

# MODEL 7173 - K INSTRUCTION MANUAL

## CONTENTS

1. MODEL 7173 - K ELECTRONIC FFU STEERING SYSTEM
2. MODEL 7173 - K COMPONENTS
3. MOUNTING THE 7173 - K AMPLIFIER UNIT
4. MOUNTING THE FFU CONTROLLER UNITS
5. MOUNTING THE MODEL 7174 RUDDER FEEDBACK UNIT
6. WIRING THE SYSTEM
7. TESTING THE SYSTEM
8. TROUBLE SHOOTING

## DRAWINGS

- 7173 - 001* - SINGLE SPEED STEERING SYSTEM WIRING DIAGRAM
- 7173 - 002* - DUAL RATE SPEED STEERING SYSTEM WIRING DIAGRAM
- 7173 - 003* - SINGLE SPEED CATAMARAN STEERING SYSTEM WIRING DIAGRAM (ELECTRONICS TIE BAR)
- 7173 - 004* - TWO INDEPENDENT SINGLE SPEED STEERING SYSTEM WIRING DIAGRAM
- 7173 - 005* - SINGLE SPEED STEERING SYSTEM BLOCK DIAGRAM
- 7173 - 006* - DUAL RATE SPEED STEERING SYSTEM BLOCK DIAGRAM
- 7173 - 007* - SINGLE SPEED CATAMARAN STEERING SYSTEM BLOCK DIAGRAM
- 7173 - 008* - TWO INDEPENDENT SINGLE SPEED STEERING SYSTEM BLOCK DIAGRAM
- 7173 - 009* - SINGLE STEERING SYSTEM WITH OPTIONAL JOG LEVER CONNECTION DIAGRAM
- 7173 - 010* - SINGLE STEERING SYSTEM WITH OPTIONAL AUTO PILOT CONNECTION DIAGRAM
- A - 400899* - 7174 FEEDBACK UNIT LIMIT SWITCHES WIRING DIAGRAM



## **Electronic Full Follow-up Amplifier Model 7173-K**

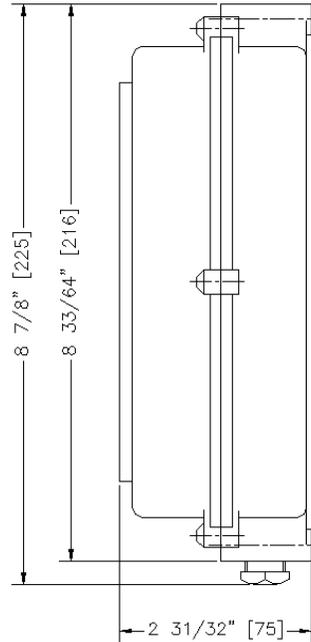
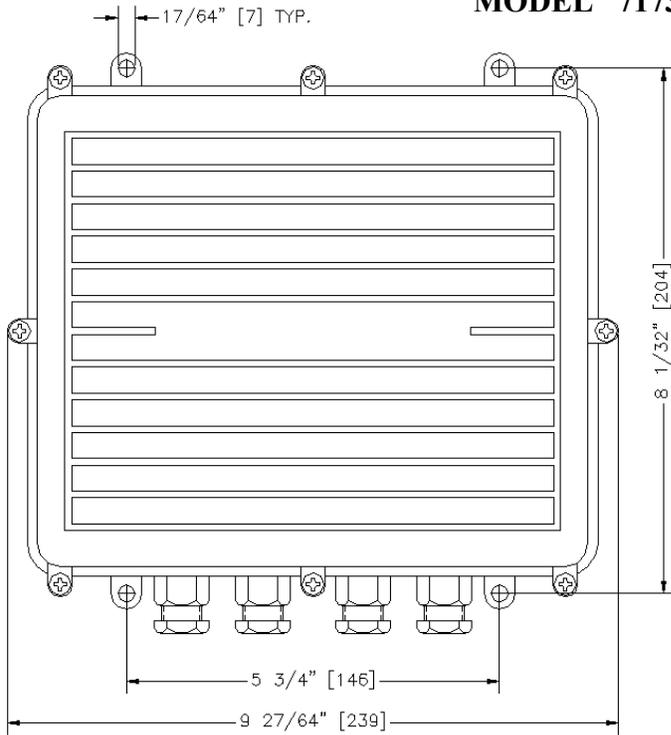
This unit is designed to accept the command signal from our Models 7165, 7166, 7167, 7169, 7171, 7172 and 7176 and co-ordinates the desired rudder position with our feedback unit Models 7168 or 7174. Models 7144, 7145 and 7148 are equipped with solenoid valves and can be activated by the Model 7173-K and will disperse hydraulic fluid to the hydraulic steering system to maintain the desired position.

This device can be located anywhere aboard ship, even in the steering compartment, since its watertight and non-corrosive materials will not affect the electronics internally.

The Model 7173-K is a multi-optional driver board (12 or 24-Volt DC) which can control:

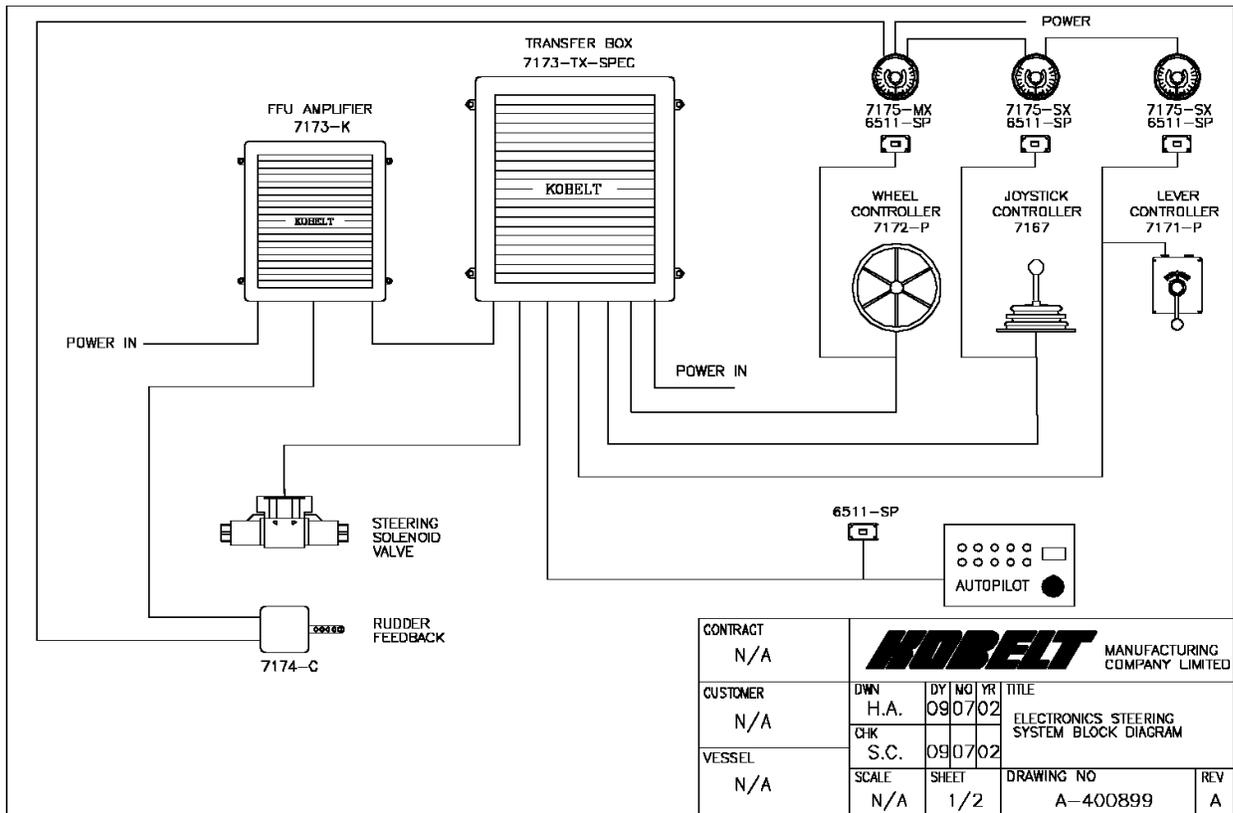
1. Single steering system  
See drawing 7173-001 / 7173-005
2. Dual speed steering system  
See drawing 7173-002 / 7173-006
3. Two independent steering systems controlled by the same controller (This is ideal for catamaran steering because of its electronic tie bar.)  
See drawing 7173-003 / 7173-007
4. Two independent hydraulic systems; i.e. steering and bucket control  
See drawing 7173-004 / 7173-008 and can be changed in the field. See manual.

## DIMENSIONS MODEL 7173 - K



**Dimensions - Inch (mm)**

### TYPICAL MULTIPLE STATION



## **MODEL 7173-K ELECTRONIC FULL FOLLOW-UP STEERING SYSTEM**

The **KOBELT 7173-K** System consists of the following components:

1. Electronic FFU Amplifier
2. Controller (Wheel Controller, FFU Lever or Joystick)
3. Follow-Up (Rudder Feedback Unit)
4. Solenoid Interface Valve

The Model **7173-K** System is used to set the position (or the angle) to which the Rudder goes. The Amplifier Unit compares the respective command and feedback signals from the Controller and Follow-Up Unit. If the signals are not equal, the Amplifier Unit applies directional control to the Hydraulic Pressure to move the Rudder in the proper direction. When the Controller and Follow-Up signals are equal, the Amplifier shuts off directional control and the Rudder stops.

