SECTION A - OPERATION

1. Have both engines running and advance speed slightly above idle.
2. Switch SYNCHRONIZER ON - Pilot light will be ON.
3. MOVE SLAVE ENGINE LEVER TO MAXIMUM SPEED POSITION - since the SYNCHRONIZER is now controlling the slave engine, the lever is "limp" or non-effective. Advancing the slave engine lever eliminates the SYNCHRONIZER of undue strain in moving the entire control cable system.
4. Both engines are now under the control of a single movement of the lead engine control and may be advanced or retarded through the entire crusing range.
5. To disengage - switch OFF SYNCHRONIZER - move slave engine lever back towards idle. It will automatically re-engage with the engine control. A safety collar assures positive return to idle when switching OFF and moving lever back.

Use of the SYNCHRONIZER at minimum and maximum engine speeds calls for engine speed settings to be as follows:

SLAVE engine IDLE set LOWER than LEAD engine
SLAVE engine MAXIMUM set HIGHER than LEAD engine

Automatic deactivation of the SYNCHRONIZER will result from conditions contrary to the above settings. The pilot light will go OFF, the SYNCHRONIZER will be deactivated. To reengage, switch OFF and ON again.

SECTION B - LOCATION FOR SYNCHRONIZER

Selection of slave engine and location of the SYNCHRONIZER is determined by considering these factors:

A. Prime location is in the engine compartment on the throttle control cable path to the slave engine.

B. Space available in the engine compartment where the unit does not interfere with normal engine servicing.

C. Consideration must be given to the control cable routing - bridge cable to the SYNCHRONIZER and the short Morse cable from the SYNCHRONIZER to the engine. The latter cable - not over 8' - a single 90 degree bend is allowable - **NO "S" BENDS**. Cables are available from 3' to 8' in 6" increments.

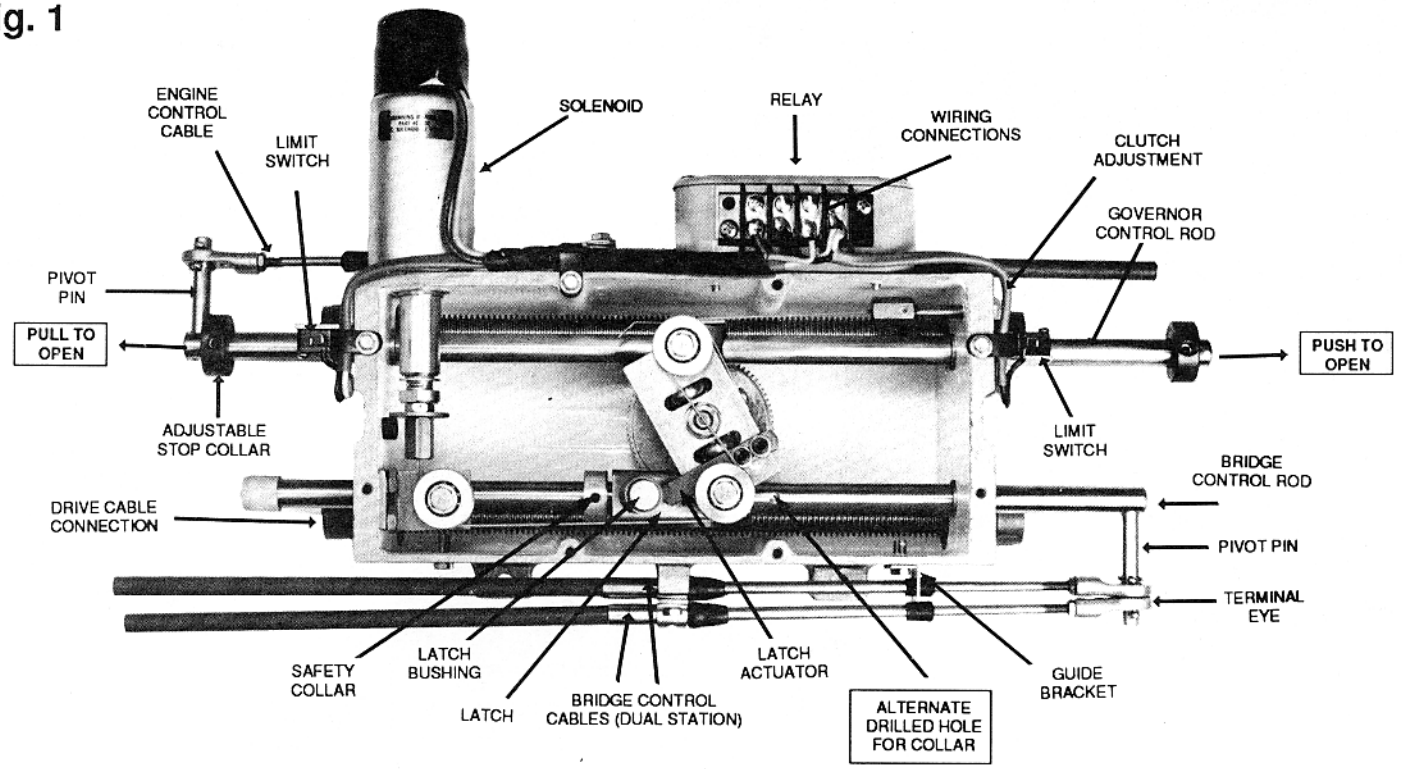
D. A location where drive cable length from the engine's tachometer take-off can be kept to a minimum - not over 14'.

