



## **ELECTRONIC COMMAND STEERING**

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## **DESCRIPTION OF SYSTEM**

The HYPRO MARINE Electronic Command Steering (ECS) comprises two distinct systems:

- a. A hand operated electronic command system which provides the control.
- b. A powered hydraulic circuit to carry out the working duty which operates from a 12v or 24v dc supply, to be advised.

The electronic control part of the system allows a command generated at the helm unit to be relayed to the power pack assembly via the wiring harness installed through the boat.

The power pack assembly contains the motor and its controller, pump, solenoid, pressure relief valve and oil reservoir. This unit operates in response to a helm command whereupon the motor will start and oil is diverted to the steering cylinder through a direction solenoid. When the wheel stops turning, the motor switches off. End of stroke is felt by a stop being felt at the wheel.

Auto pilot integration is by the use of a separate suitably sized reversing pump introduced into the hydraulic circuit.

Installation is simplified using pre made harness assemblies with push together water proof connectors.

## SCHEMATIC LAYOUT ELECTRONIC COMMAND STEERING

TITLE:

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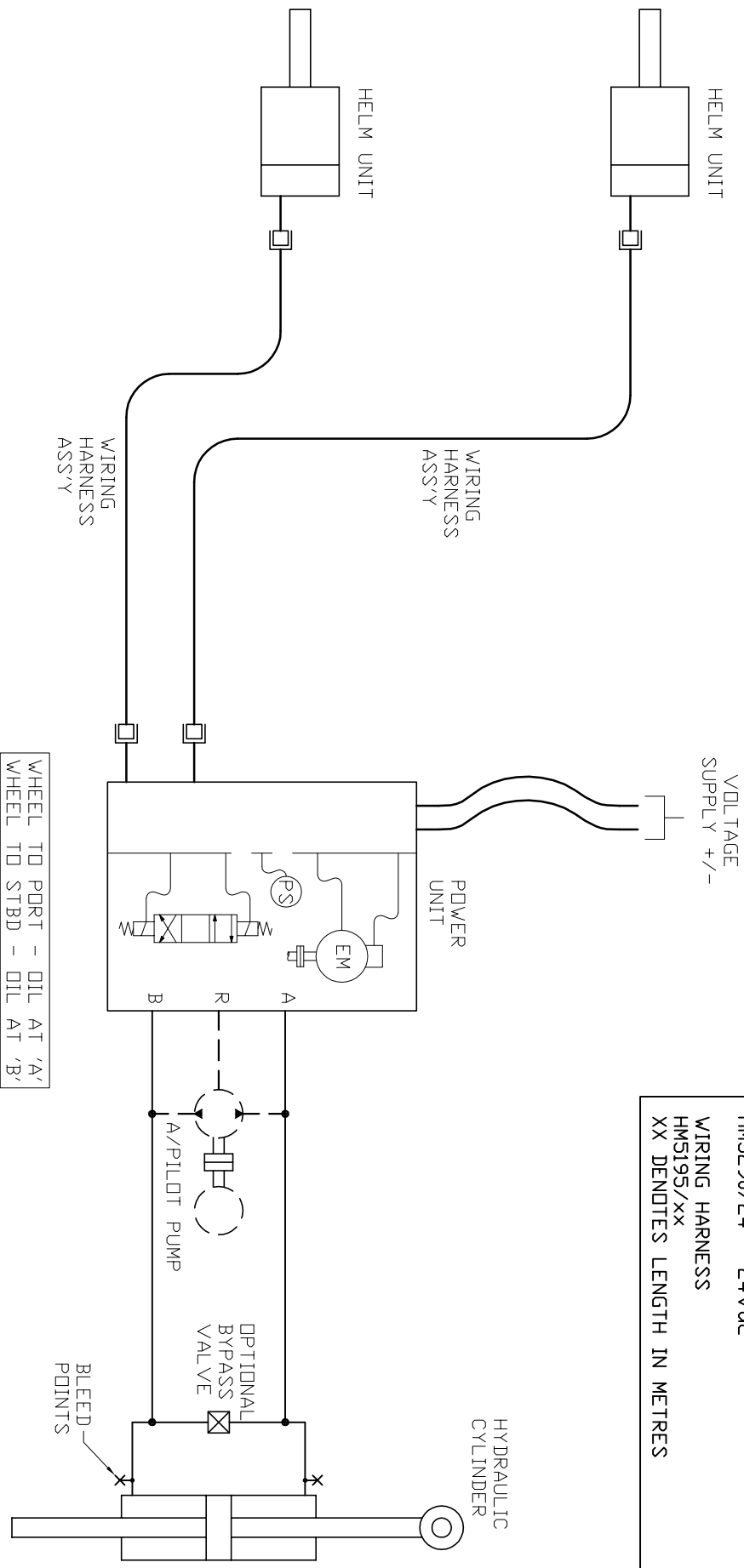
DRAWN: MC

DATE: 25/5/07

DRG. NO:

# HMS176

ISSUE: 2 - 10476



- HELM UNITS
- HMS160 - FRONT MOUNT FIXED SHAFT
- HMS160/RTB - REAR MOUNT TAPER SHAFT
- HMS160/RS - REAR MOUNT STRAIGHT SHAFT
- HMS200 - TILT HELM
- POWER UNIT
- HMS190/24 - 24Vdc
- HMS190/12 - 12Vdc
- HMS290/12 - 12Vdc
- HMS290/24 - 24Vdc
- WIRING HARNESS
- HMS195/xx
- XX DENOTES LENGTH IN METRES

# INSTALLATION

## GENERAL PREPARATION INSTRUCTIONS

1. It is recommended that prior to starting any work installing the system, the contents of this manual are fully considered.
2. Before commencing installation, check all components have been received and that all installation materials are available.
3. It is recommended that hydraulic fittings are made to component ports prior to installation. In the case of taper threads we would recommend the use of a suitable thread sealant “Loctite 542 Hydraulic Sealant” or equivalent. This sealant should be used sparingly, and care taken to ensure that it does not enter the system. Do not use thread sealant on connections made to hydraulic tube, or hose fittings.
4. It is recommended that all system components are installed prior to running the system tubing. This not only allows the tubing to be run between definite positions, but minimises the chance of incorrect pipework connections. If pipework needs to be pre-installed then an effective means of marking and preventing contaminant entering the system should be adopted. Pipework should be cut cleanly, and it is good practice to blow through each line with clean compressed air before connections are made.

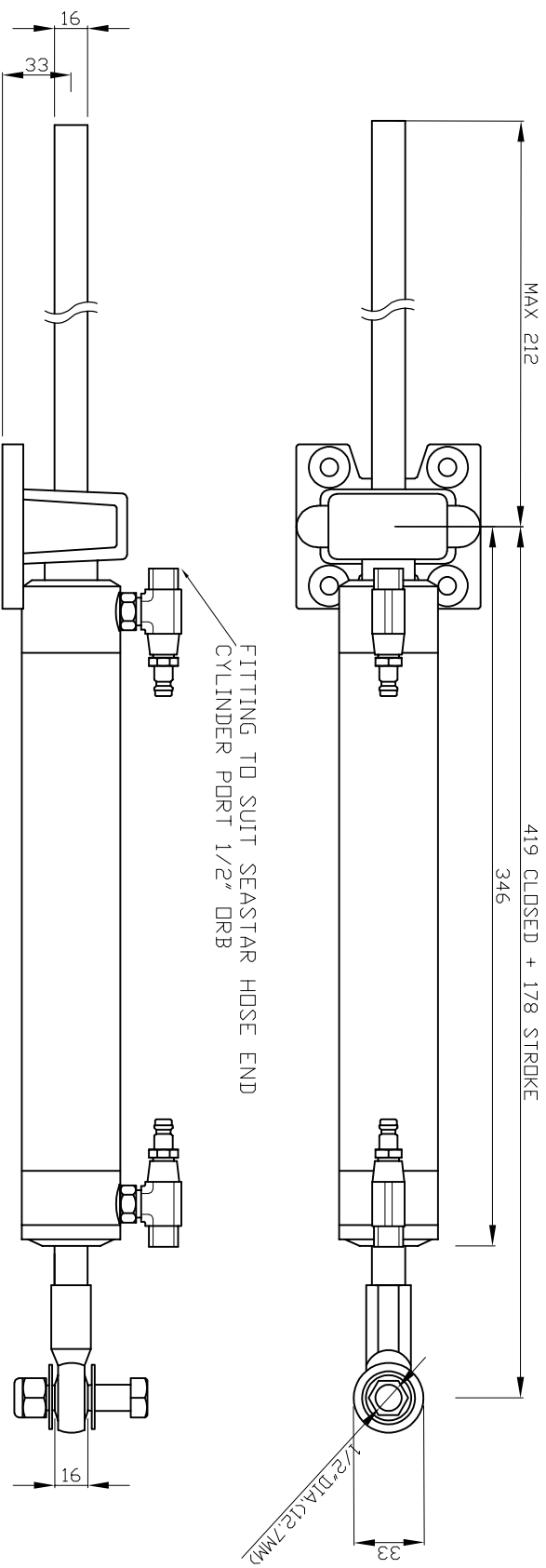
### **CLEANLINESS IS EXTREMELY IMPORTANT**

5. Pipework and wiring should be routed to prevent damage from any moving parts or on machinery removal etc. Avoid running close to hot areas, i.e. adjacent to exhaust systems or turbo-chargers. Pipework and wiring should be adequately supported and secured avoiding sharp edges or dissimilar metals.

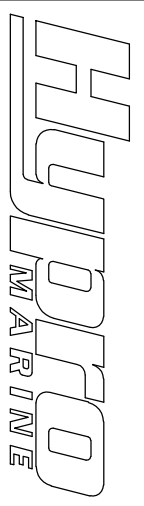
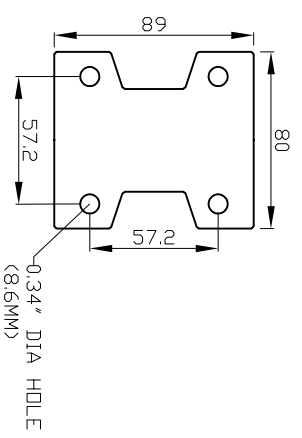
## RUDDER ARM PREPARATION

1. Check operating stroke of cylinder supplied with system.
2. The following chart defines tiller arm radius against required rudder angle for typical cylinder strokes.