### **MOUNTING THE MODEL 7173-K AMPLIFIER UNIT**

The Model **7173-K** Amplifier unit is mounted inside a waterproof housing. The housing should be mounted in a convenient, easily serviced location. Allow enough space to permit opening of the housing cover (see Model **7173-K** data sheet).

### **MOUNTING THE FFU CONTROLLER UNITS**

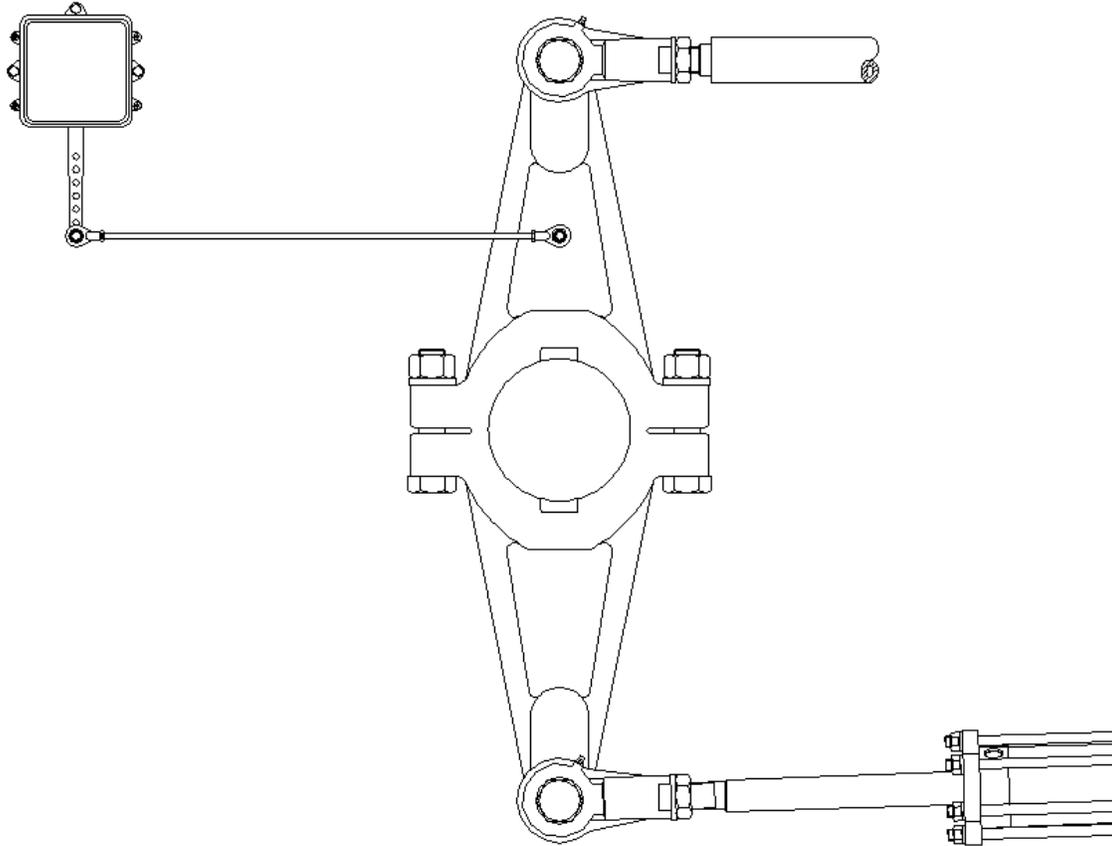
The following types of controllers are available:

1. Model **7172** Wheel Controller
2. Model **7171** Lever Controller
3. Model **7169** Joystick Controller
4. Model **7176** Satellite Controller
5. Model **7167** 2-Axis Joystick Controller
6. Model **6655** Steering Wheel Engine Control
7. Model **7165** Joystick Controller
8. Model **7166** Wheel Controller

The Model **7172** Wheel Controller is normally bulkhead mounted. A steering wheel with a 1.0" bore should be attached to this Controller (see Model **7172** data sheet). The Model **7171** FFU Lever Controller is completely waterproof and normally mounted on a flat surface (see Model **7171** data sheet). The Model **7169** Joystick Controller is normally mounted on a flat surface.

## MOUNTING THE MODEL 7174 RUDDER FEEDBACK UNIT

The Model **7174** or **7168** Follow-Up must be mounted near the steering gear as shown in the diagram.



**IMPORTANT:** Hydraulic steering gears using a hydraulic Full Follow-Up System (often referred to as “Telemotor” or “Accumotor”) must drive the Feedback Unit from the Servo Cylinder, and not the Rudder Stock. In such a case, the Model **7174** Follow-Up should be mounted approximately two feet from the end of the Servo Cylinder. This is done to ensure proper linear motion. The cable from the Models **7174** or **7168** Feedback Unit should be a 3-conductor, #18-gauge cable.

## WIRING THE SYSTEM

All cable should be weatherproof marine type and be free of joints or splices. If it is necessary to join wires, a proper waterproof junction box should be used.

The input power to the Model **7173-K** Amplifier Unit is 11 VDC to 28 VDC. The power cable (2-conductor, #14-gauge) should be run from the switchboard through a customer-supplied on/off switch via a circuit breaker or fuse (8 amp).

The cable to the pumpset solenoid/relay is a 3-conductor #16 gauge.

The Controller should use a 3-conductor, #18 gauge cable. If more than one controller is used, a “station selector switch” must be connected between the Controller and the Model **7173-K**. The “station selector switch” is optionally supplied. A mechanical selector switch requires a single pole, multi-position switch. Consult the factory for electronic station selector systems (Model 7173-T). The 8 VDC reference supply from the Model **7173-K** terminals #9 and #12 or #13 and #16 is common to all Controllers. Only the output signals coming back from each FFU Controller are connected to the station selector. From the station selector switch, the FFU Controller output is connected to Model **7173-K** terminal #11 or #15.

The Model **7170** NFU Controller can also be connected to the Model **7173-K** System (see Model **7170** data sheet). Activating the Model 7170 Jog Switch will temporarily override the FFU System. FFU Control will be returned automatically as soon as the Jog Switch is deactivated. If the rudder moves in the wrong direction, reverse the black and white wires.

**NOTE:** See Drawing **7173-009** for how to interface a NFU Jog Switch to a FFU System where the Jog Switch can be used for backup.

