown in Fig. A.

Fig. A



ADJUSTMENT

It is not necessary to make any adjustments, simply rotate the coupling/eye to its limits to ensure that the natural position of the bellows is with the head horizontal.

AVONRIDE HEAD LOCK

PRIOR TO CARRYING OUT THESE TASKS PLEASE REFER TO PRECAUTIONS

These instructions cover adding lock to a coupling head originally supplied without one, and also the replacement of an existing lock.

1. Operate the latch and lift the handle to expose the latch pin. Block in position. See Fig. A.
2. Using a punch drift the pin out allowing the lock housing to lift off. See Fig. B.

Fig. A

Fig. B

3. If the housing is not currently fitted with a lock remove the spring for re-use. Remove the washers and the plastic blanking plug and discard.
4. If the housing has a lock fitted remove the spring, centre screw, washer and actuator lever for re-use, followed by the lock barrel ring nut.
5. Fit the plastic cover to the new lock, insert lock into casting and secure with the ring nut.
6. Fit the actuator lever with washer and centre screw and locate the spring.
7. Place the assembly into position on the coupling body, line up the pivot hole and gently drift in the pin.
8. Check all parts are secure, that the lock mechanism operates and that the safety catch moves freely securing the handle.

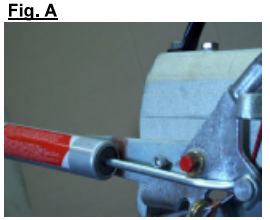
HUBS, SEALS & BEARINGS

PRIOR TO CARRYING OUT THESE TASKS PLEASE REFER TO PRECAUTIONS

These instructions refer to the Knott-Avonride bearing arrangements although others are similar. Always refer to the trailer manufacturer's handbook.

There are many varieties of hub bearing / seal arrangement, usually specific to each manufacturer. However these fall into two types; separate bearings (taper roller or angular contact ball races) which are assembled with some clearance and unitised bearings which are a single bearing and are assembled using a high torque locking nut. **WARNING!** Be aware that hub bearing failure in service results in a catastrophic failure with a high possibility of the wheel becoming detached from the stub with obvious potential consequences. Always err on the safe side and replace suspect components.

Fig. A



Place the trailer on stands with all wheels free. **WARNING!** The handbrake should be released and the handbrake locking bolt fitted. See Fig. A. Some couplings do not have provision for the locking bolt. In this case or if a bolt cannot be used the handbrake lever should be secured in the off position to prevent the handbrake lever operating.

HUB/DRUM REMOVAL

1. Assess the condition of the bearing by rocking the road wheel to see if there is play in the bearing, then spin the wheel rapidly and listen for a rumbling sound which indicates pitting of the races.
2. Remove the wheels and hub cap. Slacken off the brake adjuster if needed.
3. Remove the grease cap by carefully prying progressively around the flange of the cap.
4. For installations with a castellated nut and split pin, remove the pin, nut and, where fitted, washer.
5. For installations with a high torque nut unscrew the nut. **WARNING!** High forces are needed; ensure that the trailer is stable.
6. Remove the brake drum (hub puller may be required and adjustment may require slackening) taking care not to displace the bearings.
7. Once the linings are exposed take extreme care to avoid contaminating them and the friction face of the drum with grease as this will impair braking performance.

BEARING INSPECTION

Hubs with separate bearings

1. Wash grease and oil from the bearing with a suitable solvent; inspect each roller, inner and outer races. If any pitting, damage or corrosion is present then the bearing must be replaced. **NOTE.** If any one part shows damage or wear we always recommend replacing all bearings in the hub and fitting a new oil seal.
2. Using a brass drift carefully drive out the outer races working around the circumference. **WARNING!** Be sure to wear safety glasses when removing or installing force fitted parts. Failure to comply may result in eye injury.
3. Clean the hub and carefully tap in the new bearing outer races with a brass drift. Be sure they are seated against the shoulders.
4. Grease the bearings and fit with a new seal. Force grease into the bearing between each roller; apply a light coat of grease to the bearing races. Refer to the trailer manual for grease specification. **CAUTION!** Do not fill the cavity between the bearings, this is not necessary and can lead to grease leaking from the seals onto the brake linings.

Recommended grease is Shell Retinax EP2, Bearings should be lubricated every 12 months or 12,000 miles.

Hubs with unitised bearings

Unitised bearings used in Knott hubs are a single non-adjustable lubricated for life assembly with integral seals. If the check in (1) above indicated excess play in the bearing then the bearing should be pressed/drifted out having removed the circlip and replaced. The new bearing should be pressed/gently drifted into place ensuring that it remains square to the bore and seats against the shoulder, the circlip is then re-fitted.

SEAL INSPECTION AND REPLACEMENT

Installations with separate bearings have a seal on the inside end to retain grease, whenever the hub is removed inspect the seal to ensure that it is not nicked or torn and is still capable of properly sealing the bearing cavity. If there is any question that it may be in poor condition, replace the seal.

To replace the seal: Pry the seal out of the hub with a screwdriver. Never drive the seal out with the inner bearing as you may damage the bearing. Tap the new seal into place using a clean wood block. Very lightly lubricate the seal face with grease. Unitised bearings have an integral seal which is less prone to damage and is not replaceable, if failure is suspected then the whole bearing must be replaced.