Total Rudder Arc	Tiller Radius	
	7" Stroke	9" Stroke
70°	6.1" (155mm)	7.85" (199mm)
60°	7" (178mm)	9" (229mm)
50°	8.28" (210mm)	10.65" (270mm)



CYLINDER MODEL - BA150-7A1TM  
 BODY DIAMETER - 1.87" (47.5MM)  
 SHAFT DIAMETER - 5/8" (16MM)  
 SWEEP VOLUME - 10.2 CUIN (167CC)  
 RUDDER TORQUE @ 35° AND 1000 PSI - 7117 LBIN  
 WEIGHT - 2.5 KG



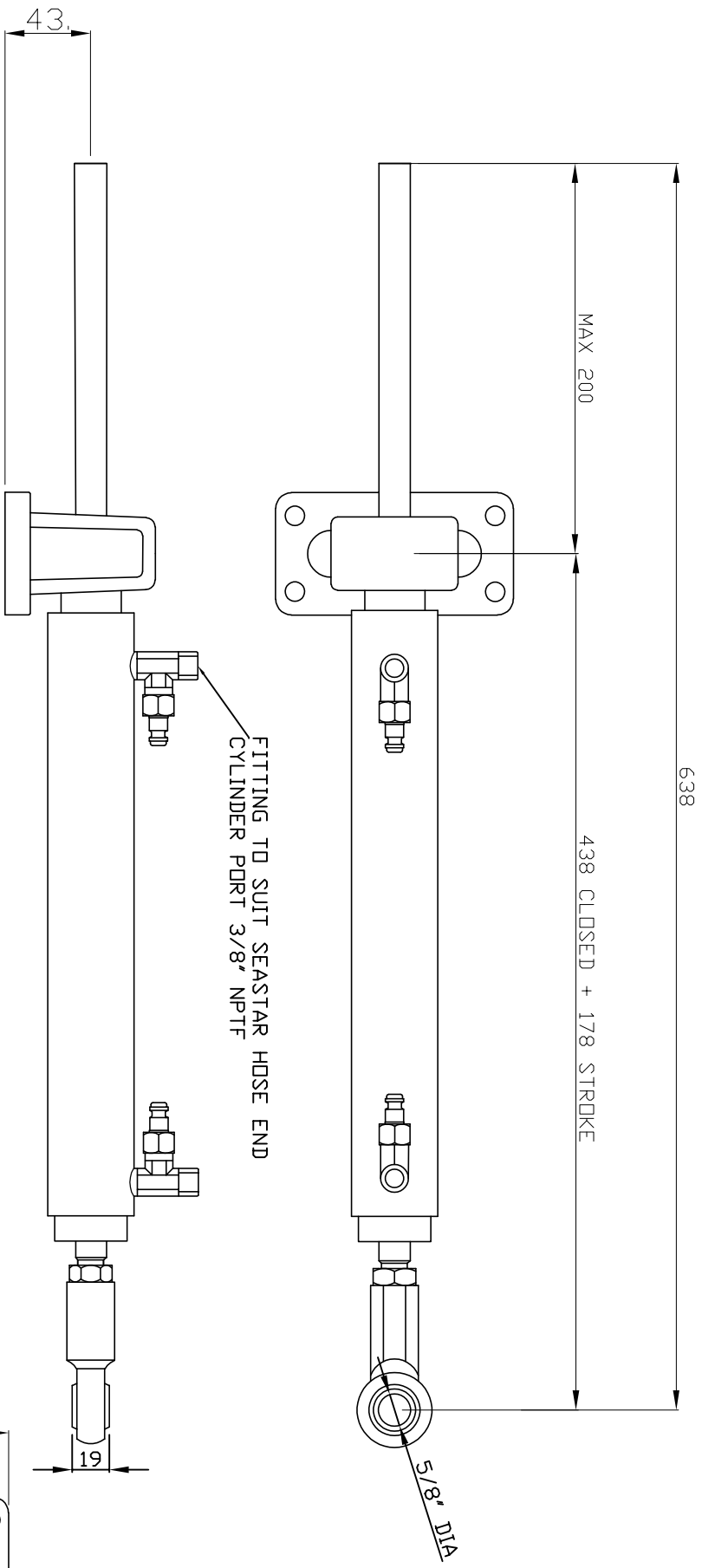
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 INBOARD CYLINDER BRASS

DRAWN: KM  
 DATE: 07/7/16

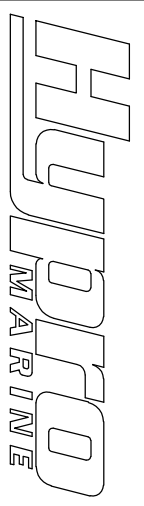
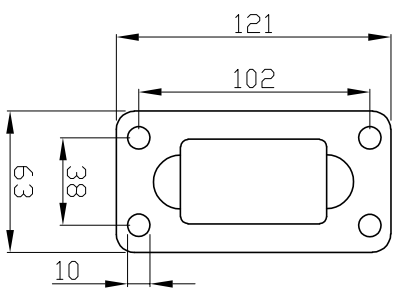
DRG. NO: HCS314-3

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ISSUE: 1 - ORIGINAL



CYLINDER MODEL - BA150-7TM  
 BODY DIAMETER - 1.75" (44MM)  
 SHAFT DIAMETER - 5/8" (16MM)  
 SWEEP VOLUME - 10.2 CUIN (167.5CC)  
 RUDDER TORQUE @ 35° AND 1000 PSI - 7117 LBIN  
 WEIGHT - KG

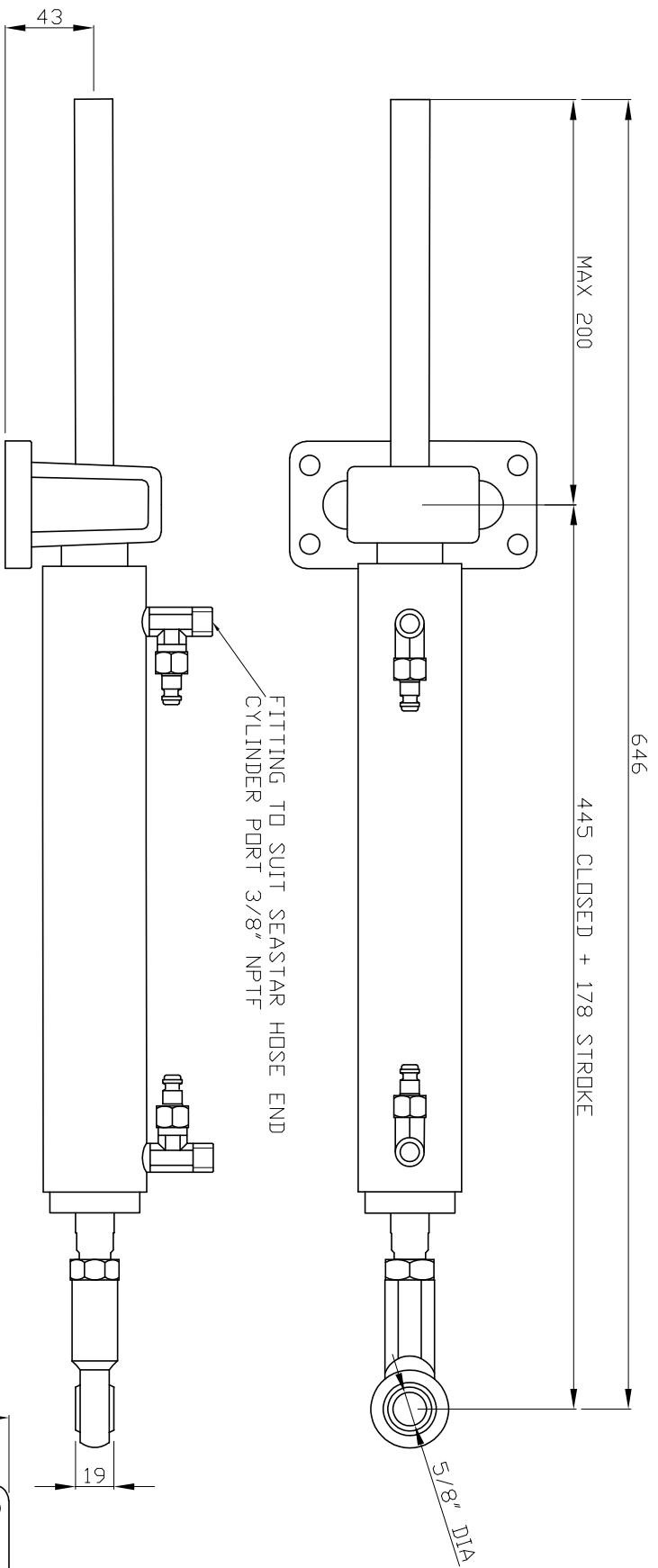


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 INBOARD CYLINDER BRASS

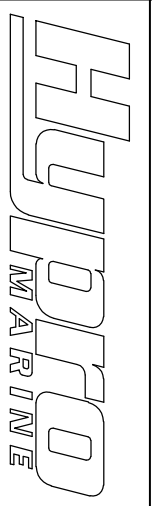
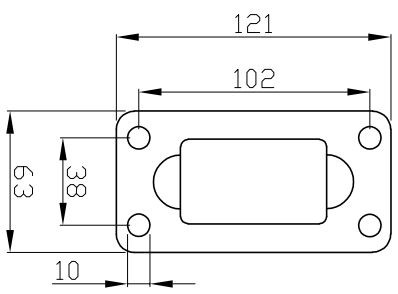
DRAWN: KM  
 DATE: 29/6/16