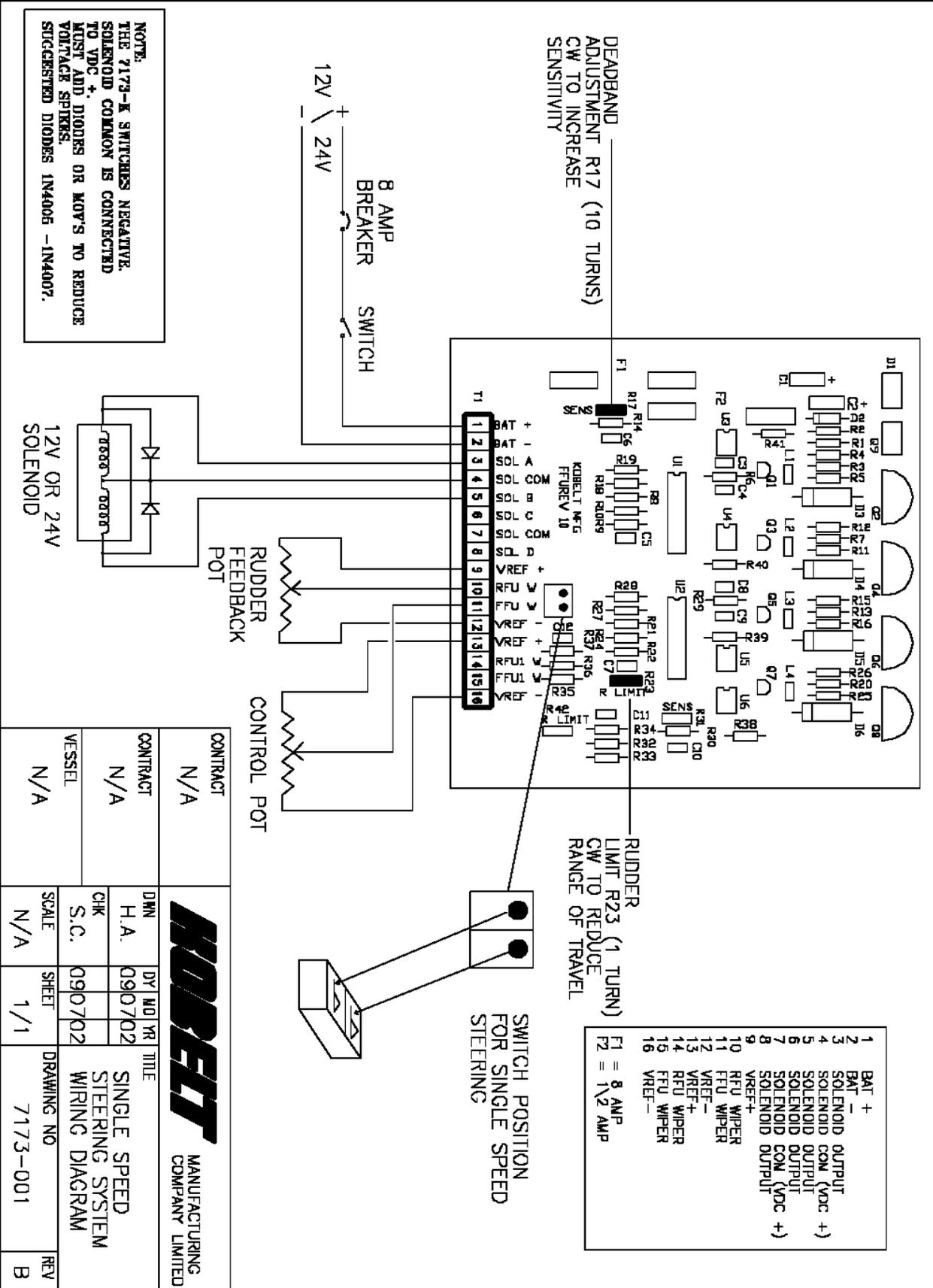
## TESTING THE SYSTEM

1. Check that the supply voltage is connected to the correct amplifier terminals. The circuit board has built-in polarity protection to prevent circuit damage, but the system will not initialize until polarity is correct.
2. Centre the rudder and ensure that the rudder follow-up unit is mechanically centred. Centre all FFU controllers.
3. Turn on power to the Model **7173-K** Amplifier Unit.
4. Turn on the hydraulic pumpset or, in the case of an engine driven pumpset, start the engine.
5. The rudder should stay at midships and may hunt back and forth (see steps #9 and #10) at the midship position. If the rudder moves to a hardover position, shut off power to the amplifier and reverse the wires going to the solenoid or the black and white wires coming from the feedback unit (see applicable drawing) on the Model **7173-K** circuit board.  
Re-apply power to the Model **7173-K** Amplifier Unit.
6. Move the FFU controller to 20° port. The rudder should move in the port direction. If the rudder moves to starboard, reverse the black and white wires coming from the controller.
7. Repeat step #6 for any additional controllers wired via a station selector.
8. Move the FFU controller to a hardover position and adjust the internal FFU controller trim pot until the rudder stops just before the hardover position. Also, rudder limit adjustment can be achieved by adjusting rudder limit trimpots on 7173-K board or by adjusting the stroke on the feedback unit. **NOTE:** you must not allow the cylinder to continually push against the mechanical stops (hardover position).
9. Move the FFU controller to the centre position and adjust, the deadband adjustment trimpot (R17 or R31) clockwise until the rudder begins to hunt back and forth (rudder may already be doing this).
10. Carefully adjust the R17 or R31 deadband control counterclockwise until the hunting effect stops. This setting will be the maximum useable gain for your system. Check the adjustment several times by moving the controller to various positions. If hunting starts, re-adjust R17 or R31 counterclockwise to stop.

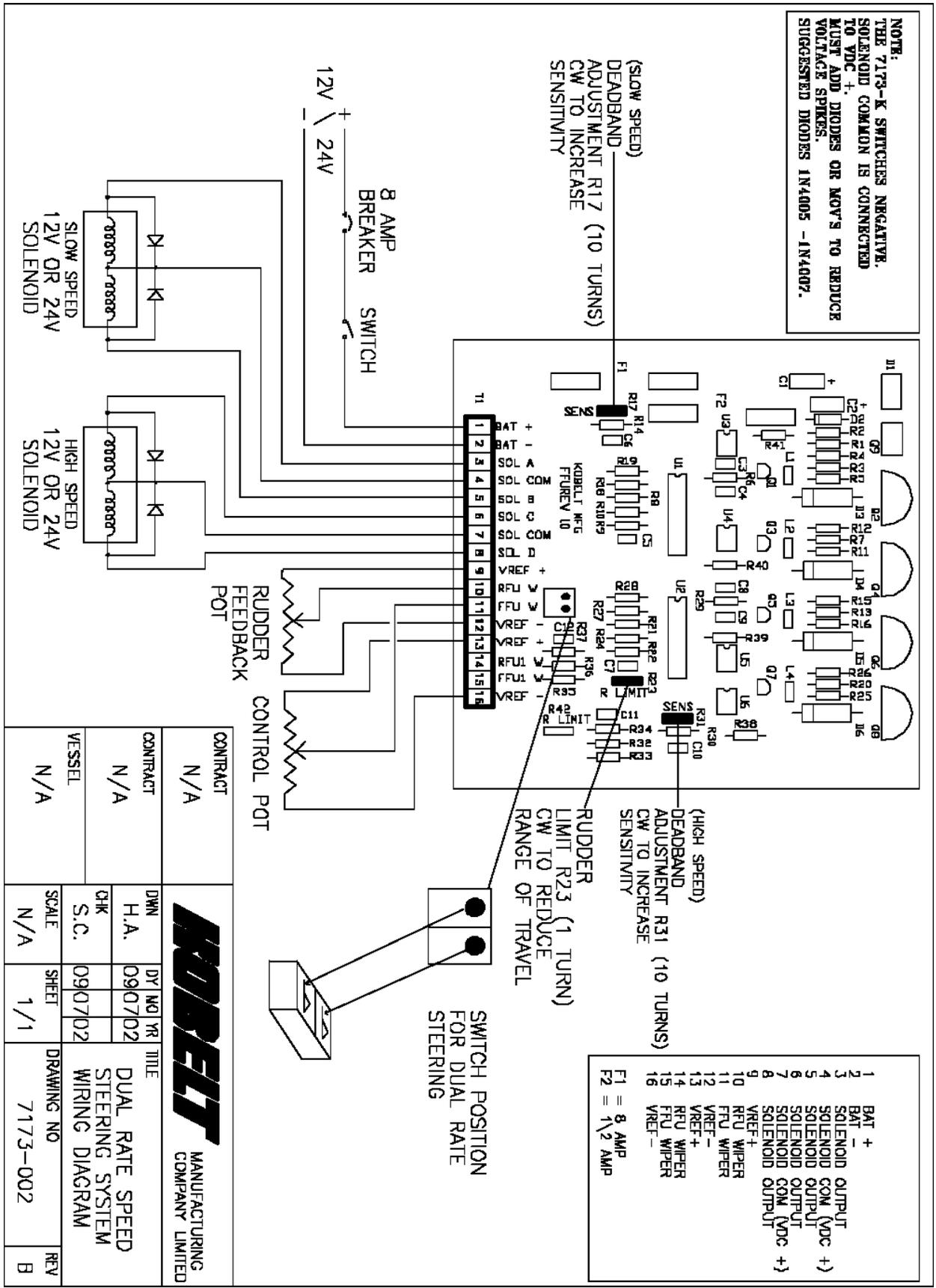
**NOTE:** In order not to overheat/damage the solenoid coils or the **7173-K** amplifier, power to the amplifier should be disconnected, if hydraulic power is not available.

## TROUBLE SHOOTING

<u>SYMPTON</u>	<u>POSSIBLE CAUSES</u>	<u>REMEDY</u>
System dead	<ul style="list-style-type: none"><li>- power off</li><li>- fuse blown</li><li>- DC power input polarity reversed</li></ul>	<ul style="list-style-type: none"><li>- turn on power</li><li>- replace fuse</li><li>- reverse connection</li></ul>
Erratic operation	<ul style="list-style-type: none"><li>- follow-up pot of FFU controller potentiometer defective</li></ul>	<ul style="list-style-type: none"><li>- check follow-up and controller potentiometer</li><li>- meter output voltage, replace if necessary</li></ul>
Rudder hunts back and forth	<ul style="list-style-type: none"><li>- R17 or R31 deadband control in Model 7173-K Amplifier incorrectly adjusted</li></ul>	<ul style="list-style-type: none"><li>- reduce gain by turning counter-clockwise</li></ul>
Rudder goes to a hardover position	<ul style="list-style-type: none"><li>- defective potentiometer</li><li>- damaged cable</li><li>- sticky solenoid valve or relay</li><li>- loose follow-up linkages</li><li>- solenoid wires reversed</li><li>- feedback wires reversed</li></ul>	<ul style="list-style-type: none"><li>- replace</li><li>- repair</li><li>- repair or replace</li><li>- repair</li><li>- reverse wires</li><li>- reverse wires</li></ul>
Rudder does not travel same number of degrees hardover to hardover	<ul style="list-style-type: none"><li>- control potentiometer not centred</li><li>- feedback unit or potentiometer not centred</li></ul>	<ul style="list-style-type: none"><li>- meter output voltage or resistance</li><li>- meter output voltage or resistance</li></ul>
L1 and L2 continuously ON	<ul style="list-style-type: none"><li>- U1 damaged</li></ul>	<ul style="list-style-type: none"><li>- replace</li></ul>
L3 and L4 continuously ON	<ul style="list-style-type: none"><li>- U2 damaged</li></ul>	<ul style="list-style-type: none"><li>- replace</li></ul>



NOTE:  
 THE 7173-K SWITCHES NEGATIVE.  
 SOLENOID COMMON IS CONNECTED  
 TO VDC +. MUST ADD DIODES OR MOV'S TO REDUCE  
 VOLTAGE SPIKES.  
 SUGGESTED DIODES 1N4005 - 1N4007.