DRUM INSPECTION

Check the condition of the brake drum, replace the drum and bearing if deep score marks are visible.
WARNING! Avoid inhaling brake dust. Do not use a compressed air line to clean the drum. Carefully remove the dust using a small brush or brake cleaner.

BEARING ADJUSTMENT & HUB REPLACEMENT

Refitting taper roller hubs with castellated nut and split pin.

If the hub has been removed or bearing adjustment is required, the following adjustment procedure must be followed.

1. After placing the hub, bearings, washers and spindle nut back on the axle spindle in reverse order as detailed in the previous section on hub removal, rotate the hub assembly slowly while tightening the axle nut to approximately 50lbs – ft. (69Nm).
2. Loosen the axle nut to remove the torque. Do not rotate the hub.
3. Finger tighten the axle nut until just snug.
4. Back the axle nut out slightly until the first castellation lines up with the split pin hole and insert the split pin. **NOTE.** Always use new split pin.
5. Bend over the split pin legs to secure the nut.
6. Nut should be free to move with only restraint being the split pin.

Refitting unitised bearing hubs with high torque nut

1. Fit the drum to the axle shaft and tighten the nut to the correct torque (280 Nm as specified inside the dust cap for Knott-Avonride hubs).

   WARNING! Other manufacturers' figures differ. Refer to the trailer manufacturer's handbook if there is any uncertainty.

   NOTE. The nut may only be used twice so if the history is not known it must be replaced.
2. Refit the hub cap and replace wheels securing wheel nuts as specified in the trailer manufacturer's handbook. Confirm that there is no excessive play at the wheel rim.

After the first 1000km wheel bearings should be checked for excessive end float.

WHEEL STUDS

1. Remove hub as detailed above.
2. Place hub on flat surface with studs showing up, and gently tap out studs.
3. Invert hub on raised surface, allowing room for new studs to be knocked through.
4. Align ribs on new wheel studs with grooves in stud holes.
5. Gently tap in studs using brass drift to protect studs.

WHEEL NUTS

Replace worn wheel nuts as necessary.
NOTE. Tighten up to wheel manufacturers recommended torque (if in doubt consult supplier). We recommend that once the hubs have been refitted that the brakes are adjusted – please refer to the "adjustment" section of SPREADLEVER BRAKES.

The service consists of a functional check - if this identifies a fault then an initial visual check followed by a methodical series of tests will be needed.

VISUAL INSPECTION

a. 7 Pin or 13 Pin Plug & Trailer to Vehicle Cable

Check for damage or deterioration.
Plug electrodes are clean and not worn.
Plug body and seal is not damaged.
Cable is not abraded or cracked, especially near the plug or where secured to the trailer.
Open the plug and check the connections for corrosion or loose connections.

b. Junction Boxes

Check the junction box(es) for damage. Check that the lid is securely fitted and seals are intact.

c. Fixed Wiring

Check for damage, cuts and cracks especially where the cable runs over metal edges or is flexed.

FAULT FINDING STRATEGIES

These are simple systems and work logically. The difficulty sometimes lies in finding that answer quickly. If a lamp is not working and the bulb proves to be functioning:-

1. Check anything that has been disturbed recently.
2. Check areas known to be susceptible to damage or deterioration.
3. Check things that are easy and quick.

If this does not identify the fault then:-

4. Follow systems in a logical and thorough manner.

Earth faults are common, particularly on older towing vehicles and can repay investigation.

If these do not yield a result, then follow the malfunctioning system through from one end to the other omitting nothing. Be aware that the circuit may pass from one colour wire to another.

Do not assume that the trailer is always at fault. A great deal of time can often be saved by checking the wiring of the towing vehicle at an early stage.

EQUIPMENT

1. Lighting Board
   A specialist fault finding device can be used to check the towing vehicle but a simple lighting board makes a readily available substitute. Make sure it is wired correctly and double check it is still working before using as a checking aid. Use this to check the towing vehicle and as an emergency field recovery replacement.

2. Multi Meter
   The ranges required for trailer purposes are 12 (occasionally 24) volts DC (direct current) for detecting voltage and Resistance for checking continuity.

3. Test Lamp
   A small 12 probe, one with a small crocodile clip. Attach the crocodile clip to earth (white lead) and use the probe to detect where a positive voltage is being supplied.

4. Extension Lead
   A long lead with two crocodile clips to enable the multimeter or test lamp to be used between two remote points eg between the 7-pin plug and the junction box or a rear lamp.

LIGHTING SYSTEMS - FAULTS

LAMP DOES NOT WORK

FAULT: One lamp doesn't work at all and the others work correctly:

CHECK THE BULB

1. Make sure that it is the correct type, power and voltage of bulb.
2. Ensure that the contact on the base of the bulb is clean.
3. Frequently the filament can be seen to be damaged but not all bulb faults are visible. Either replace with a known good bulb or put the suspect bulb into another lamp of a similar type. If the new bulb works or the fault follows the suspect bulb, then it is faulty.

CHECK THE BULB HOLDER

1. Corrosion. Cleaning with abrasive paper and a smear of grease can get the lamp working but if there are any doubts replace the lamp unit.
2. Bulb mounting. Make sure that the bulb retaining tags are not bent or broken or loose and hold the bulb securely against the contacts.