E. Sufficient clearance to enable the drive and control cables to have a favorable curve to the unit - check chart under Section E to determine drive cable connections at the SYNCHRONIZER.

F. A dry and splash free location.

G. Unit may be installed on its base, inverted on the overhead or on a bulkhead. Bulkhead mounting calls for control rods to be horizontal. Control rods should never be vertical.

Fig. 1



NOTE: The above picture is shown set up for PULL TO OPEN operation. If engines are PUSH TO OPEN then safety collar is required to be changed. Remove cover, loosen aluminum safety collar on control rod (3/32" allen wrench), depress latch bushing, slide bridge control rod to the right, re-install safety collar on right side of clutch assembly using alternate drilled hole on control rod, replace cover.

SECTION C - MOUNTING AND CONTROL CABLE CONNECTIONS

A. Remove the throttle control cable from the engine selected as slave. (On dual station boats with a parallel system, there will be two cables at the engine). Obtain a short "Morse Supreme" or equivalent control cable, NOT OVER 8' long; secure this control cable to the slave engine in place of the cable or cables that were removed. This will be referred to as the engine control cable.

B. Using 3/4" marine plywood or other flat surface, mount the SYNCHRONIZER.

C. Secure engine control cable to SYNCHRONIZER on solenoid side. (Labeled "Attach Engine Control Cable Here") This cable should be installed between the slave engine and SYNCHRONIZER to operate freely with minimum of "lost motion". Not to exceed 180 degrees in total bends.

NOTE: Control cable rests in clamp between mounting pads and the flat strap is put on last.

D. Attach terminal eyes to engine control cable ends - adjust terminal eyes so that when installed on the pivot pins, the governor lever is not restricted in its travel. Install cotter pins in pivots.

ATTENTION INSTALLER: Probably the most important operation in the installation is connecting the engine control cable from the SYNCHRONIZER to the slave engine. Use the shortest length possible, (cables available 3' - 8' in 6" increments) avoid sharp bends, 90 degrees is allowable. It should operate freely with minimum back lash.

SECTION D - BRIDGE CABLE CONNECTIONS

A. Secure bridge control cable or cables, removed from engine in Section C (A), to SYNCHRONIZER (See Fig. 2). Cable is placed in clamp between mounting pads before flat strap. If two cables are used, flat strap is sandwiched between cables. If length is excessive and cannot be "lost" effectively, bridge control cable should be replaced with a shorter one.