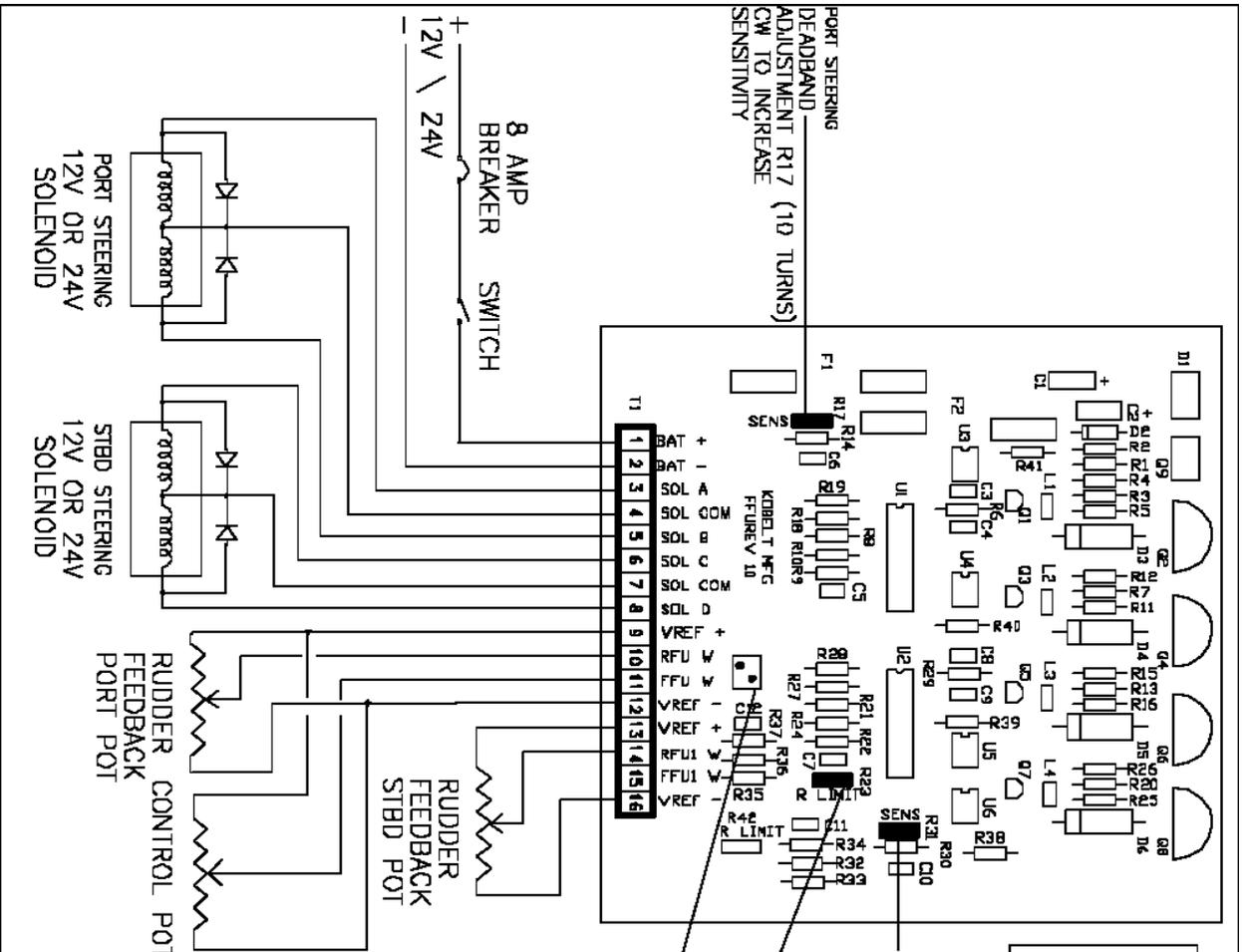


CONTRACT		N/A	
CONTRACT		N/A	
VESSEL		N/A	
DWN	DAY	MO	YR
H.A.	09	07	02
CHK	S.C.	09	07
SCALE	SHEET	DRAWING NO	
N/A	1/1	7173-002	
TITLE		REV	
DUAL RATE SPEED STEERING SYSTEM WIRING DIAGRAM		B	

**ROBELT**  
 MANUFACTURING COMPANY LIMITED

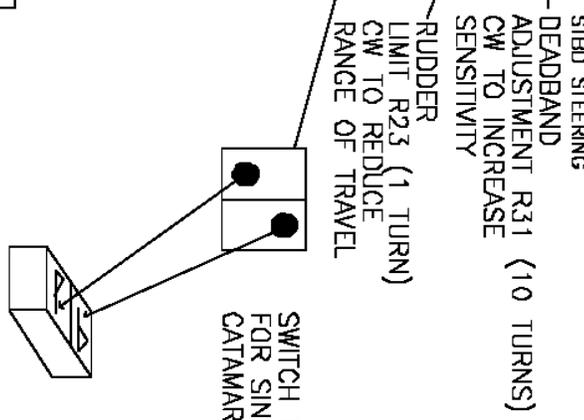
- 1 BATT +
  - 2 SOLENOID OUTPUT
  - 3 SOLENOID COM (VDC +)
  - 4 SOLENOID OUTPUT
  - 5 SOLENOID OUTPUT
  - 6 SOLENOID COM (VDC +)
  - 7 SOLENOID OUTPUT
  - 8 VREF+
  - 9 RFU WIPER
  - 10 RFU WIPER
  - 11 RFU WIPER
  - 12 VREF-
  - 13 RFU WIPER
  - 14 RFU WIPER
  - 15 VREF-
  - 16 VREF-
- F1 = 8 AMP  
 F2 = 1/2 AMP

SWITCH POSITION  
 FOR DUAL RATE  
 STEERING



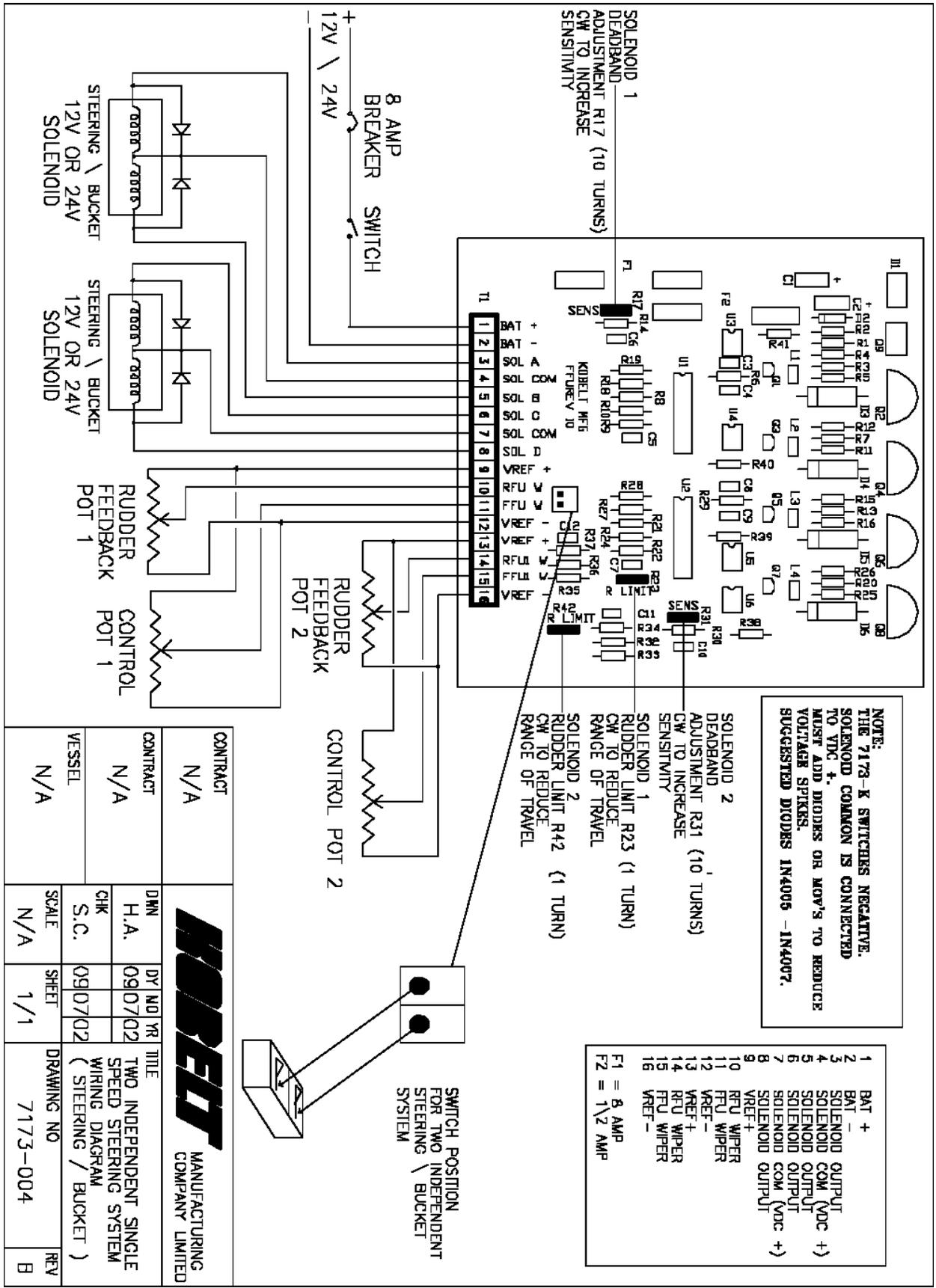
**NOTE:**  
 THE 7173-K SWITCHES NEGATIVE SOLENOID COMMON IS CONNECTED TO VDC +. MUST ADD DIODES OR MOV'S TO REDUCE VOLTAGE SPIKES. SUGGESTED DIODES 1N4005 - 1N4007.