DRG. NO: HCS318

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 ISSUE: 1 - ORIGINAL



CYLINDER MODEL - BA175-7TM  
 BODY DIAMETER - 2" (51MM)  
 SHAFT DIAMETER - 0.75" (19.1)  
 SWEEP VOLUME - 13.7 CUIN (225.4 CC)  
 RUDDER TORQUE @ 35° AND 1000 PSI - 9569 LBIN  
 WEIGHT - 6 KG



TITLE:

SEASTAR  
 INBOARD CYLINDER BRASS

DRAWN:

KM

DATE: 29/6/16

DRG. NO:

HCS319

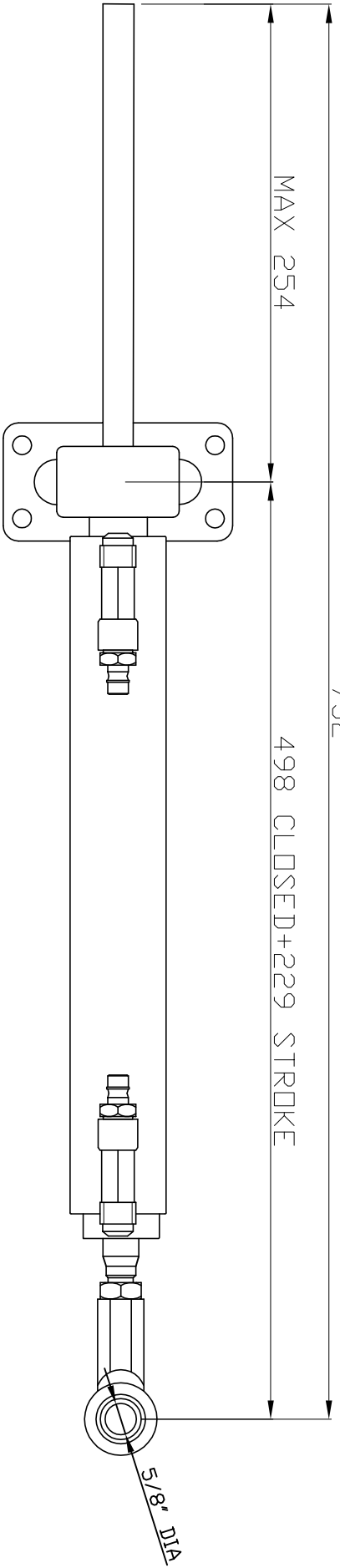
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ISSUE: 1 - ORIGINAL

752

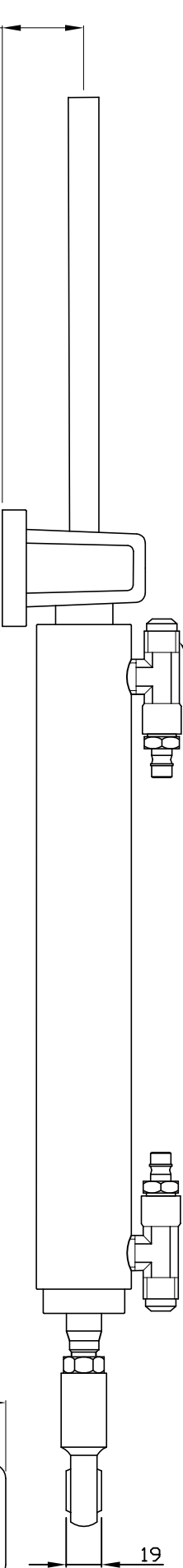
MAX 254

498 CLOSED+229 STROKE

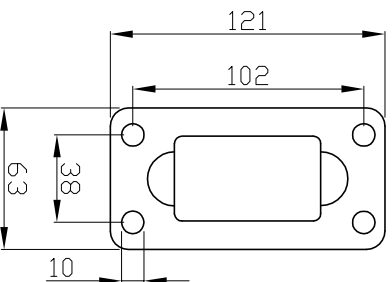


3/4" SAE FITTING  
CYLINDER PORT 3/8" NPTF

5/8" DIA



19



CYLINDER MODEL - BA175-9TM  
 BODY DIAMETER - 2.0" (51MM)  
 SHAFT DIAMETER - 3/4" (19MM)  
 SWEEP VOLUME - 17.7CUIN (290CC)  
 RUDDER TORQUE @ 35° AND 1000 PSI - 12600 LBIN  
 WEIGHT - 6.5 KG



TITLE:

SEASTAR  
INBOARD CYLINDER BRASS

DRAWN:

KM

DATE:

28/6/16

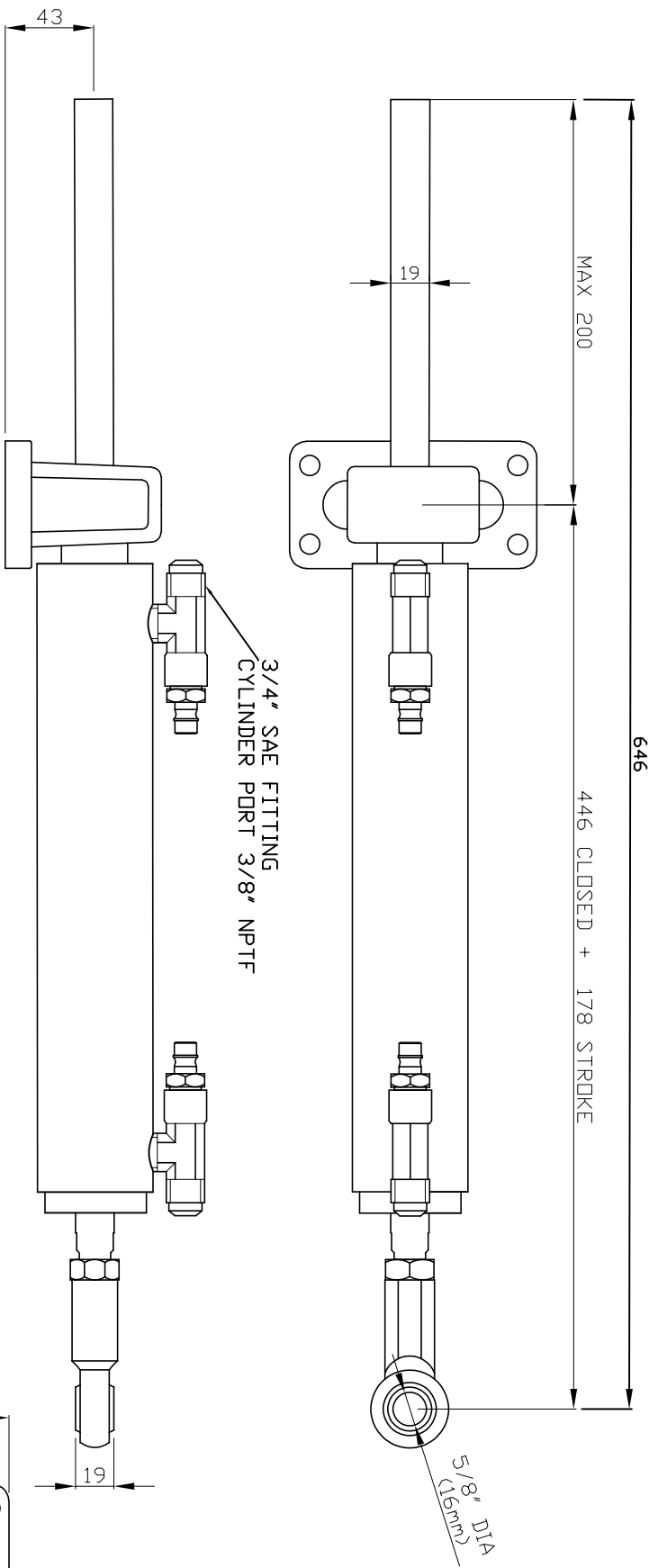
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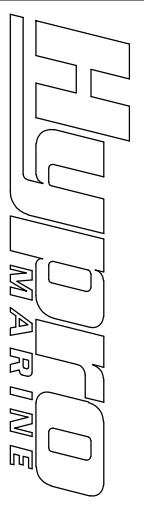
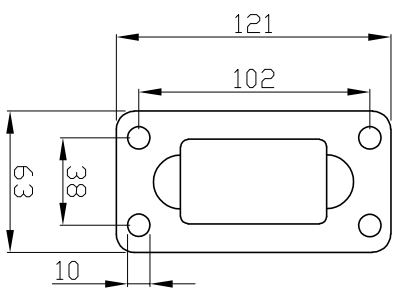
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CYLINDER MODEL - BA200-7TMB  
 BODY DIAMETER - 2 1/4" (57MM)  
 SHAFT DIAMETER - 3/4" (19MM)  
 SWEEP VOLUME - 18.9 CUIN (310CC)  
 RUDDER TORQUE @ 35° AND 1000 PSI - 13200 LBIN  
 WEIGHT - 6.6 KG