CHECK FOR POWER

1. Check that a voltage appears between the contact and bulb holder when the lamp is switched on. If there is no power then go to the plug at the front of the trailer and check for voltage between the live and the white earth cable. Follow the feed for that lamp back to the next connector or junction box and check for voltage again. Check leads coming into and out of each connector/junction box, all the way back to the lamp if necessary. Following a progression from the lamp to the power source will indicate in which connector or cable run the problem lies.

CHECK CABLES

1. If the problem lies in a cable run then identify if the problem is in the feed or ground wires. This can be done by continuity test or by substitution.
2. Check each crimp terminal. Check there is good contact between the crimp and the core and there is no insulation getting in the way. Cores sometimes break just inside the insulation.
3. If both terminals are good, then the fault lies in the wire. If there is no visual damage to indicate the location of the problem, the simplest solution is to replace the cable or add a supplementary cable.

WRONG LAMP COMES ON

FAULT: One lamp comes on instead of another:

- This is almost certainly a wiring error. Follow the cables from the lamp to the vehicle plug to find the mistake.

FAULT: Correct lamp on, others come on very dimly:

- An earth fault. The lamp being tested is trying to earth itself through the other lamps. Follow the earth from the lamp in question to find the fault.

FAULT: Fuses blow in the towing vehicle:

- Longer trailers with side marker lamps can draw more current from right and left hand side lamp circuits than the towing vehicle is capable of supplying. NB. Each 5 watt bulb draws 0.4 amps over and above the requirements of the towing vehicle itself. Check the fuse capacity on the side lamp circuit. If this is inadequate install a by-pass relay. More modern lighting systems use LEDs for side marker lamps reducing the current consumption.

  This problem can be caused by a live feed touching either the chassis or the white earth return wire.

  Do not use a towing vehicle to test for this problem, use a multimeter to identify the fault. Use the resistance function of a multimeter to determine which wire has the fault. At the plug check each feed wire in turn against the white earth wire and then against the chassis. Low or zero resistance will indicate which feed wire is contacting which return. Follow the feed wire through the system to locate the fault.

LED LAMPS

There are significant issues with the use of LED lamps on trailers. Vehicle indicators to show that the trailer is connected may not work. Incompatibility of towing vehicle electronics can cause trailer lamps to show dim or pulsate. Specialist help should be sought in all cases where investigation of LED lamps is needed.

DAILY CHECKS PRIOR TO USE

Coupling head	Ensure positive locking onto ball and wear indicator acceptable
Lighting	Secure plug and check lights are operational
Tyres/Wheels	Check correctly inflated, sidewalls for damage, tread for wear, wheel nuts secure.
Noseweight	Ensure positive noseweight not exceeding maximum recommendations.
Towing height	Ensure trailer is “towing” horizontal to ground
Load	Ensure load is safe and secure and does not exceed maximum weight capacity
Tow vehicle	Ensure that trailer is within tow vehicle manufacturers weight range
Legal obligations	Ensure driver has licence category for the trailer. Tachograph regulations and duty hours to be observed if applicable

GENERAL CHECKS

Coupling head	Oil moving parts and pivots Clean and lubricate coupling head Check coupling head for positive locking onto tow ball
Coupling assembly	Check bellows for damage and apply grease to the two grease nipples on the coupling body and check drawtube for play Carry out a damper reaction test. Pull the handbrake lever as far as possible. Push the ball coupling as far back into the overrunning hitch. This requires force to compress and should extend smoothly when released Check the handbrake lever including auto reverse. Braked: check break-away cable for damage, fraying and security of the fittings Unbraked: check secondary coupling (cable, chain) for damage and security of the fittings The use of a break-away cable or secondary coupling is a legal requirement. Always use a compatible cable from the original manufacturer
Wheelbrake / brake rod mechanism	After 500 miles and then every 3000 miles (or annually) adjust the wheel brakes at the backplate and re-check the mechanism. Note it is important that the brake wear is taken up by adjusting the brake hubs and not by adjusting the linkage to compensate for mis-adjusted hubs. Ensure that cables/rods are not pre-tensioned prior to adjusting the wheel brake
Rubber torsion axle	Check ride height Check wheel bearings
Jockey Wheel	Dismantle and lubricate

FAULT FINDING

Fault	Cause	Solution
Braking too weak	Too much play in the brake system	Re-adjust
	Brake linings not run in	Drive with caution and re-check
	Brake linings oiled or damaged	Replace shoes and clean drum and brake components
	Over-run hitch stiff in operation	Lubricate and check for free movement
	Brake rod bent	Inspect and replace
	Brake cables rusty, frayed, buckled or damaged	Inspect and replace
Jerky braking	Too much play in the brake system	Re-adjust
	Defective coupling damper	Replace damper
	Auto-reverse brake shoe binding in carrier	Clean, check for wear and lubricate or replace
Trailer slews under braking	Wheel brakes working one side	Check system, replace as necessary, adjust
	Brake linings oiled or damaged in one or more hubs	Replace shoes and clean drum and brake components
Trailer brakes when tow vehicle throttle released but brakes not applied	Defective coupling damper	Replace damper
Difficulty reversing (brakes lock)	Brake system too tightly adjusted	Re-adjust hubs and cables do not overtighten
	Pre-tension in cables	Check hubs, cables and links for adjustment
Handbrake too weak	Too much play in the brake system	Re-adjust
	Brake rod bent	Inspect and replace
	Brake cables rusty, frayed, buckled or damaged	Inspect and replace
Wheel brakes get hot	Possible normal operation	Request opinion of service centre
	Brake system too tightly adjusted	Re-adjust system taking care not to overtighten
	Pre-tension in cables	Check hubs, cables and links for adjustment
	Overloaded trailer	Ensure that heating is not simply due to high duty
Ball coupling does not locate – fails to lock on	Inside of coupling head dirty	Clean and lubricate
	Incorrect tow vehicle ball hitch	Ensure that hitch is ISO 50 mm (49.61/50.0 diameter)
Ball coupling does not locate – loose or play evident	Wear in head or ball	Inspect and replace
	Faulty head	Replace head