B. Attach terminal eyes to cables.

C. To meet the requirements of limited space, or short bridge control cables, or for versatility of routing, provision has been made to route the bridge control cables to the SYNCHRONIZER in three (3) different methods (as below):

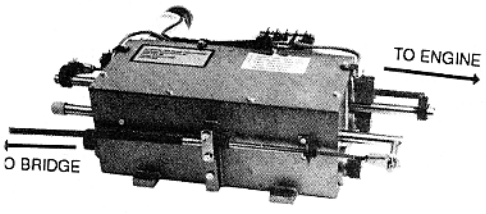


FIG. 2 STANDARD HOOKUP

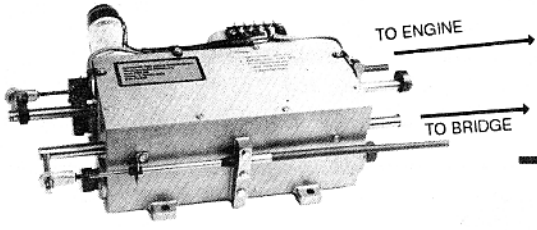


FIG. 3 REVERSE
- Change pivot pin on bridge control rod
- Change cable entry under control head.
- Control cable guide bracket should be changed if cables are connected to the SYNCHRONIZER

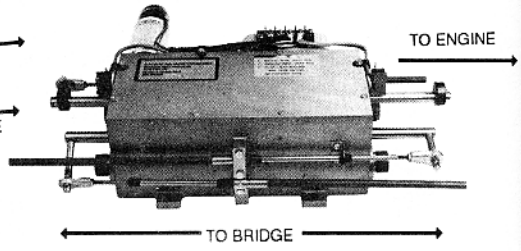


FIG. 4
1 CABLE: STANDARD HOOKUP
1 CABLE: REVERSE
- Two pivot pins (offset at 20 degrees) are used.
- Order an extra pivot pin Part #51205
- Only one cable entry under control head requires changing.

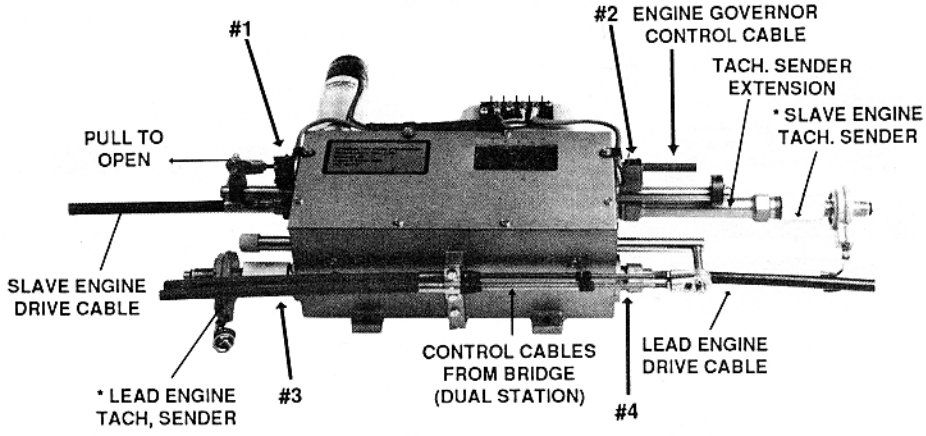


FIG. 5
SYNCHRONIZER connections as shown above indicate clockwise rotation (both engines) and pull-to-open.
* NOTE: The electric senders shown as mounted above are for illustration only and are not the products of G.M.P., Inc.