TITLE: SEASTAR  
 INBOARD CYLINDER BRASS

DRAWN: KM  
 DATE: 25/7/16

DRG. NO: HCS351

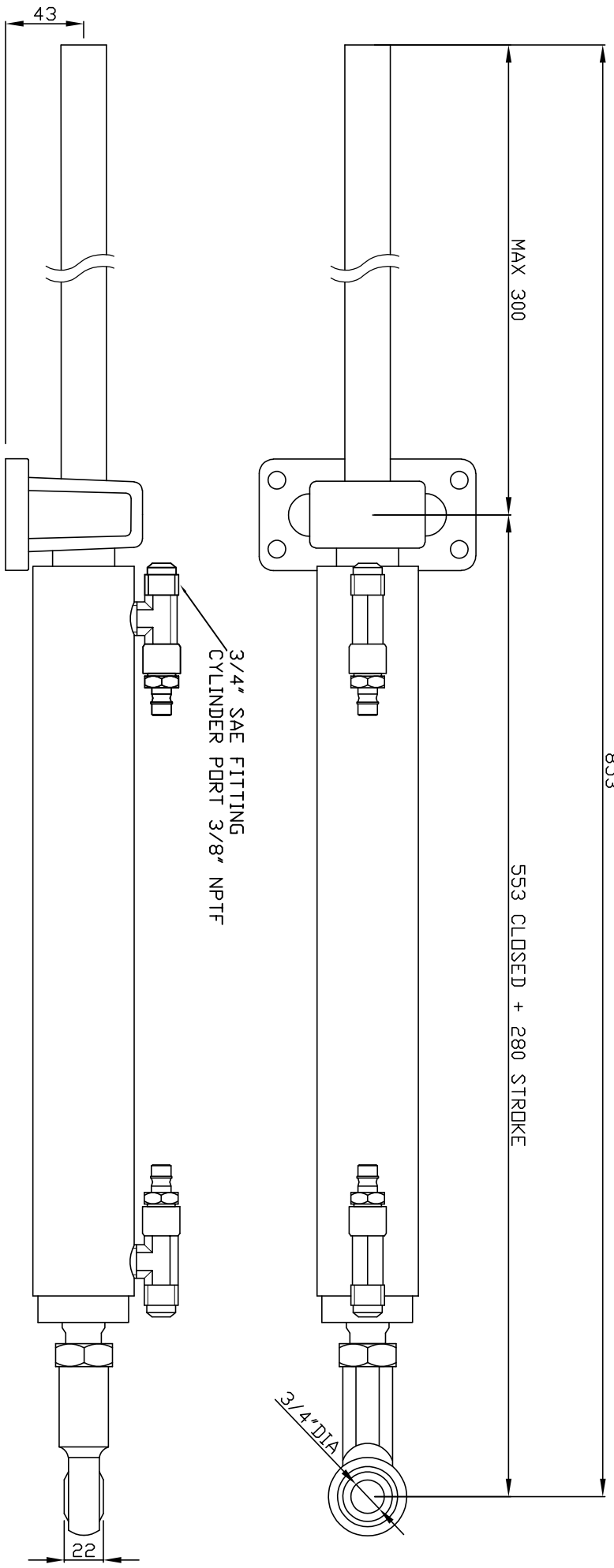
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ISSUE: 1 - ORIGINAL

853

MAX 300

553 CLOSED + 280 STROKE



CYLINDER MODEL - BA200-11TMB  
 BODY DIAMETER - 2.25" (57MM)  
 SHAFT DIAMETER - 1" (25.4MM)  
 SWEEP VOLUME - 26 CUIN (426CC)  
 RUDDER TORQUE @ 35° AND 1000 PSI - 23140 LBIN  
 WEIGHT - 8.8 KG



TITLE:

SEASTAR  
 INBOARD CYLINDER BRASS

DRAWN:

KM

DATE:

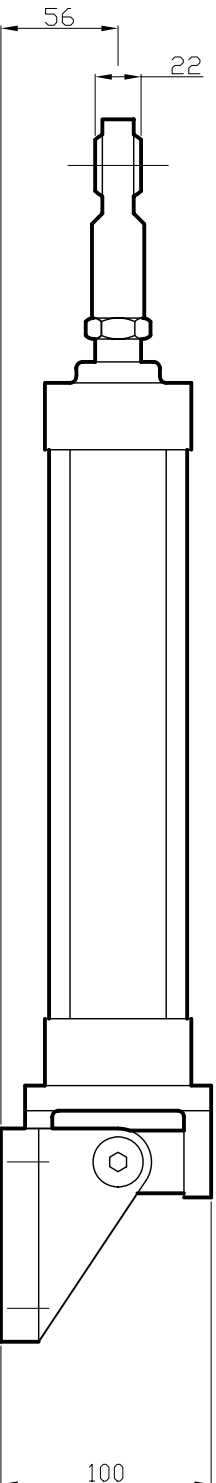
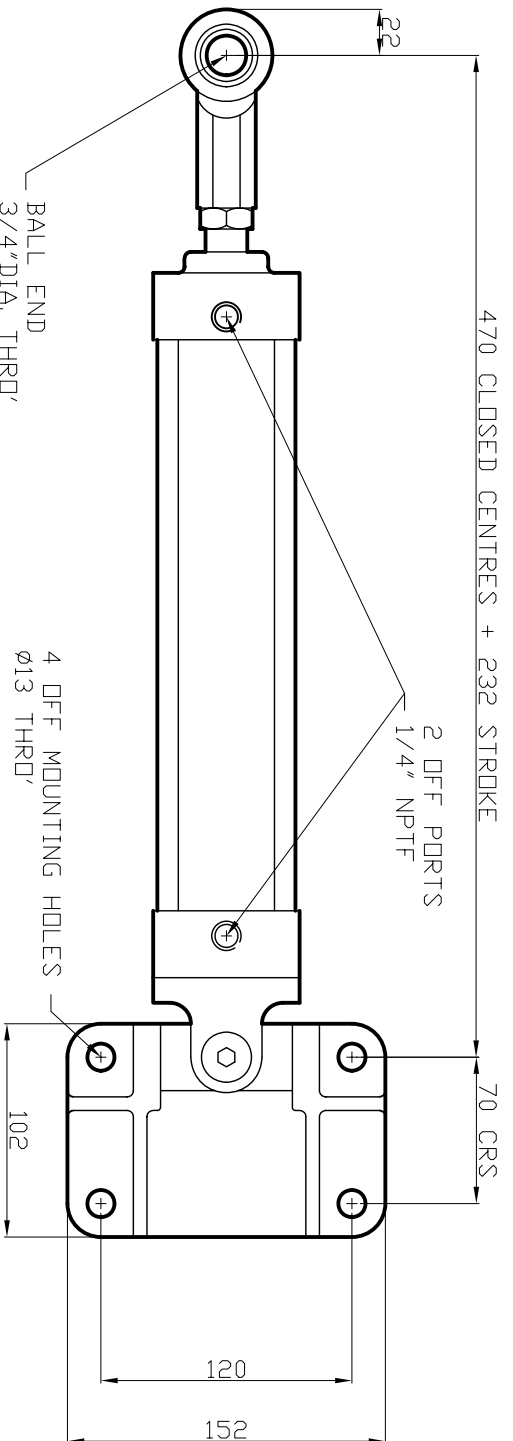
30/6/16

DRG. NO:

HCS378

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ISSUE: 1 - ORIGINAL



THRUST: 2930 lbf (1332 Kgf) @ 1000PSI (70 BAR)

SWEPT VOLUME:- 28.4 CUIN. (MEAN)

WEIGHT - 8.5 KG

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TITLE

AUXILIARY POWER CYLINDER

ISSUE

ALT. NO

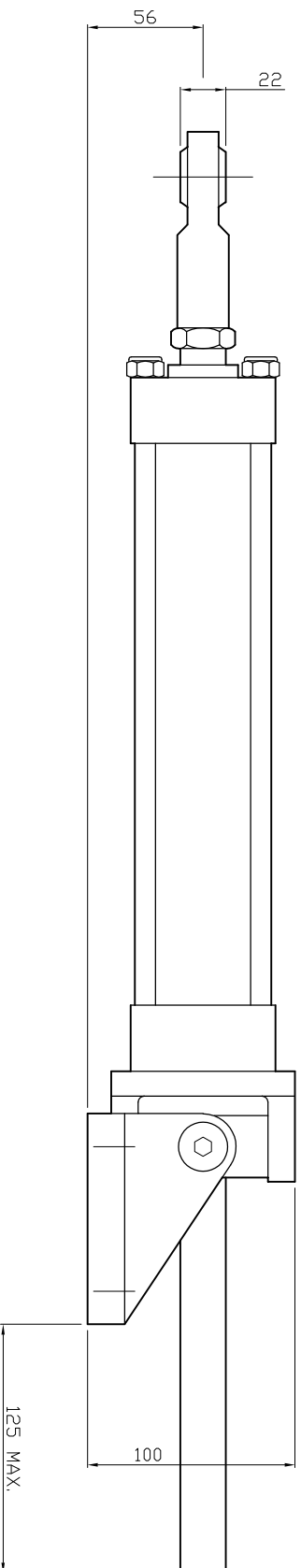
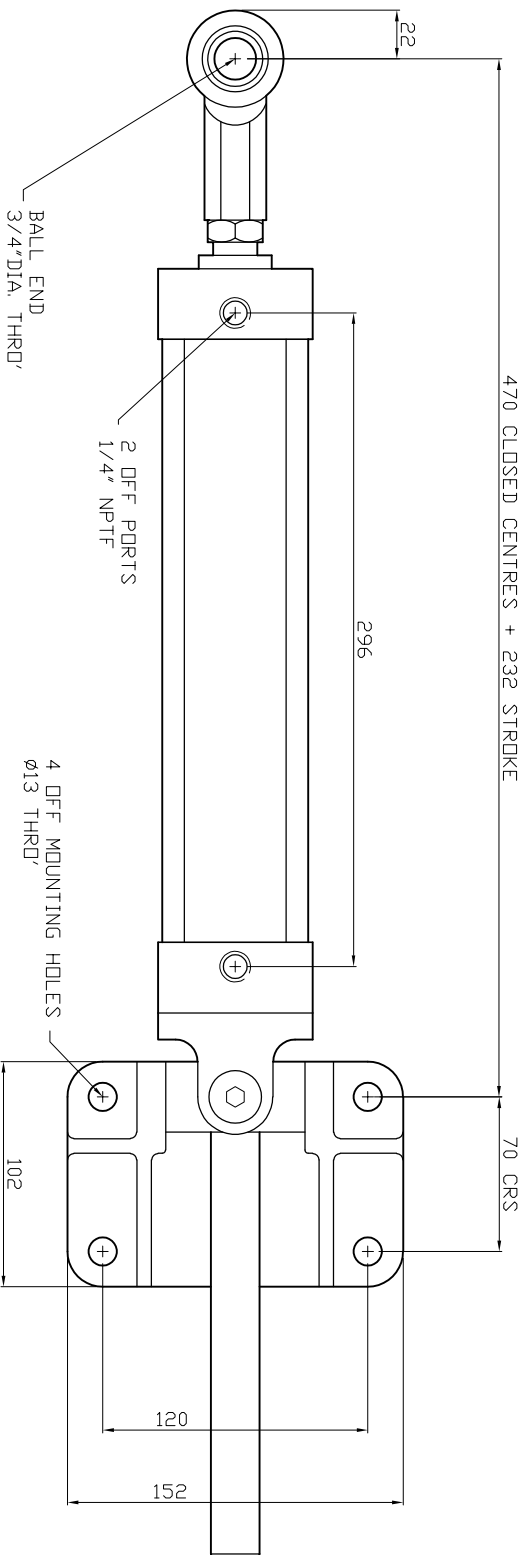
DRAWN  
MC

DRG. NO

DATE  
17/12/02

HM4470

**HYPRO MARINE**



# HYPRO MARINE

TITLE: **STEERING CYLINDER  
S232 B55 R22  
BALANCED**

DRAWN: **MC**  
DATE: **4/4/18**

DRG. NO: **HM4470/9B**

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ISSUE: **1 - ORIGINAL**

3. Ensure that the attachment bolt to be used matches the ball joint provided on the Cylinder. Machine hole in tiller arm to ensure a close fit with the bolt.