- 1 BAT +
  - 2 BAT -
  - 3 SOLENOID OUTPUT
  - 4 SOLENOID COM (VDC +)
  - 5 SOLENOID OUTPUT
  - 6 SOLENOID OUTPUT
  - 7 SOLENOID COM (VDC +)
  - 8 SOLENOID OUTPUT
  - 9 VREF+
  - 10 RFU WIPER
  - 11 FTU WIPER
  - 12 VREF-
  - 13 VREF+
  - 14 RFU WIPER
  - 15 FTU WIPER
  - 16 VREF-
- F1 = 8 AMP  
 F2 = 1/2 AMP



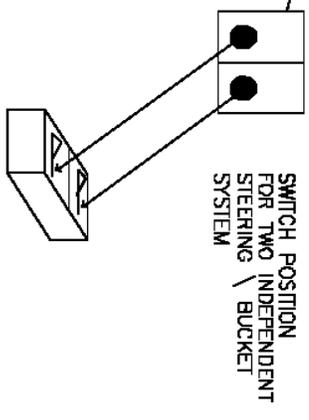
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CONTRACT		N/A	
VESSEL		N/A	
DMN	DAY	NO	YR
H.A.	09	07	02
CHK	S.C.	090702	
SCALE	SHEET	DRAWING NO	
N/A	1/1	7173-003	
TITLE		REV	
SINGLE SPEED CATAMARAN STEERING SYSTEM WIRING DIAGRAM (ELECTRONICS THE BAR)		B	

**ROBERT** MANUFACTURING COMPANY LIMITED

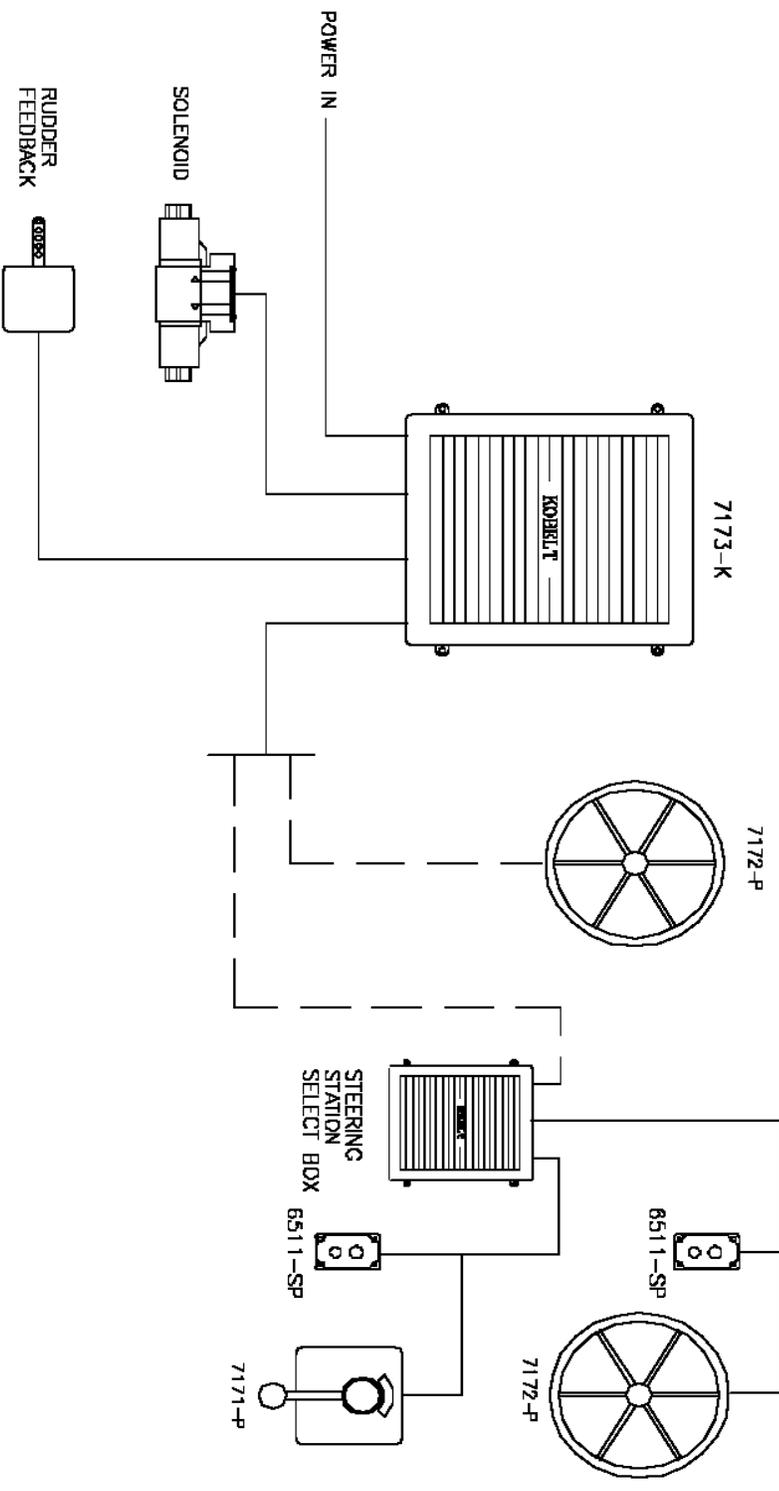


NOTE:  
THE 7173-K SWITCHES NEGATIVE.  
SOLENOID COMMON IS CONNECTED  
TO YDC +.  
MUST ADD DIODES OR MOV'S TO REDUCE  
VOLTAGE SPIKES.  
SUGGESTED DIODES IN4005 - IN4007.

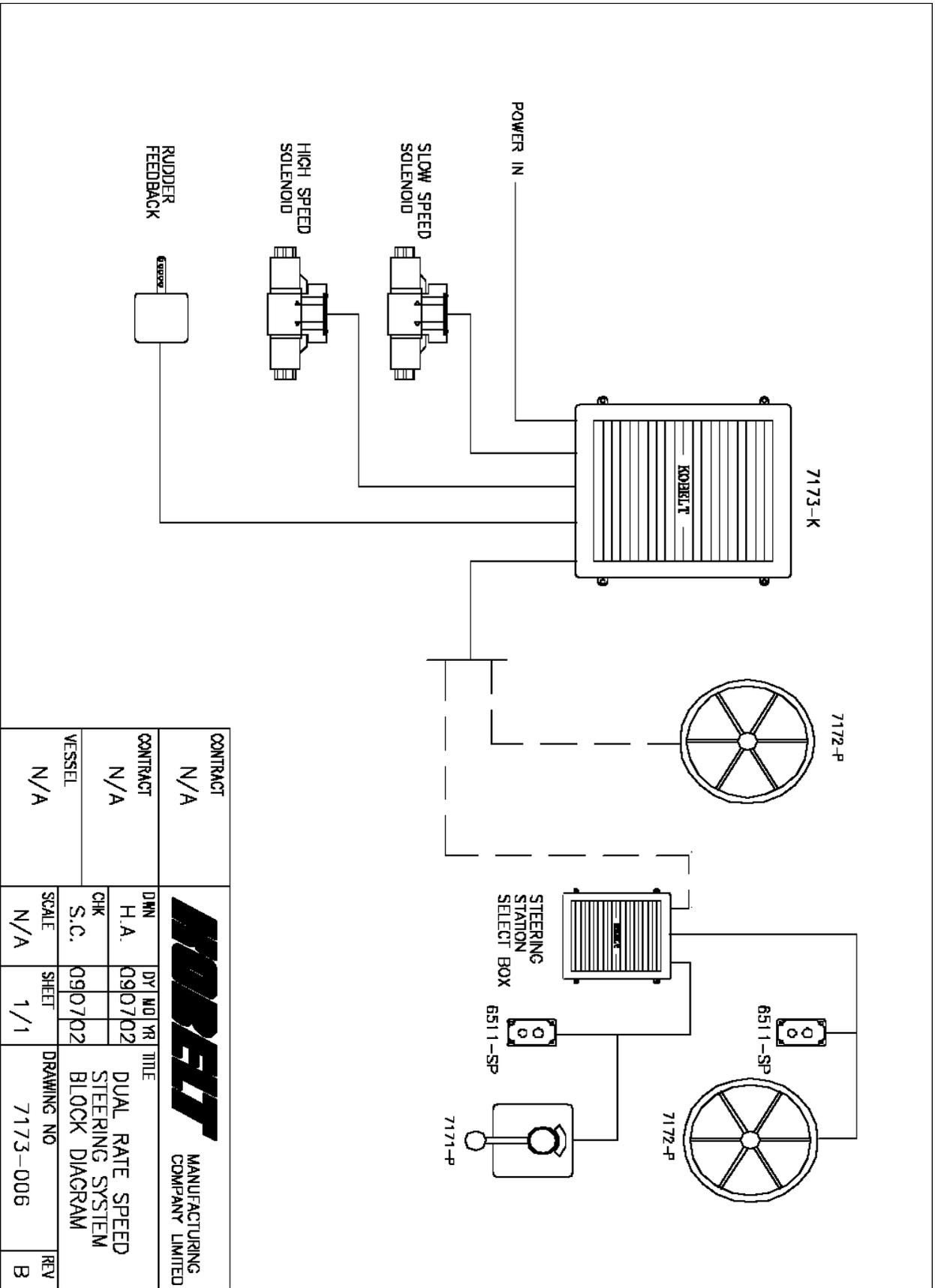
- 1 BAT +
  - 2 SOLENOID OUTPUT
  - 3 SOLENOID COM (VDC +)
  - 4 SOLENOID OUTPUT
  - 5 SOLENOID OUTPUT
  - 6 SOLENOID COM (VDC +)
  - 7 SOLENOID OUTPUT
  - 8 VREF+
  - 9 RFU WIPER
  - 10 RFU WIPER
  - 11 VREF-
  - 12 VREF+
  - 13 RFU WIPER
  - 14 RFU WIPER
  - 15 VREF-
  - 16 VREF+
- F1 = 8 AMP  
F2 = 1/2 AMP