“MOT” STYLE ANNUAL CHECK

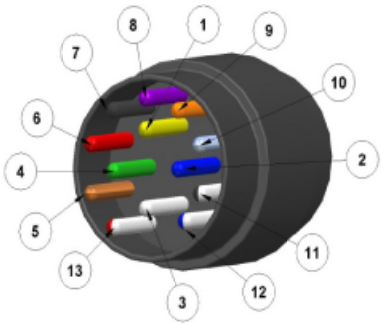
Test	Method	Go/no-go
Check drawtube for play	Grasp and feel play vertically and horizontally	Max 1 - 2 mm play at the head
Check damper operation	Force inwards and allow to extend	Requires force to compress and extends smoothly
Check coupling head “fit onto” tow ball	Trial fit to tow ball	Head indicators should show acceptable
Check coupling head and coupling assembly for loose, worn or broken parts. Particularly the bellows for damage	Inspection and check moving parts	All parts move freely, no damage or wear
Check rubber suspension for soundness	Visual inspection and measurement	Ride height at the same height on both sides
Check coupling assembly and suspension mounting points (axle pads) for security	Use spanner to check critical fasteners (coupling or delta plate plus axle pad bolts)	All secure
Look at tyre treads for any clues to misalignment or possible suspension failure	Inspection	Tyres must be legal, have the correct load rating and any unusual treadwear investigated further
Check wheel bearings	Raise trailer, rock wheel	No/minimal play
Check the handbrake lever including brakes in auto-reverse.	Apply handbrake, push rearwards and observe lever	Brakes should re-lock as handbrake lever travels further overcentre
With trailer handbrake on check adjustment	Apply handbrake	Check that compensator remains parallel.
With trailer handbrake on check function of compensator	Raise trailer, turn each wheel backwards until it locks	Wheels should lock one at a time, compensator must articulate and return to a parallel position when all wheels are locked
Check that the trailer holds securely on the handbrake	Apply handbrake and attempt to tow forwards with vehicle	Braking effect should be felt plus likelihood of skidding wheels on poor terrain
Inspect linkage, cables and compensator for security and corrosion	Inspection	All secure and minimal corrosion

BOLT TORQUES & LUBRICATION

	Torque	
Fastener	lb. ft.	Nm
M10 grade 8.8 general service	33	45
M12 grade 8.8 general service M12 grade 8.8 (10.9) pressed heads	59 52	80 70
M12 grade 10.9 general service M12 grade 10.9 cast head / eye	74 74	100 100
M14 grade 10.9 general service M14 grade 10.9 cast head / eye	125 92	170 125
M16 grade 8.8 general service	144	200

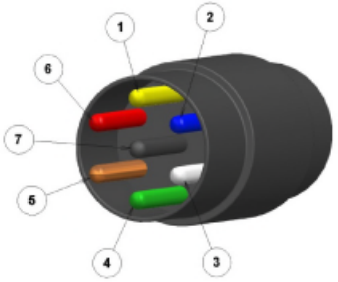
	Oil	Grease
Coupling head cup		Yes (Morris K2EP Longlife Grease)
Coupling pivots	Yes	
Coupling drawtube		Yes (Morris K2EP Longlife Grease)
Handbrake	Yes	
Jockey wheel thread		Yes (Morris K2EP Longlife Grease)
Exposed cables, rod ends, threads, pivots		Yes (Shell Albeida RL1)
Compensator	Yes	Yes (Shell Albeida RL1)

ELECTRICAL WIRING CONNECTIONS



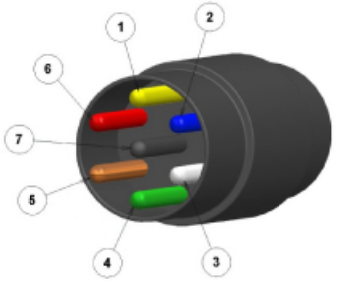
13 PIN WIRING

No	Colour	Description
1	Yellow	LH Indicator
2	Blue	Rear Fog Lamp
3	White	Earth for Pins 1 to 8
4	Green	RH Indicator
5	Brown	RH Tail Lamp, End Outline, No Plate Lamp
6	Red	Stop Lamps
7	Black	LH Tail Lamp, End Outline, No Plate Lamp
8	Pink	Reversing Lamp
9	Orange	12V Power Feed
10	Grey	Fridge (IGN Switched Live)
11	White/Black	Earth for Pin 10
12	White/Blue	Spare (Signal)
13	White/Red	Earth Return for Pin 9



12 N 7 PIN 12 VOLT (Normal)

No	Colour	Description
1 (L)	Yellow	LH Indicator
2 (54G)	Blue	Rear Fog Lamp
3 (31)	White	Earth
4 (R)	Green	RH Indicator
5 (58R)	Brown	RH Tail, End Outline, No Plate Lamp
6 (54)	Red	Stop Lamps
7 (58L)	Black	LH Tail, End Outline, No Plate Lamp



12 S 7 PIN 12 VOLT (Supplementary)

No	Colour	Description
1 (L)	Yellow	Reversing Lamp
2 (54G)	Blue	Spare
3 (31)	White	Earth
4 (R)	Green	12V Power Feed
5 (58R)	Brown	Spare
6 (54)	Red	Fridge (IGN Switched Live)
7 (58L)	Black	Spare or Earth for Pin 6

Converters are available to enable attachment of 13 pin, 7 pin and 7S connectors for both tow vehicle and trailer.