## MOUNTING THE STEERING CYLINDER

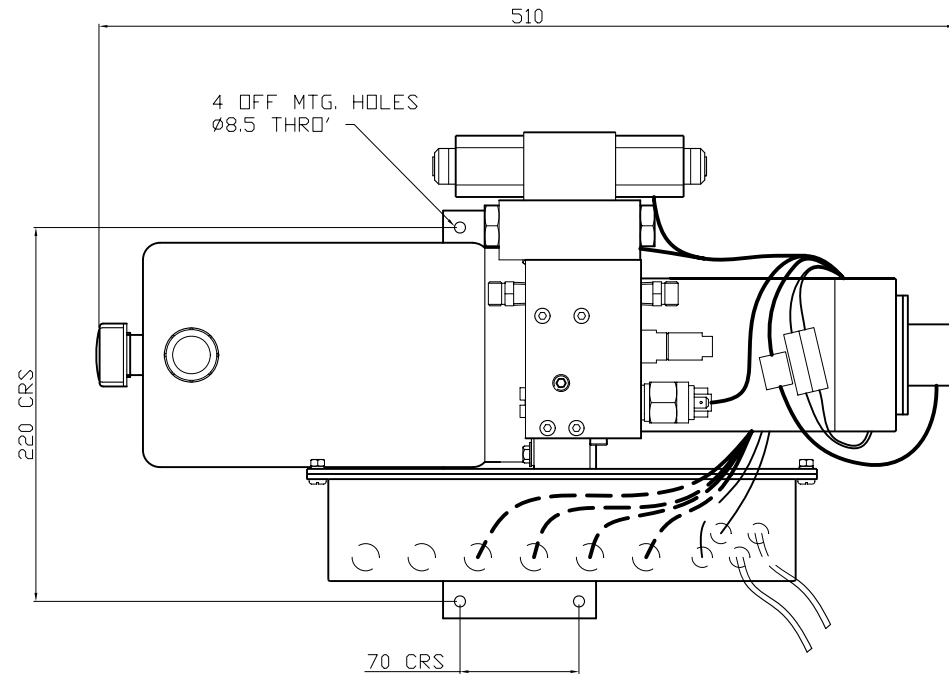
1. In mounting the steering cylinder it is important to ensure that a free passage exists for the flexible hoses which connect to it. In operation these hoses should not be obstructed, or come into contact with any other part.
2. Ensure that the tiller arm can operate freely through its intended angle of operation. When connected to the tiller arm the Cylinder Assembly must be unobstructed throughout the full angle of travel.
3. With the steering cylinder rod attached to the rudder arm, the mounting foot should be positioned such that the cylinder unit will operate horizontally. When viewed from above it should lie crosswise to the boat when the tiller arm is midway between dead ahead and maximum hard over.

**NOTE: Care should be taken not to damage the cylinder rod as leakage may result.**

4. The mounting bracket to which the cylinder will be connected should have sufficient strength to withstand the forces in operation. If in doubt, refer to HYPRO MARINE to obtain force value.
5. The specification of the flexible hose used to connect to the unit must provide for a working pressure of at least 1500 PSI and a suitable bleed point should be provided at the cylinder end of the pipework.

## MOUNTING THE POWER PACK ASSEMBLY

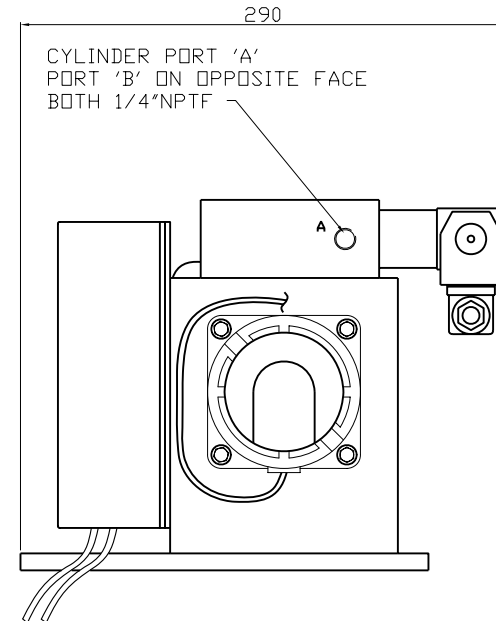
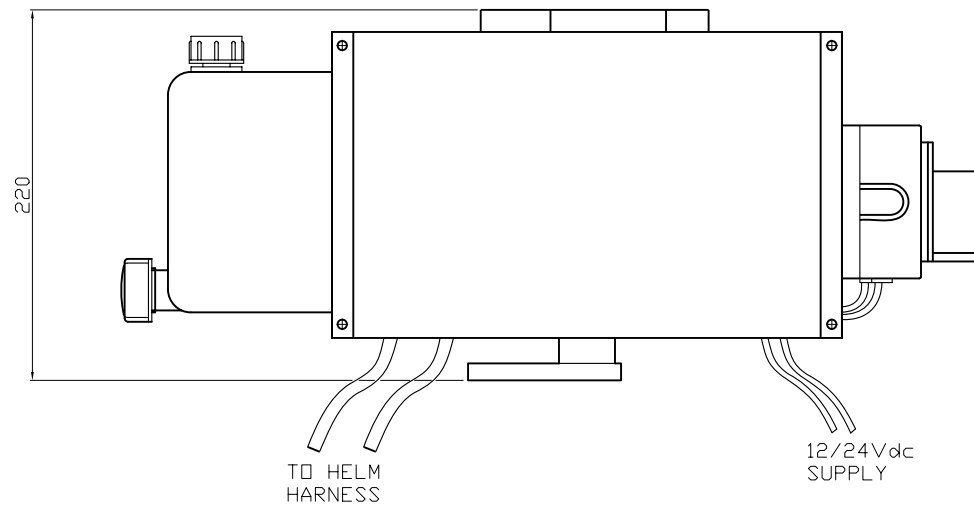
1. Select a mounting position which will remain reasonably dry and not create pipework runs that are longer than necessary. The position chosen should allow for easy fluid filling and level checking.
2. The electronic system components should not be mounted where they would be subjected to, excessive heat (e.g. engine exhausts), vibration, shock, contact with water or other liquids.



CURRENT DRAW: (24VDC UNIT)  
TYP. 35-40A MAX. @ 1500PSI (100BAR)