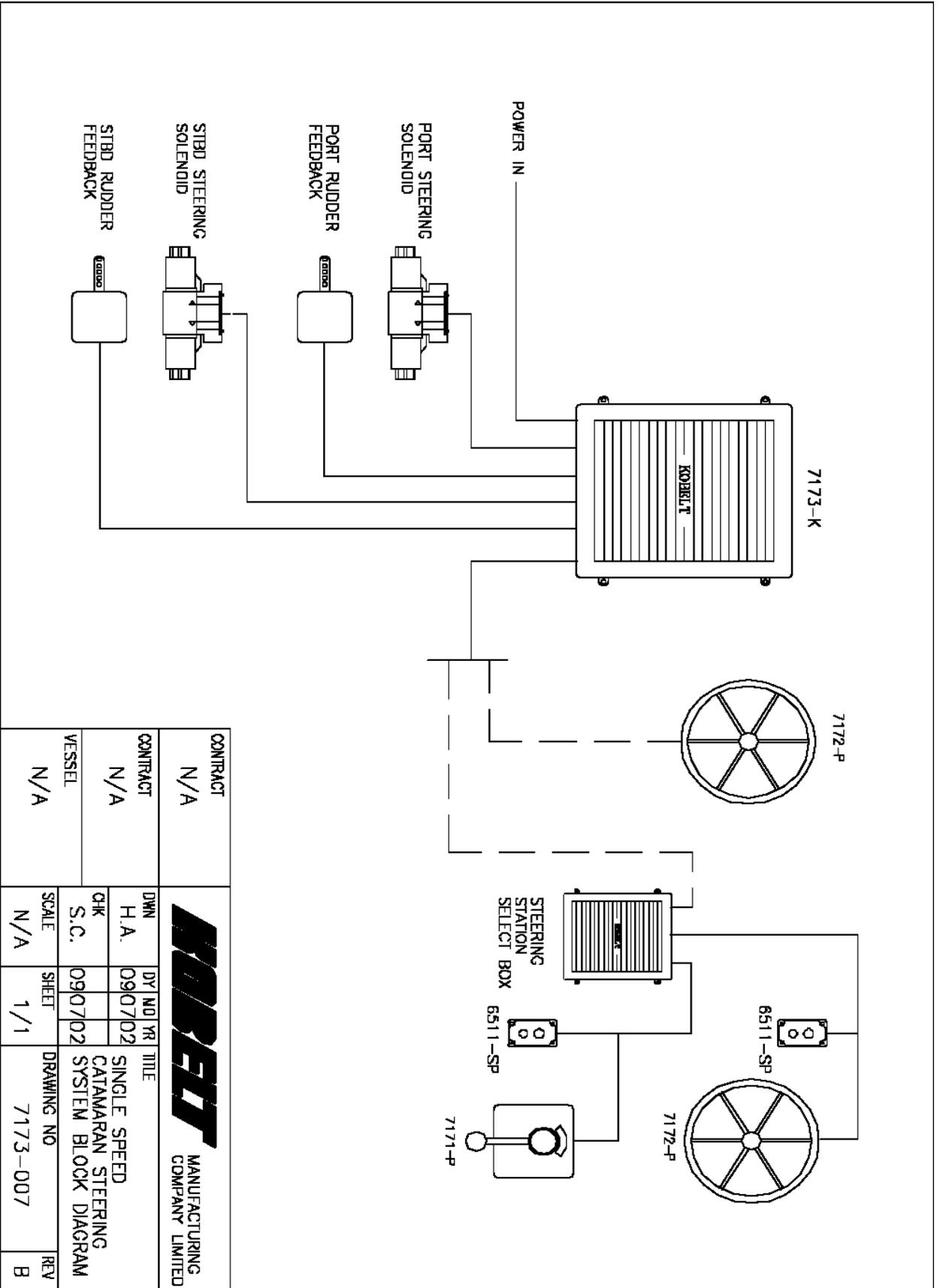
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CONTRACT		N/A						
VESSEL		N/A		DMN	0910702	TITLE	TWO INDEPENDENT SINGLE SPEED STEERING SYSTEM WIRING DIAGRAM (STEERING / BUCKET )	
SCALE		N/A		CHK	0910702			
SHEET		1/1		DRAWING NO	7173-004		REV	B



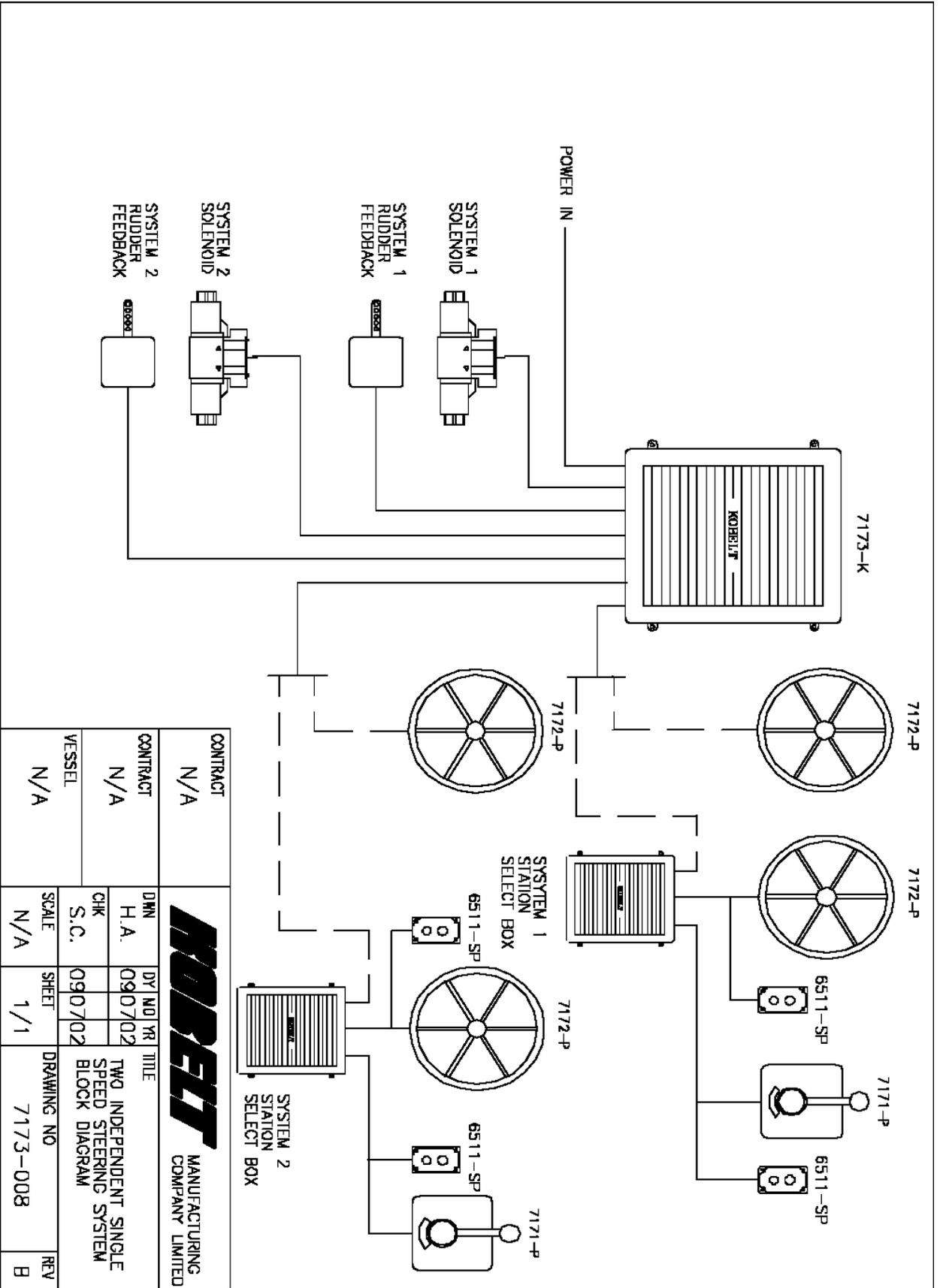
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CONTRACT		N/A				
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N/A		N/A		H.A.	090702	SINGLE SPEED STEERING SYSTEM
N/A		N/A		CHK	090702	BLOCK DIAGRAM
N/A		N/A		S.C.	090702	
N/A		N/A		SCALE	SHEET	DRAWING NO
N/A		N/A		N/A	1/1	7173-005
N/A		N/A				REV
N/A		N/A				B