SECTION E - DRIVE CABLE CONNECTIONS

A. Remove present tachometer cables or electric senders from engines.
(Disregard if using mechanical drive adapters)

B. Check tachometer take-off rotation by looking into drive outlet and turning engine over slowly with starter button.

C. Determine whether the control cable on the engine PULLS or PUSHES the engine throttle or governor lever to increase speed.

D. Drive cable connection is determined by using chart (at right) with information from "B" and "C" (above). (EXAMPLE: For tachometer clockwise rotation on both engines and pull to open, the slave is in #1 and the lead in #4 - See picture on Page 4) Fig. 5.

E. Cable core size not less than .187" diameter. DO NOT use standard .151" tachometer core. Factory assembled cables are available - specify length and model.

F. Locations are marked on the SYNCHRONIZER end and also on the wiring diagram.

G. At least an 8" operating radius should be maintained on all drive cables. Maintain a minimum of 6" straight routing from either engine or SYNCHRONIZER before any curves are made.

ROTATION AT ENGINE TAKE-OFF		TO INCREASE SPEED			
		PULL		PUSH	
SLAVE	LEAD	SLAVE	LEAD	SLAVE	LEAD
CLOCKWISE	CLOCKWISE	1	4	4	1
COUNTER CW	COUNTER CW	2	3	3	2
CLOCKWISE	COUNTER CW	1	3	4	2
COUNTER CW	CLOCKWISE	2	4	3	1

WARNING!

NEVER connect engine drive cables to the SAME worm shaft!, that is, directly opposite each other.
Fractured cable ends will result on start-up.

SECTION F - TACHOMETER INSTRUMENT DRIVE CONNECTIONS

(Disregard if using mechanical drive adapters)

Electrical Tachometers

A. Using Tach Sender Extensions connect the tachometer senders to the SYNCHRONIZER at the ends directly opposite the drive cable entry (See page 4, Fig. 5) and extend wiring to senders.

OR B. Use dual outlet drive joints at the engine to accommodate the SYNCHRONIZER (see accessory sheet for details).

SECTION G - GOVERNOR LEVER ADJUSTMENT

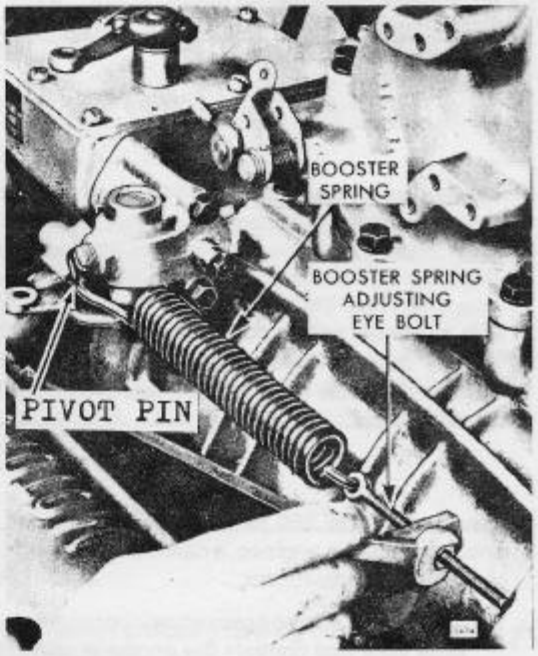
(Only required if governor tension is excessive)

NOTE: On all Detroit Diesel engines equipped with variable speed governor, check governor lever tension. Adjust to keep tension under 10 lbs. pull, and yet allow full return to idle. Correct adjustment will result in improved SYNCHRONIZER performance and easier bridge control operation. Governor lever tension should be checked with engine running.
NOTE: A convenient method to determine if the governor tension on Detroit Diesel engines is excessive and requires adjustment is to: with synchronizer on, bring engines up to approx. 1800 r.p.m.'s. When in sync., shut off synchronizer. If slave engine deaccelerates rapidly then governor tension should be checked and adjusted. A drop of 200 rpm is acceptable.