NOM. MAX. FLOW - 3 LPM

OIL CAPACITY: 2.5 LITRE NOM.  
WEIGHT: 13kg WITHOUT OIL



**Hypro**  
MARINE

TITLE: DC ELECTRO-HYDRAULIC  
POWER UNIT FOR ECS

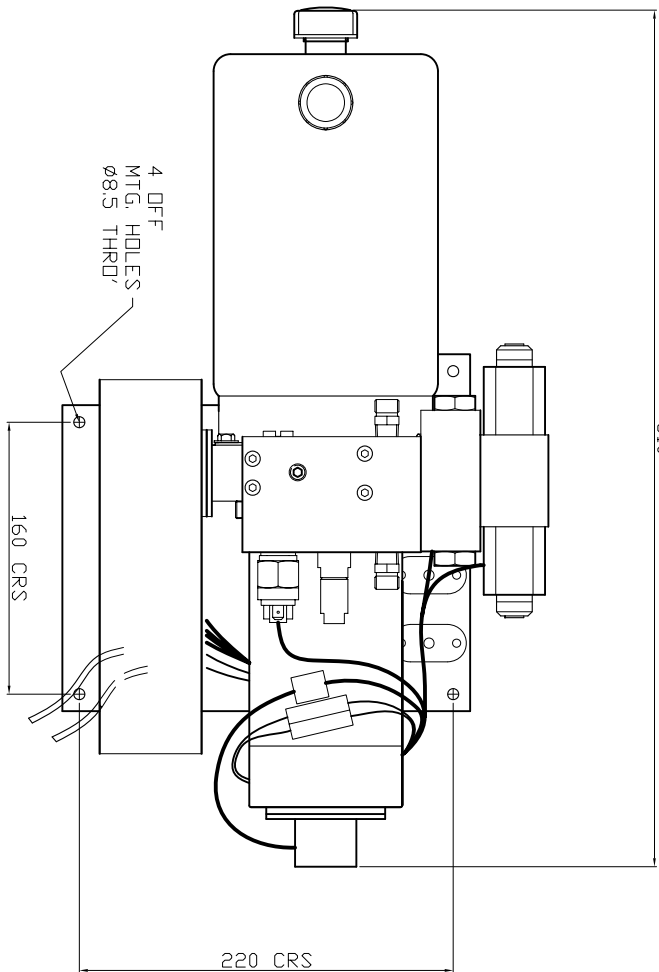
DRAWN: MC  
DATE: 1/8/07

DRG. NO:  
HM5190

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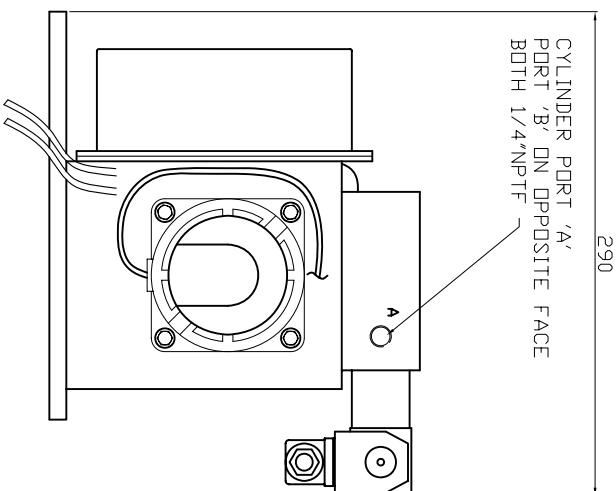
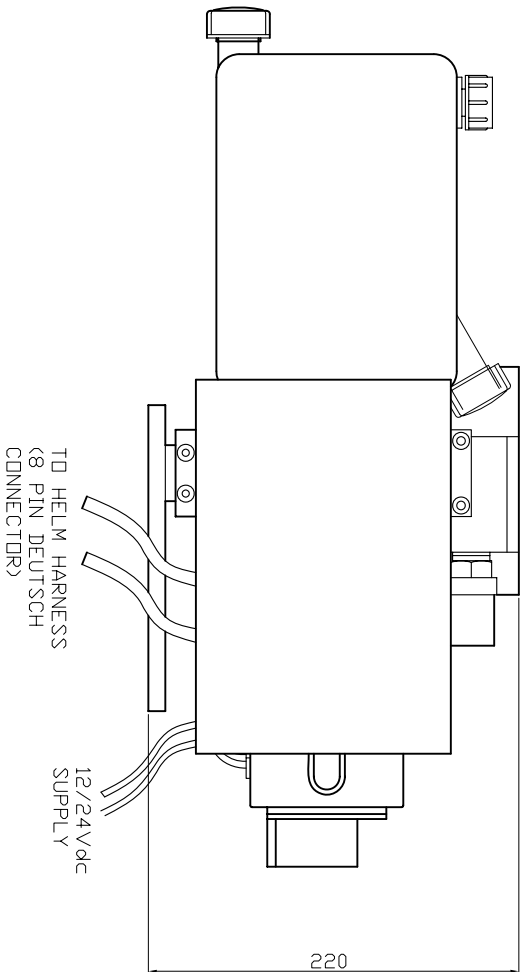
510



CURRENT DRAW: (24VDC UNIT)  
 TYP. 55-60A MAX. @ 1500PSI (100BAR)

NOM. MAX. FLOW - 5 LPM

OIL CAPACITY: 2.5 LITRE NOM.  
 WEIGHT: 13kg WITHOUT OIL



# HYPROMARINE

TITLE:

DC ELECTRO-HYDRAULIC  
 POWER UNIT FOR ECS

DRAWN: MC

DATE: 18/9/08

DRG. NO:

HMS290

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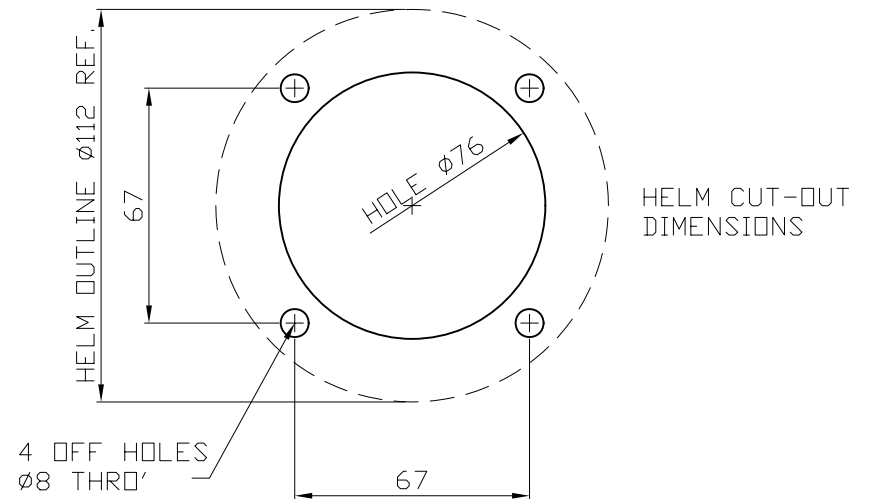
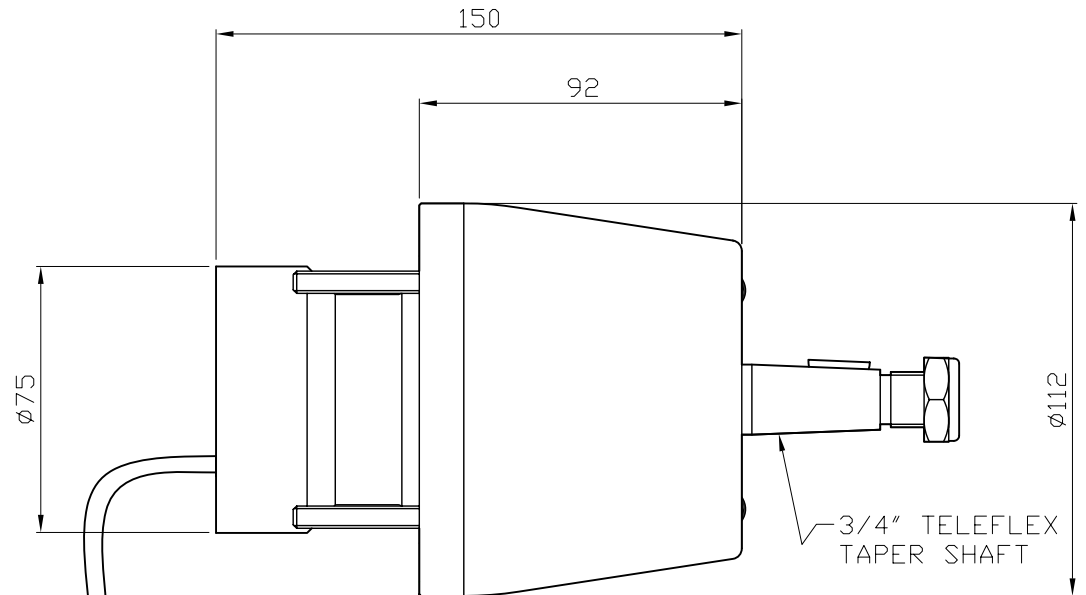
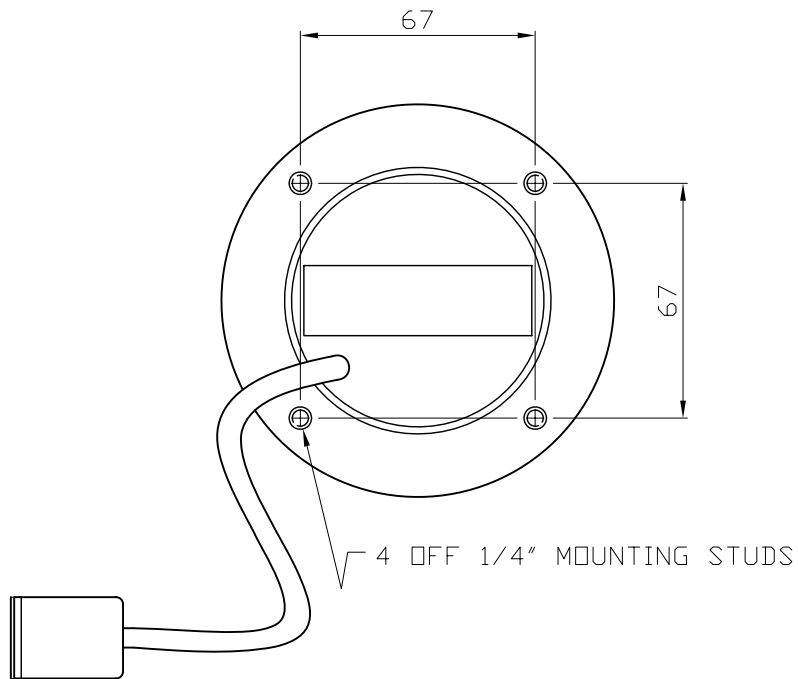
ISSUE: 2 - 10345

3. The power pack/control electronics should not be mounted at locations where it would be possible for service personnel or others to either stand on any part of the system, or use it as a prop or steadying hand hold.
4. The power pack/control electronics should be mounted enabling easy, but not accidental, operation of the Emergency Steering facility.
5. A separate dedicated power supply should be provided from the battery terminals, via a motor rated breaker, of capacity matched to the motor power (Hypro Marine to advise) and adequate to provide protection for the system/wiring under fault conditions.
6. The power pack is supplied with 0.5m flying leads for the power supply. A suitable junction box should be used to connect to the power supply.
7. Two 8 way “Deutsch” connects are provided for easy connection to the helm wiring harnesses.
8. Care should be taken to avoid contact of wiring and pipework to and from the power pack with any hot or sharp objects, and they should be suitably clipped or tied back if necessary.
9. The autopilot pump, if fitted, should be mounted so that it is below the oil level in the reservoir.

### MOUNTING THE HELM UNIT

1. The helm unit can be mounted at any angle to suit the installation. If a tilt helm is specified this should be mounted with the release lever facing down.
2. Ensure adequate room exists at the rear for connection of the helm to the wiring harness, which is done using a “Deutsch” 8 way connector provided.
3. Ensure that when installed, the helm shaft does not bind on or interfere with the mounting panel.
4. The boats magnetic compass should be positioned suitably distant from the helm if interaction at end of stroke condition is to be avoided. This is due to an electro magnetic device within the helm which is activated under these conditions.