A 13 pin equipped trailer with reversing lights will need an adaptor when coupled to a 7 pin equipped tow vehicle and reversing lamp will not be functional.

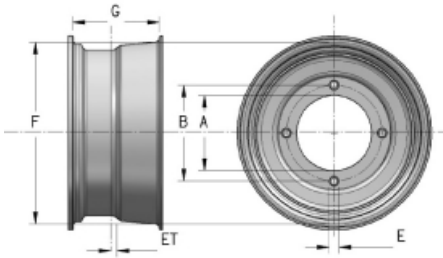
Type approved trailers will need to be equipped with reversing lights:-

O_1 optional **** O_2 mandatory (one lamp up to 6m long, two lamps over 6m long)

HUB FITTINGS

CENTRE WHEEL STUDDING

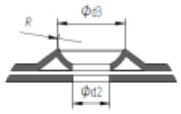
No of Bolts	Bore (A)	PCD (B)	Bolt
4	58	98	M12
4	57-60	100	M12
4	66.7	(4") 101.6	3/8"
5	63-67	112	M12/M14
5	80	(4½") 115	M12
4	95.25	(5½") 139.7	M12
5	94	140	M12/M16
5	115	(6½") 165.1	M12/M16
6	161	205	M14

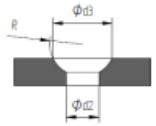


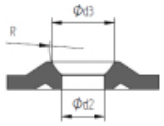
A = Bore (mm)
B = Pitch circle diameter (PCD) (mm)
ET = Offset (mm)
E = Bolt hole diameter (mm)
F = Rim diameter (inches)
G = Rim width (inches)

The correct nut or bolt must be used to suit the wheel seating i.e. Conical or spherical.

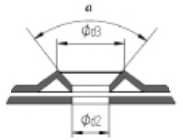
SPHERICAL COUNTERSINK

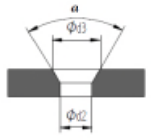


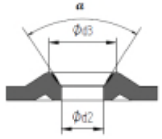




CONICAL COUNTERSINK







SPHERICAL COUNTERSINK SIZES

Internal Thread	R	Ød2	Ød3
3/8"	12.7	10.5	20
M12 x M1,5	12	16	20
M14 x 1,5	14	16	23

CONICAL COUNTERSINK SIZES

Internal Thread	α	Ød2	Ød3
M10	60°	11	-
M10	90°	11	-
M12 x 1,5	60°	14	-
M12 x 1,5	90°	16	-
M14 x 1,5	60°	16.8	-

TYRE SPEED SYMBOLS & TYRE LOAD INDEXINGS

TYRE SPEED SYMBOLS

Speed Symbol	Max. car speed for which tyre is suitable	
	Km/h	mph
J	100	60
K	110	69
L	120	75
M	130	81
N	140	87
P	150	93
Q	160	100
R	170	106
S	180	113
T	190	118
U	200	124
H	210	130
V	240	150

TYRE LOAD INDEX

LI	Kg	LI	Kg	LI	Kg	LI	Kg	LI	Kg	LI	Kg
60	250	71	345	82	475	93	650	104	900	115	1215
61	257	72	355	83	487	94	670	105	925	116	1250
62	265	73	365	84	500	95	690	106	950	117	1285
63	272	74	375	85	515	96	710	107	975	118	1320
64	280	75	387	86	530	97	730	108	1000	119	1360
65	290	76	400	87	545	98	750	109	1030	120	1400
66	300	77	412	88	560	99	775	110	1060	121	1450
67	307	78	425	89	580	100	800	111	1090	122	1500
68	315	79	437	90	600	101	825	112	1120	123	1550
69	325	80	450	91	615	102	850	113	1150	124	1600
70	335	81	462	92	630	103	875	114	1180	125	1650

LI = Load Index Kg = Load (Kg)

The LOAD INDEX is a numerical code associated with the maximum load a tyre can carry at the speed indicated by the SPEED SYMBOL under service conditions, specified by the E.T.R.T.O Standards Manual – published annually.

A bonus load of 10% over the load capacity quoted in the table is permitted when passenger car tyres are fitted to caravans and light trailers operated within the UK with a maximum operating speed up to 100Km/h.

Commercial vehicle tyres attracted a smaller bonus load of 5% under the same conditions.

Dedicated trailer tyres classed as “Free Rolling Tyres” do not attract a bonus load.

The bonus load does not apply in territories where the speed limit for trailers is higher than in the UK, hence for export trailers or ones likely to be used in continental Europe bonus load should not be used.