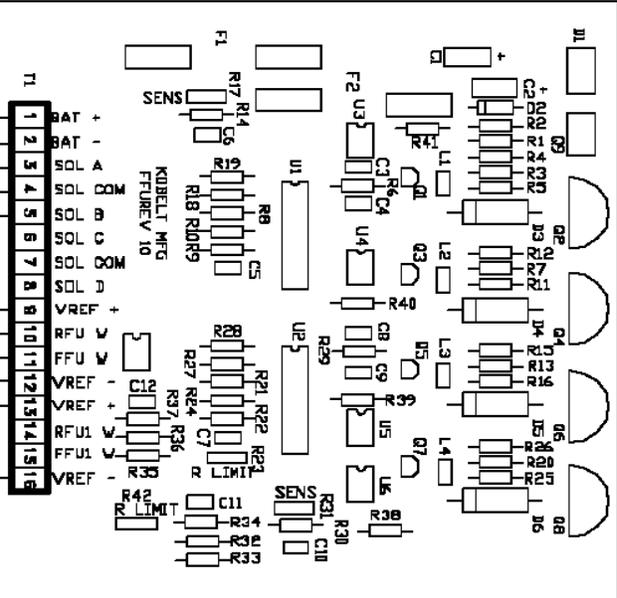
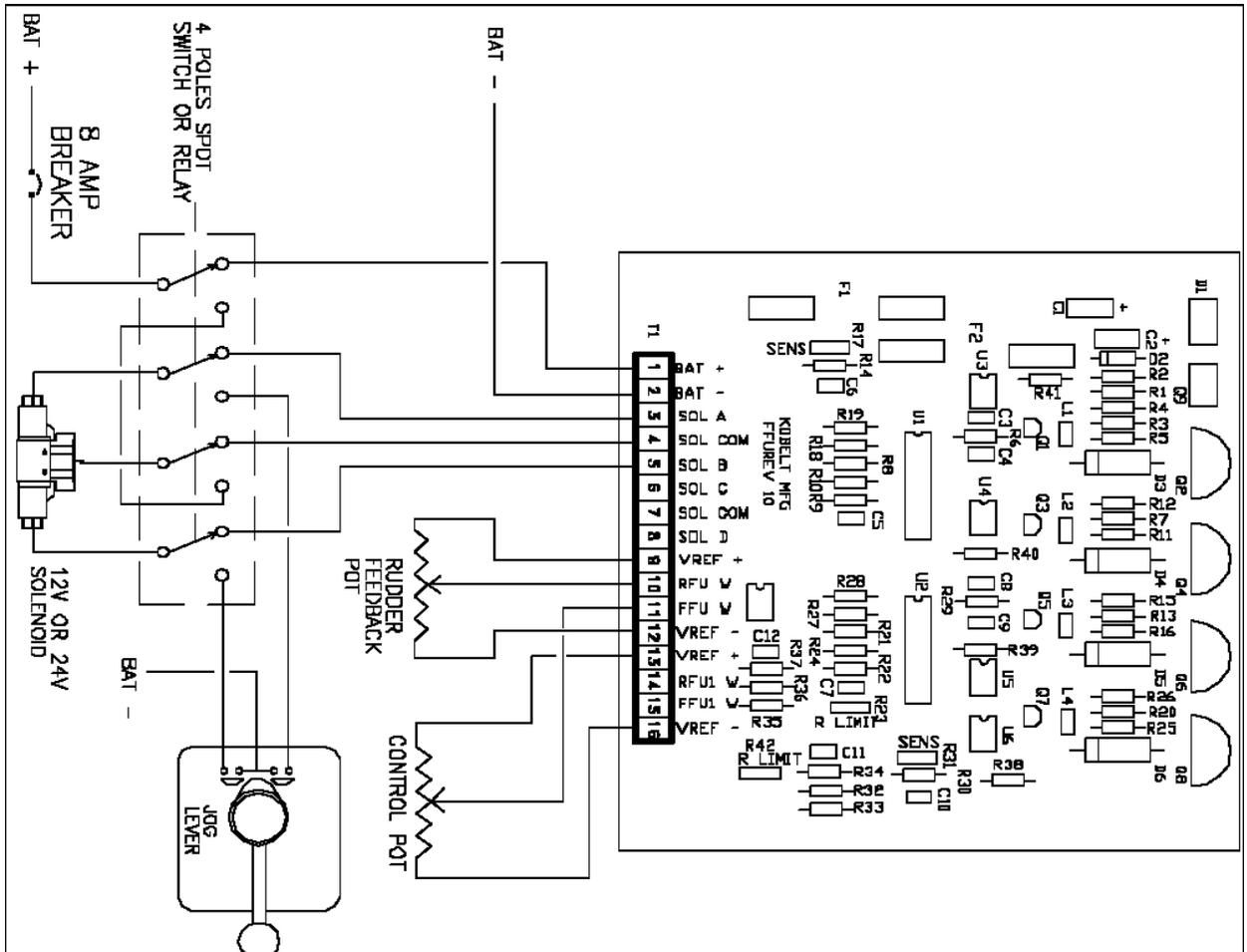
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CONTRACT		N/A			DMN	DT	MO	YR	TITLE
VESSEL		N/A			H.A.	09	07	02	DUAL RATE SPEED STEERING SYSTEM BLOCK DIAGRAM
SCALE		N/A		S.C.	09	07	02	DRAWING NO	
SHEET		1/1		DRAWING NO		7173-006		REV	
REV		B		DRAWING NO		7173-006		REV	



CONTRACT N/A		<b>KOBERL</b> MANUFACTURING COMPANY LIMITED	
CONTRACT N/A	DWN H.A.	DY NO YR 09/07/02	TITLE SINGLE SPEED CATAMARAN STEERING SYSTEM BLOCK DIAGRAM
VESSEL N/A	CHK S.C.	09/07/02	
	SCALE N/A	SHEET 1/1	DRAWING NO 7173-007
			REV B



CONTRACT		N/A		<b>KOEBELT</b>		MANUFACTURING COMPANY LIMITED	
CONTRACT		N/A					
VESSEL		N/A		DMN	DAY NO YR	TITLE	
VESSEL		N/A		H.A.	090702	TWO INDEPENDENT SINGLE SPEED STEERING SYSTEM BLOCK DIAGRAM	
SCALE		N/A		CHK	090702	DRAWING NO	7173-008
SCALE		N/A		S.C.	090702	SHEET	1/1
SCALE		N/A				REV	B

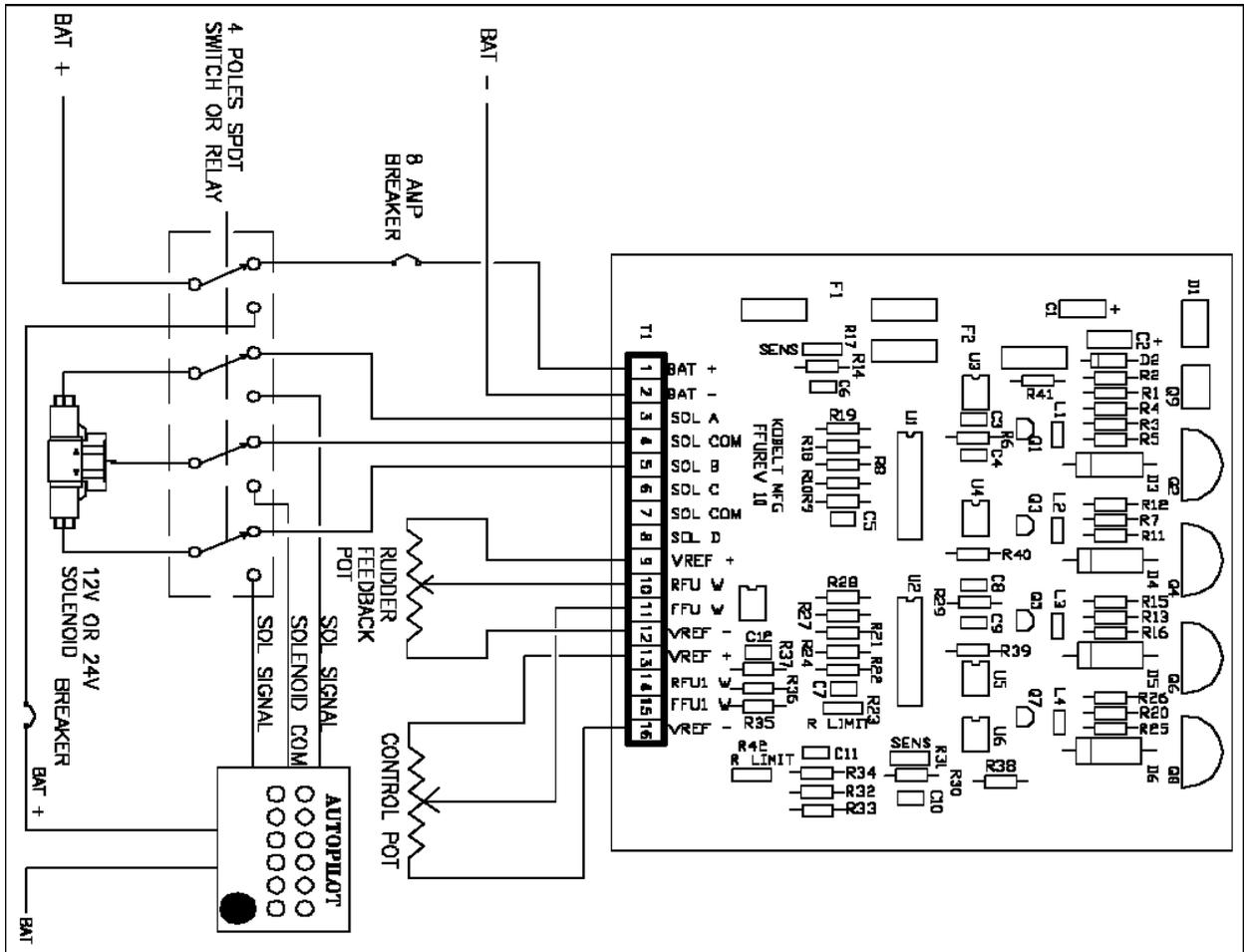


- 1 BAT +
  - 2 BAT -
  - 3 SOLENOID OUTPUT COM (VDC +)
  - 4 SOLENOID OUTPUT
  - 5 SOLENOID OUTPUT
  - 6 SOLENOID OUTPUT
  - 7 SOLENOID COM (VDC +)
  - 8 SOLENOID OUTPUT
  - 9 VREF+
  - 10 RTU WIPER
  - 11 FFU WIPER
  - 12 VREF-
  - 13 VREF+
  - 14 RTU WIPER
  - 15 FFU WIPER
  - 16 VREF-
- F1 = 8 AMP  
F2 = 1/2 AMP