**Hypro**  
MARINE

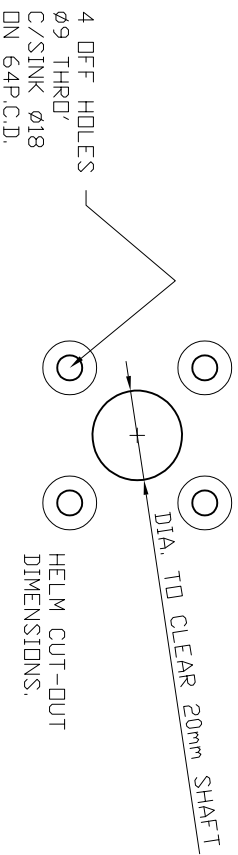
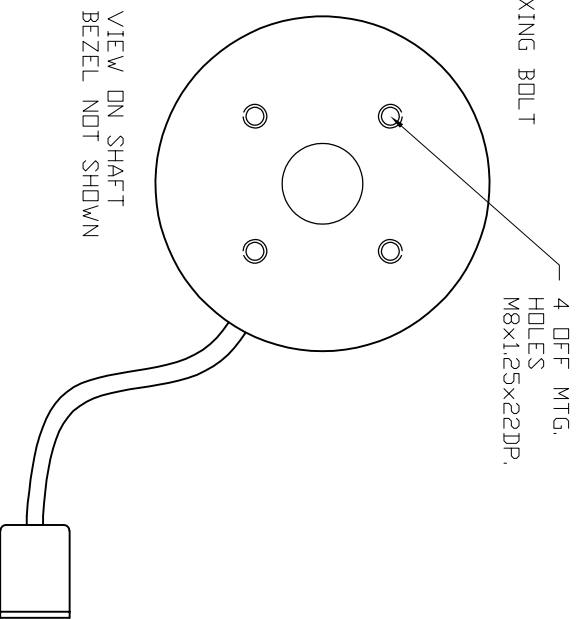
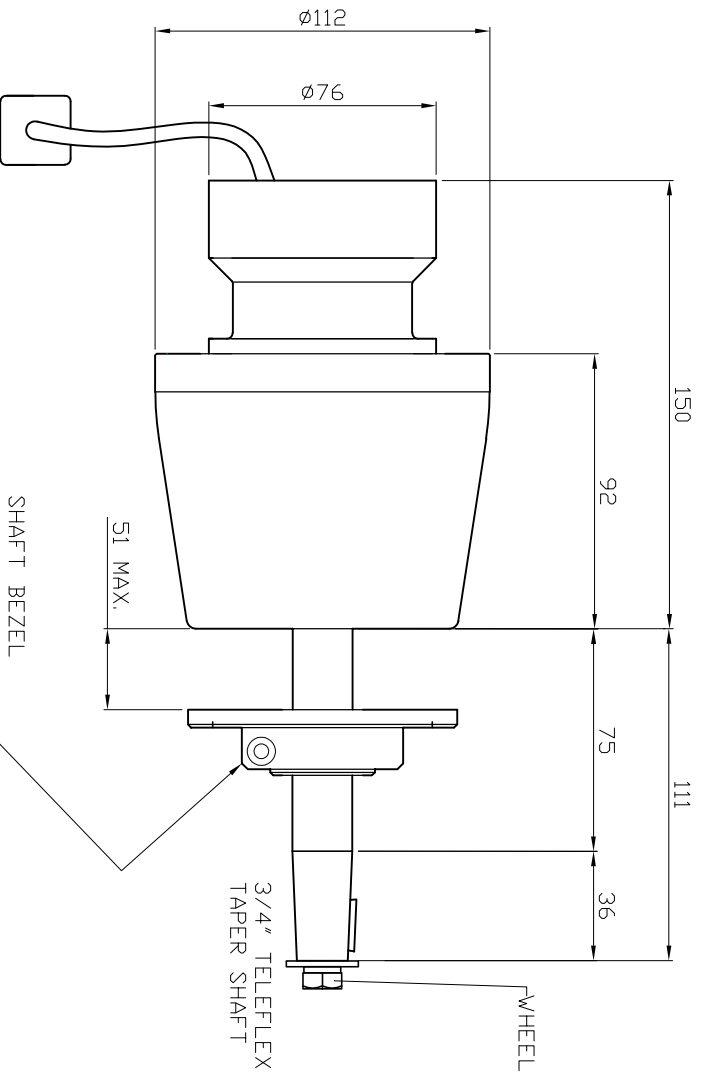
TITLE: ELECTROHELM ASSEMBLY  
FIXED SHAFT

DRAWN: MC  
DATE: 1/5/07

DRG. NO:  
HM5160

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ISSUE: 1 - ORIGINAL



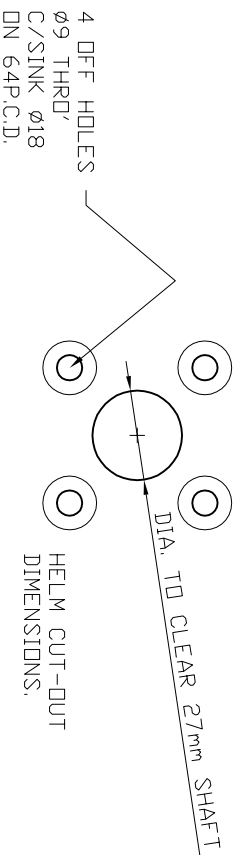
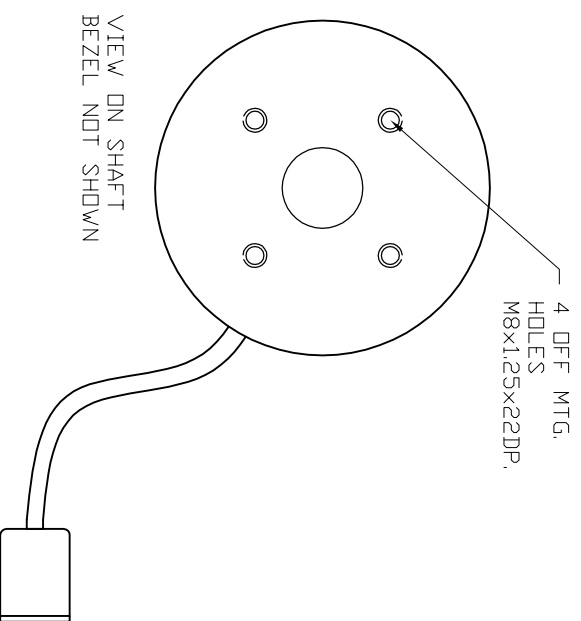
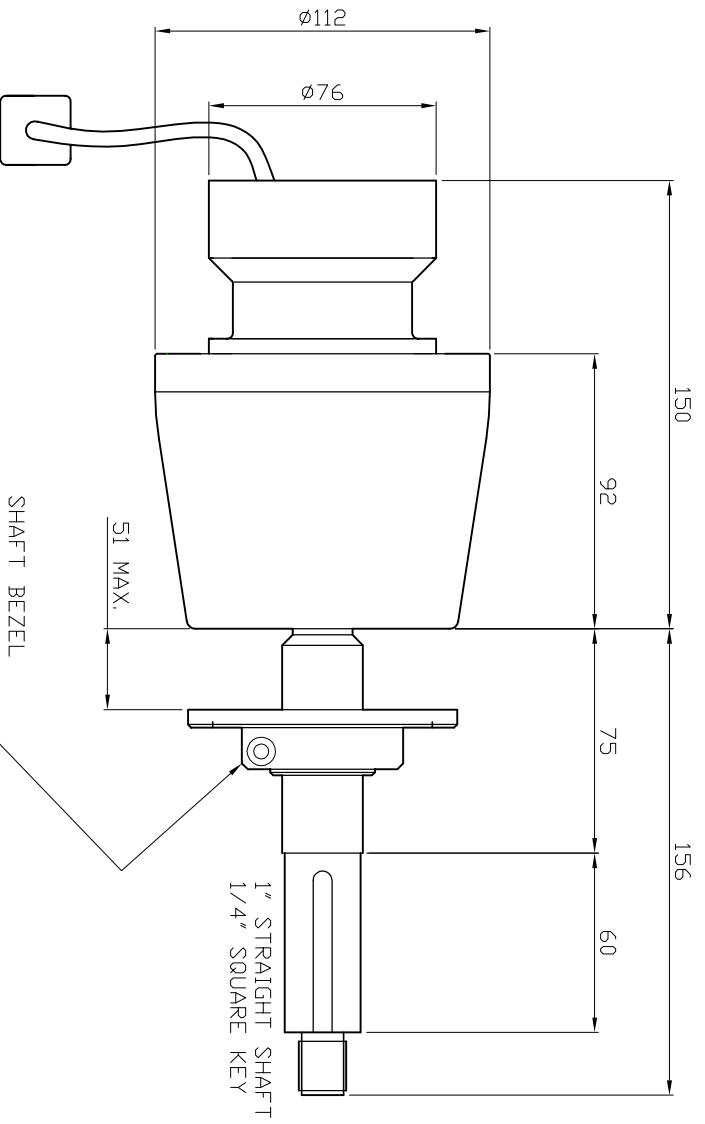
# HYPRO MARINE

TITLE: ELECTROHELM STRAIGHT SHAFT

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DRAWN: KM  
DATE: 04/7/16

DRG. NO: HM5160/RTB  
ISSUE: 1 - ORIGINAL



# HYPORO MARINE

TITLE: ELECTROHELM  
 STRAIGHT SHAFT

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DRAWN: MC  
 DATE: 26/7/11

DRG. NO: HMS160RS  
 ISSUE: 1 - ORIGINAL

# HYPRO MARINE

TITLE:

ELECTROHELM + TILT

DRAWN: MC/KM

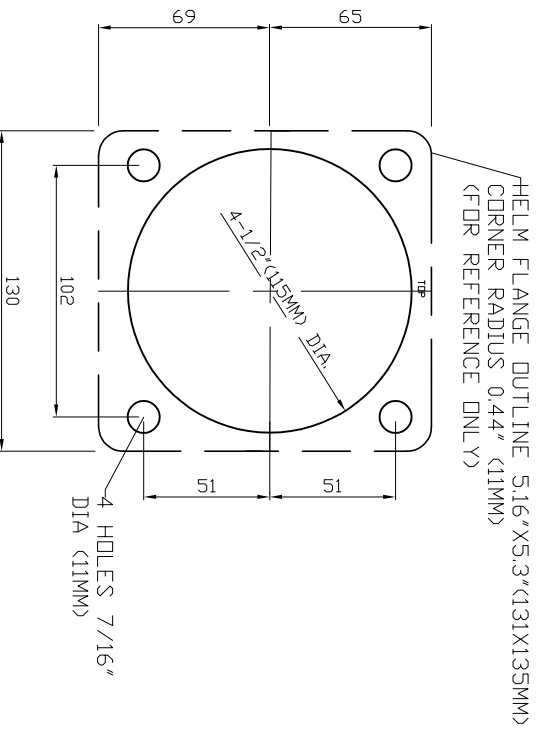
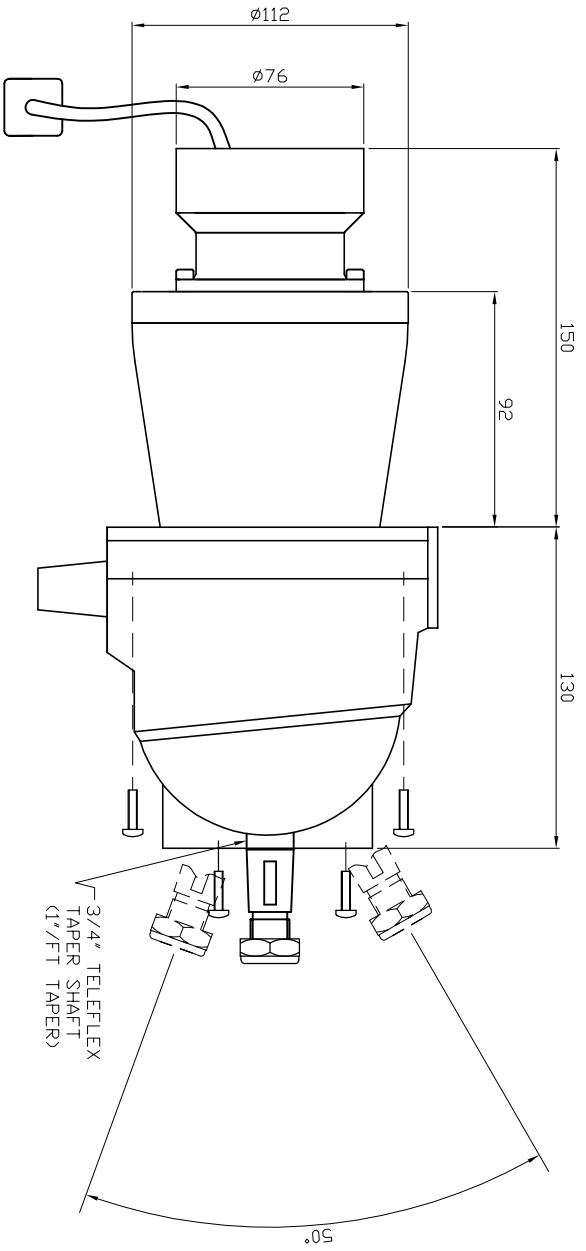
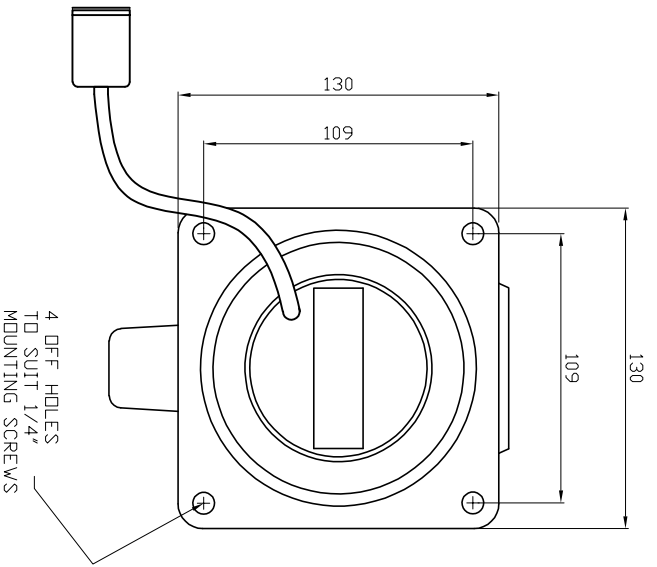
DATE: 23/8/16

DRG. NO:

HMS200

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ISSUE: 2 - 10568



## PIPEWORK AND HARNESS INSTALLATION

1. In considering the installation, ensure that hoses allow for movement of the cylinder in operation. Hoses should be rated for a working pressure of at least 100 bar (1500 psi), and typically be of 5/16" bore.
2. If an emergency ball valve is to be installed, consideration should be made as to accessibility when required.
3. The helm harnesses are supplied pre-made with connectors on either end. Although some excess length will not affect performance, care should be taken that any excess does not become vulnerable to damage. It is preferable that harnesses are run in a suitable conduit or trunking for protection.
4. Please note that the harness is equipped with a male and female end, so care is required to ensure the correct way round to avoid extra work swapping round later.
5. Cables associated with the steering control system should not be run in close proximity to potential sources or electrical interference, such as cables to radio transmission aerials or high current/electrically noisy loads.

## ELECTRICAL SUPPLY

It is recommended that the electrical supply to the power pack is interlocked with the engine start/run so that the electric motor pumps are only in operation during engine(s) running.

The electrical supply should be adequately protected through a separate circuit breaker rated for maximum current draw as follows:

HM5190	@ 70 bar	- 30 amp
	@100 bar	- 40 amp
HM5290	@70 bar	- 40 amp
	@100 bar	-55 amp

The above figures are at 24v supply, and suitable consideration should be made for 12v applications.

It is recommended that International Standard ISO 10133 Small Craft – Electrical Systems – Extra-Low Voltage D.C. Installations – is observed for cross-sectional area of conductors and other applicable requirements covered by this Standard.

## COMMISSIONING THE SYSTEM

### PURGING THE HYDRAULICS

1. Remove filler plug from top of reservoir and fill reservoir to approximately 3/4 full. We recommend the use of an oil to ISOVG10 or 15 specification.
2. Attach a suitable length of clear plastic tube between the cylinder bleeds and open both bleed fittings 1/2 – 3/4 turn.
3. With voltage supply to the power pack in place, a green light should be present adjacent to the emergency/normal operation switch on the power pack. Flick switch to engage emergency mode where a red light will be seen, and the motor will run continuously.
4. Oil may now be circulated through the pipework by pushing the solenoid override pins in each end of the solenoid valve. Any air in the oil may be seen in the clear tube and the process should be carried out until no air is visible. During this process the cylinder should be allowed to move through its working stroke to expel air from this area. If an autopilot pump is fitted, this should be run in each direction.
5. Switch power pack back to normal operation (green light) and close bleed fittings at cylinder. Check reservoir level and top up if required.
6. The system should now operate under command from the helm with a stop being felt at the helm when full lock is achieved. No further set up of the electronics should be required.

## PREVENTATIVE MAINTENANCE

### Every 30 days or before usage of vessel

Check hydraulic fluid level which should be approximately 3/4 full.

### Every 6 months

1. Check fluid level in reservoir.
2. Check pivot points on cylinder mounting are free to operate.
3. Check mounting bolt to steering tiller arm, and bolts to vessel structure are suitably tightened.
4. Ensure ball joint on steering cylinder is operating freely. It is suggested that, if a tie bar is fitted to the vessel, this is also checked at this point.
5. Ensure there is no wear in either the ball joint or the rear pivot mounting of the steering cylinder.
6. Check all hoses on the installation for possible chafing or scuffing against one another or against part of the vessel. Replace if braiding under outer sheath is exposed.

### After one year or first 50 hours

Additional to 6 month check, check helms still turn smoothly and freely, and check emergency mode by switching power pack over and operating solenoids manually.

### After 3 years or 300 hours

Additional to 6 month check, carry out oil change and re-purge system. Refer to Page 5 "Purging the Hydraulics"

## TROUBLESHOOTING

<b>PROBLEM</b>	<b>POSSIBLE CAUSE</b>	<b>SOLUTION</b>
One helm unit will operate the rudder, but the other has no effect.	<ol style="list-style-type: none"> <li>1. Non continuity through harness/plugs.</li> <li>2. Electronic problem within helm.</li> <li>3. Electronic problem within power pack.</li> </ol>	<p>Pull apart plugs and check/clean as required.</p> <p>Swap harnesses at input to power pack to determine if problem is in helm or power pack. Replace defective unit.</p>
Rudder will not retain set position.	<p>Leakage across cylinder.</p> <p>Leakage across Pilot Check Valve.</p> <p>Leakage across Auto Pilot Pump.</p>	Carry out tests to determine location of leak. Repair/replace as required.
System appears not purged after commissioning.	Air saturation in oil.	Re-purge after reasonable settling period.
Steering locks at hard-over or no stop is felt at hard over.	<ol style="list-style-type: none"> <li>1. Non continuity through harness/plugs.</li> <li>2. End of stroke switch stuck closed.</li> <li>3. Problem with brake within helm.</li> </ol>	<p>Swap helms at Power Pack to determine if problem is in helm/harness or Power Pack.</p> <p>Investigate as appropriate and repair/replace.</p>
Operation at helm(s) gives incorrect steering direction.	Pipework crossed between Power Pack and Cylinder	Swap pipework and recommission.
Helm(s) pumps in one direction but not in the other.	<ol style="list-style-type: none"> <li>1. Check whether problem is with one or both helms.</li> <li>2. Non continuity through harness/plugs.</li> <li>3. Non continuity through solenoid connections.</li> </ol>	<p>Swap helms at Power Pack if problem is in one helm.</p> <p>Investigate wiring plug connections, also solenoid and its connections.</p>
Helm unit(s) give excessive turns for lock to lock.	<ol style="list-style-type: none"> <li>1. System designed to give design turns at up to 1 sec/rev input at wheel, turns will increase above this.</li> <li>2. Is problem with one helm or both?</li> <li>3. Partial continuity through harness/plugs.</li> </ol>	Ascertain by swapping where problem lies. Investigate and repair/replace as required.
Loss of fluid in the reservoir.	Leak in reservoir or pipework.	Check all connections, repair as necessary. Re-purge if required.