As higher rated tyres become more readily available the use of bonus load is reducing and in all cases we recommend seeking advice from the tyre manufacturer if bonus loads are to be used, including suitable inflation pressure.

It is important to ensure that the wheel is suitable for the trailer mass and suits the tyre manufacturers fitment requirements.

New legislation is in preparation defining additional side wall markings for rolling resistance, noise and manufacturing date. This will potentially lead to limits on the age of tyre allowed in service.

TORQUE SETTINGS

HUB NUT

Manufacturer	One Piece Bearing	Taper Roller Bearing
Knott-Avonride Ltd	280 Nm	70 Nm (Rotate Hub) then back off. Retighten finger tight then fit split pin.
Ifor Williams Trailers	350 Nm	
Al-Ko	280 Nm	

NOTE: Manufacturers specific recommendations for torque settings and for replacement of hub nut and split pin.

WHEEL BOLTS / NUTS

Thread Type	Torque Value
M10 x 1.25 Bolt	55 Nm
M12 x 1.5 Bolt*	90 Nm
M14 x 1.75 Bolt	145 Nm
3/8” UNF Nut	60 Nm
7/16” UNF Nut	70 Nm
M12 x 1.5 Nut	100 Nm
1/2" UNF Nut	90 Nm
5/8” UNF Nut	110 Nm
M16 x 1.5 Nut	195 Nm

* Steel wheels (grade 8.8 or 10.9). For alloy wheels please contact our Technical department.

FASTENERS - GENERAL

Bolt	Torque Value
M10 Grade 8.8	45 Nm
M12 Grade 8.8	70 Nm
M12 Grade 10.9	125 Nm
M14 Grade 10.9	170 Nm
M16 Grade 8.8	195 Nm

HEAD SECURING BOLTS

Bolt	Torque Value
M12 Grade 10.9	100 Nm
M14 Grade 10.9	125 Nm

BREAKAWAY CABLES & SECONDARY COUPLINGS (EXTRACT FROM UNECE REGULATION 13)

5.2.2.1 Trailers of category O_1 need not be equipped with a service braking system; however, if a trailer of this category is equipped with a service braking system, it shall satisfy the same requirements as a trailer of category O_2.

5.2.2.2 Trailers of category O_2 shall be equipped with a service braking system either of the continuous or semi-continuous or of the inertia (overrun) type. The latter type shall be permitted only for centre axle trailers.

5.2.2.9 The braking systems shall be such that the trailer is stopped automatically if the coupling separates while the trailer is in motion. However, this provision shall not apply to trailers with a maximum mass not exceeding 1.5 tonnes, on the condition that the trailers are equipped with, in addition to the coupling device, a secondary coupling (chain, wire rope, etc) capable, in the event of separation of the main coupling, of preventing the drawbar from touching the ground and providing some residual steering action on the trailer.

These paragraphs are closely mirrored in EC Directive 98/12/EC paragraphs 2.2.2, 2.2.2.1 and 2.2.2.9 with the exception that paragraph 2.2.2.1 authorises the specified braking system for all trailers other than semi-trailers.

Knott-Avonride Ltd unbraked couplings for use on trailers up to 750kg gross weight (O_1) must be fitted with a compliant secondary coupling.

All Knott-Avonride Ltd braked couplings for use on trailers up to 3500kg gross weight (O_2) are fitted with a breakaway cable.

USE ONLY KNOTT-AVONRIDE LIMITED ORIGINAL REPLACEMENT PARTS

TRAILER WEIGHTS

Classification	Gross (kg)	Braking
O_1	0 – 750	Unbraked with secondary coupling (or optionally braked with secondary coupling or breakaway cable)
O_2	750 – 3500	Overrun couplings with breakaway cable (or secondary coupling to maximum mass of 1500kg)
O_3	3500 – 10000	Power brakes, self adjusting brake mechanism and ABS
O_4	Over 10000	Power brakes, self adjusting brake mechanism and ABS

NOTE: The maximum Mass considered for classifying a trailer corresponds to the static vertical load transmitted to the ground by the axle(s) (Annex II, paragraph 3, 2007/46/EC).

TRAILER DIMENSIONS

	Tow Vehicle	Length	Width	Height
The Road Vehicles (Construction & Use) Regulations 1986	< 3500 GVW	7.0m excl. drawbar	2.55m (was 2.3m)	Practical maximum 4.2m
	> 3500 GVW	12.0m excl. drawbar	2.55m	
		(Min 4 wheels, max combination length 18m)		
EC Directive 2007/46/EEC Dimensions from 96/53/EC as amended by 2002/7/EC	M_1, M_2, M_3, N_1, N_2, N_3	12.0m incl. drawbar	2.55m (2,60m refrigerated)	4.0m
		Max articulated vehicle length 16.5m		
		Max roadtrain (wagon & drag) 18.75m		

The information here is intended as a guide. It is as accurate as we can make at the time of printing, however, Knott-Avonride Ltd do not accept any responsibility for any inaccuracies which may be in the text. Any person wishing to depend on the information contained here must check for themselves with the original documentation including any revision or additions to regulations, instruments or the law.

⚠ AS OF 29 OCTOBER 2012 ALL COMPLETE TRAILERS MUST COMPLY ⚠

GENERAL SAFETY REGULATION EC 661/2009

The General Safety Regulation (GSR) amends Directive 2007/46/EC by substituting the equivalent UNECE Regulations in place of the EC Directives. It makes compliance with the UNECE regulations for type approval submissions compulsory from 1 November 2012 and compulsory for vehicles entering into service from 1 November 2014.