NOTE:  
SWITCH OR RELAY MUST BE ABLE TO HANDLE SYSTEM CURRENT. SWITCH OR RELAY IS CUSTOMER SUPPLIED.

CONTRACT		N/A		DWG		DY/NO/YR		TITLE	
CONTRACT		N/A		H.A.		09/07/02		SINGLE STEERING SYSTEM WITH OPTIONAL JOG LEVER CONNECTION DIAGRAM	
VESSEL		N/A		CHK		S.C.		DRAWING NO	
N/A		N/A		09/07/02		1/1		7173-009	
				SCALE		SHEET		REV	
				N/A		1/1		B	

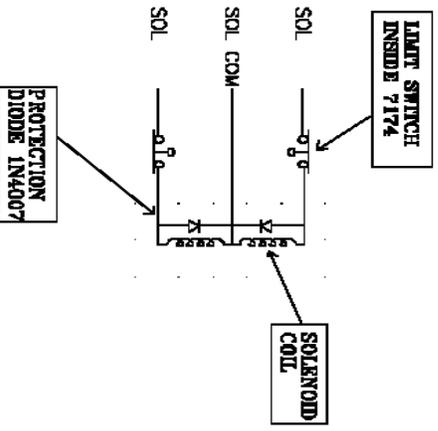
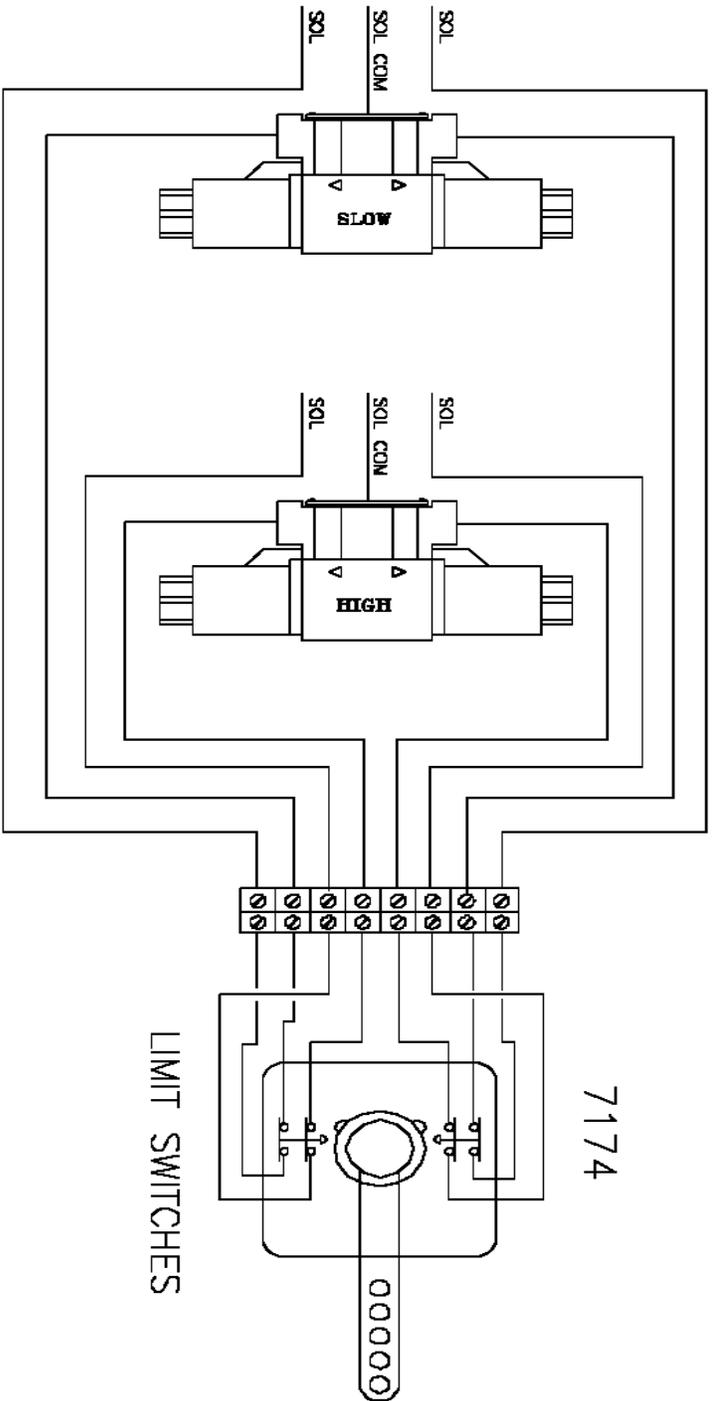
**KOBELT** MANUFACTURING COMPANY LIMITED



- 1 BAT +
  - 2 BAT -
  - 3 SOLENOID COM (VDC +)
  - 4 SOLENOID OUTPUT
  - 5 SOLENOID OUTPUT
  - 6 SOLENOID OUTPUT
  - 7 SOLENOID COM (VDC +)
  - 8 SOLENOID OUTPUT
  - 9 VREF+
  - 10 RFU WIPER
  - 11 FFU WIPER
  - 12 VREF-
  - 13 VREF+
  - 14 RFU WIPER
  - 15 FFU WIPER
  - 16 VREF-
- F1 = 8 AMP  
F2 = 1 1/2 AMP

NOTE:  
SWITCH OR RELAY MUST BE  
ABLE TO HANDLE SYSTEM CURRENT.  
SWITCH OR RELAY IS  
CUSTOMER SUPPLIED

CONTRACT		N/A		AUTOPILLOT		MANUFACTURING COMPANY LIMITED	
CONTRACT		N/A		SOLENOID COM		TITLE	
VESSEL		N/A		SOLENOID OUTPUT		SINGLE STEERING SYSTEM WITH OPTIONAL AUTOPILLOT WITH CONNECTION DIAGRAM	
SCALE		N/A		SHEET		DRAWING NO	
N/A		1/1		1/1		7173-010	
REV		B		REV		B	



NOTE:  
 DWG SHOWN FOR DUAL SPEED  
 STEERING SYSTEM.  
 MUST ADD PROTECTION DIODES  
 TO SOLENOID COILS TO REDUCE  
 VOLTAGE SPIKES.  
 7173-K AMPLIFIER SWITCHES  
 NEGATIVE, MUST SET AUTOPILOT  
 TO SWITCH NEGATIVE.

CONTRACT		N/A		 MANUFACTURING COMPANY LIMITED	
CONTRACT		N/A			
VESSEL		N/A		DIM H.A. 090702 GR 090702 S.C. 090702	DTG 10/18/11 TITLE 7174 FEEDBACK LIMIT SWITCHES WIRING DRAWING
SCALE		N/A		SHEET 2/2	DRAWING NO A-400899
				REV	A

## Periodic Inspection Notes

All mechanical and electronic components should be inspected at regular intervals, once every 6 – 12 months is recommended depending on the operating environment and frequency of use. Some Kobelt components are equipped with inspection covers which can be removed for examination of internal parts.

The followings serve as a general inspection guideline for Kobelt engine control and steering control system components. All deficiencies have to be fixed and defective parts be replaced by a certified technician to ensure a reliable and safe operation.

1. Inspect all mechanical linkages for proper movement and the bolts and nuts are tight for their functions.
2. Inspect all push / pull cable connections for free movement, adjust if necessary.
3. Check for corrosion and excessive wear at all moving parts that could cause problem in normal operation.
4. Apply lubricating oil / grease to mechanical parts at all available greasing points. For gears and rotating shafts, use of a graphite-base grease is recommended.
5. Check for signs of moisture ingress or condensation that could cause short-circuit or corrosion problem to electrical / electronic components. Surfaces of all electronic parts should be free from moisture and dust.
6. Check seals and holding screws on housings for damage and tightness.
7. Verify that primary and secondary power sources are at normal values.
8. Inspect system wiring for insulation breakdown, loose connections or potential for short-circuit failure.
9. Check limit switches for corrosion, smooth operation and correct positioning.
10. With the engine not running, perform functional test for each system – refer to individual component operating and test procedures.