All of the old EC Directives will be repealed and will be replaced by the UNECE regulations. UNECE Regulations are also recognised in a wider range of countries than the European Directives. Where equivalent UNECE Regulations are not available General Safety Implementing Measure documents are being published.

Not all Directives have an equivalent UNECE Regulation and Implementing Measures are being introduced in these cases which will be used as the Directives are repealed.

The respective Directives, Regulations and Implementing Regulations are equivalent with only detailed differences.

Knott-Avonride Ltd is in the process of re-approving our range, and all will be complete well ahead of the Directives being repealed on 1 November 2014. Any questions should be addressed to our Technical department who will be able to assist.

USEFUL CONTACTS

British Standards Institution	www.bsigroup.com
Business Link (select transport)	www.businesslink.gov.uk
Department for Transport	www.dft.gov.uk
Department of the Environment	www.doeni.gov.uk
Driver & Vehicle Agency	www.dvani.gov.uk
Driver & Vehicle Licensing Agency	www.dvla.gov.uk
European Tyre & Rim Technical Organisation	www.etrto.org
Freight Transport Association	www.fta.co.uk
Highways Agency	www.highways.gov.uk
Knott-Avonride Ltd, Burton Upon Trent, Staffordshire	www.knottuk.com
Knott-Avonride Ltd, Maesteg, South Wales	www.knottuk.com
Motor Industry Research Association	www.mira.co.uk
National Trailer & Towing Association	www.ntta.co.uk
Public Services (including transport)	www.direct.gov.uk
Road Haulage Association	www.rha.uk.net
The European Union on-line	www.europa.eu
The Institute of Road Transport Engineers	www.soe.org.uk
The Society of Motor Manufacturers and Traders Ltd	www.smmt.co.uk
Transport Engineer (magazine)	www.transportengineer.org.uk
Transport Research Laboratory	www.trl.co.uk
United Nations Economic Commission for Europe	www.unece.org
Vehicle & Operator Services Agency	www.vosa.gov.uk
Vehicle Certification Agency	www.vca.gov.uk

PLEASE ALSO VISIT OUR WEBSITE FOR PUBLICATIONS & FURTHER INFORMATION

www.knottuk.com

Trailer Service Record

Model:		VIN:	
Manufacture date:		Asset ref:	

Service type:		Service type:	
Estimated mileage:		Estimated mileage:	
Details		Details	
Date:	Sign:	Date:	Sign:
Service type:		Service type:	
Estimated mileage:		Estimated mileage:	
Details		Details	
Date:	Sign:	Date:	Sign:
Service type:		Service type:	
Estimated mileage:		Estimated mileage:	
Details		Details	
Date:	Sign:	Date:	Sign:

Trailer Service Record

Model:		VIN:	
Manufacture date:		Asset ref:	

Service type:			
Estimated mileage:			
Details			
Date:		Sign:	

Service type:			
Estimated mileage:			
Details			
Date:		Sign:	

Service type:			
Estimated mileage:			
Details			
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Service type:			
Estimated mileage:			
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Date:		Sign:	

Service type:			
Estimated mileage:			
Details			
Date:		Sign:	

Service type:			
Estimated mileage:			
Details			
Date:		Sign:	

NOTES

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November 2012 KF082

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Section 13 Warranty and Certification

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Warranty

Warranty of new products:

Equipment manufactured and supplied by Flowplant is warranted to be free from defects in materials and workmanship.
The warranty includes both parts and labour necessary to correct any such defects.
The warranty period for new products is twelve months from date of despatch from our factory.
We shall repair or, at our option, replace free of charge any product, part(s) or component(s) manufactured by Flowplant which fail due to faulty manufacture or material within the warranty period.

Warranty of spare parts:

The warranty for **new** spare parts is six months from date of despatch on materials and workmanship.
The warranty for **reconditioned** spare parts is 90 days from date of despatch on materials and workmanship.

Provided always that

1. They are returned to Flowplant for inspection (carriage paid), along with a copy of the original part(s) sale invoice (where necessary); and
2. All terms agreed by Flowplant for payment of such goods have been complied with; and
3. If a defect/failure is discovered before the expiration of the warranty, notification must be given to the Flowplant service department immediately
4. Any claim hereunder is made within 30 days of the date of discovery of the defect/failure.

Provision of this warranty shall not apply to any Flowplant product which has been:

1. Used for a purpose for which it is not designed for; or
2. Applied to a use which has not been approved by Flowplant; or
3. Subject to misuse, negligence, lack of maintenance or accident; or
4. Repaired or altered in any way so as, in the judgement of Flowplant, to adversely affect its performance and reliability

Limitations of warranty:

The new product and spare parts warranty is limited to defects in material or workmanship of the product. It does not cover loss of time, inconvenience, property damage or any consequential damages. Repair or replacement of the product is your exclusive remedy.

Our liability under this clause shall be in lieu and to this exclusion of any warranty or conditions implied or expressed by law as to the quality or fitness for purpose of any goods supplied hereunder PROVIDED THAT nothing in this clause shall operate so as to exclude liability for death or personal injury arising from the negligence of the company or its employees.

Our obligations as aforesaid shall constitute the full extent of our liability in respect of any loss or damage sustained by the purchaser whether caused by any breach of this contract or by our negligence or otherwise and we shall not be liable to make good or pay for loss of use of the goods, loss of revenue, loss of profit or goodwill or any direct or consequential losses howsoever caused and the purchaser undertakes to indemnify us against any such claims against us by third parties.

On order to comply with the provision of the Health and Safety at work etc. Act 1974 in respect of articles manufactured, supplied or installed for use at work we test all our products before they leave our factory and supply them with adequate instructions for their proper use. Further copies of these instructions are available from us upon request.

Section 14 Service Documents

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Flowplant Unit Log Book

Serial Number -

Unit Number -

Date of Manufacture -

Date ……

Engineer ……

Type of Service ……

Official Flowplant Stamp and Signature

Please state if other Service provider used ……

Date ……

Engineer ……

Type of Service ……

Official Flowplant Stamp and Signature

Please state if other Service provider used ……

Date ……

Engineer ……

Type of Service ……

Official Flowplant Stamp and Signature

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Flowplant Unit Log Book

Serial Number -

Unit Number -

Date of Manufacture -

Date ……

Engineer ……

Type of Service ……

Official Flowplant Stamp and Signature

Please state if other Service provider used ……

Date ……

Engineer ……

Type of Service ……

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Engineer ……

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Official Flowplant Stamp and Signature

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Date ……

Engineer ……

Type of Service ……

Official Flowplant Stamp and Signature

Please state if other Service provider used ……

Date ……

Engineer ……

Type of Service ……

Official Flowplant Stamp and Signature

Please state if other Service provider used ……

SERVICE CHECK LIST

FLOWPLANT

Serial Number -

Unit Number -

Sht 1 of 2

Date -

Engineer -

Hours Run -

ESR -

I - Intermediate service **Y - Yearly service** **R - Customer request**

	Engine	I	Y	R
1	Check oil level			
2	Change oil			
3	Change oil filter			
4	Clean air filter			
5	Change air filter			
6	Change fuel filter			
7	Clean water trap			
8	Check coolant level & A/F mix			
9	Inspect radiator			
10	Inspect hoses			
11	Check fan belt			
12	Check engine mounts			
13	Check exhaust			
14	Check throttle cable			
15	Check for leaks			

	Gearbox	I	Y	R
16	Check oil level			
17	Change oil			
18	Check for leaks			

	Pump	I	Y	R
20	Check valves (Inlet/delivery)			
21	Replace valves (Inlet/delivery)			
22	Check diaphragms			
23	Replace diaphragms			
24	Change oil			
25	Check hoses/fittings			
26	Check working pressure			
27	Check working temp			
28	Check smooth running			
29	Change Burst Disc (Must be changed every 6 months)			
30	Set Safety Relief Valve (Must be set by manufacturer/authorised agent and reset/certificated every six months)			
30	Check main pressure gauge			
31	Check burst disc fitted			
32	Check jump jet operational			
33	Pressure gauge reading correctly			

	Hydraulics	I	Y	R
34	Check oil level			
35	Change oil			
36	Change filter			
37	Inspect hoses			
38	Inspect reel			
39	Grease reel bearings			
40	Check reel mountings			
41	Check operation			
42	Check for leaks			

	Electrics/Controls	I	Y	R
43	Check battery			
44	Check/grease terminals			
45	Check charge system			
46	Check wiring connections			
47	Test/check operations			
48	Test remote control unit			

	Vanpack frame	I	Y	R
49	Check for cracks/damage			
50	Check fixing bolts & brackets			
51	Check safety straps			

	Trailer	I	Y	R
52	Check for cracks/damage			
53	Check wheels/tyres/pressure			
54	Check brake operation			
55	Check lights/reflectors			
56	Check tow hitch/lubricate			
57	Check safety cable			
58	Check jockey wheel condition			

	Gun & Lance	I	Y	R
59	Check for leaks on pressure			
60	Check for damage			
61	Check operation			
62	Check jets are correct			

	Water tank	I	Y	R
63	Clean water filter			
64	Change water filter			
65	Check hoses & fittings			
66	Check tank security			
67	Check tank integrity			
68	Check A/Freeze			
69	Check inlet ball valve			

	OMO Foot pedal	I	Y	R
70	Check cable & plugs			
71	Test operation			
72	Check safety button			

	Pressure Hose	I	Y	R
73	Check for wear / damage			
74	cuts / tears			
75	Braiding showing			
76	Any joins in single length			
77	Fittings in good order			
78	Leader hose satisfactory			

	Hot Wash	I	Y	R
79	Check fuel pump pressure			
80	Clean fuel filter			
81	Check swirl plate adjustment			
82	Check electrode gap			
83	Check air flow			
84	Check thermostat operation			
85	Check low water level switch			
86	Check unloader valve			
87	Check burner is running clean			

	Remote Control	I	Y	R
88	Check handset operation			
89	Check Antenna			

	Other	I	Y	R
90	Test emergency stop button			
91	Check safety decals visible			
92	Check ID plate condition			
93	Clean & tidy appearance			

I	Intermediate Service
Y	Yearly Service
R	At Request of Customer

NA - Not applicable, A - Adjusted, √ - Satisfactory, R - Repair required, O - Observation

Note - If 'Adjusted' or 'Repair required' please describe issue on sht 2

FLOW 0321 Iss 3