A. Refer to picture and loosen the booster spring pivot bolt on the speed control lever. Loosen the locknuts on the eyebolt at the opposite end of the spring.

B. Move the pivot bolt in or out in the slot of speed control lever until the center of the bolt is on or slightly below an imaginary line through the center of the bolt, lever shaft and eyebolt. Hold the pivot bolt and tighten the nut.

C. Start the engine and move speed control lever to the maximum speed position and release. The speed control lever should return to the idle position. If it does not, reduce the booster spring tension. If it does, continue to increase the spring tension until the point is reached that it will not return to idle. Then, reduce the tension until it does return to idle and tighten the locknut on the eyebolt. This setting will result in the minimum force required to operate the speed control lever.



SECTION H - LIMIT SWITCH ADJUSTMENT

(Adjustment made with engines off)

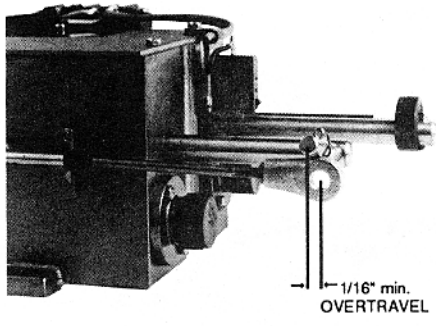
A. The purpose for the red collars and micro switches is to protect the SYNCHRONIZER and drive cables by cutting it off when the SYNCHRONIZER cannot bring the slave R.P.M. to match the lead. This will occur when slave engine speed is set higher at idle or top end R.P.M. is lower than the lead. The red stop collars (on the governor control rod of the sync.) should be adjusted when the unit is installed. The collars actuate the micro switches, cutting off the SYNCHRONIZER at the limits of engine governor lever travel at the high and low speed positions. The collars should be set on the rod at a point where it takes considerable hand pressure on the rod to "bump" the collar off the switch. Normally after adjustment is made, the red collar will be 1/16"-1/8" away from switch button. When doing this make sure that the engine governor lever is actually at the limit of its travel. Incorrect adjustment of the terminal eyes on the SYNCHRONIZER to engine cable will give one the impression the governor lever is all the way to its limit when actually the cable has reached its limit of travel. Simply stated, the SYNCHRONIZER should bring the governor lever to its limit and further pressure by the SYNCHRONIZER on the engine will cause the collar to contact the micro switch thus cutting off the SYNCHRONIZER. Failure to make proper collar adjustments will cause premature clutch wear in the SYNCHRONIZER necessitating frequent clutch adjustment.

B. Under way with SYNCHRONIZER on, and cruising at near idle or high speed a cut-off may occur, the evidence being the pilot light goes out and the SYNCHRONIZER is off. It is not necessary to move the slave speed control lever, just turn the SYNCHRONIZER switch off and on. The light should come on; the SYNCHRONIZER is now operating. Should it stay on only momentarily check the stop collar adjustment or adjust lead engine speed accordingly. Assuming the red collars are set properly as noted above, the cut-off could be a normal function, indicating that the slave engine cannot be automatically controlled to match the lead engine speed.

C. Any consequent re-adjustment in the length of the short cable from the SYNCHRONIZER to the engine will require a check and re-adjustment of the stop collars.

SECTION J - BRIDGE CABLE TERMINAL EYE ADJUSTMENT - CABLE OVERTRAVEL

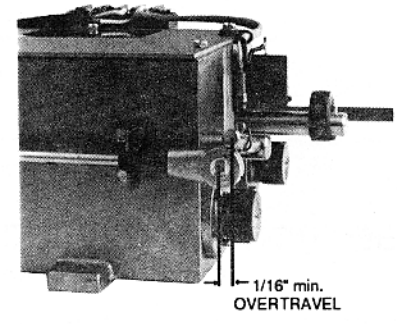
(Adjustment made with engines off)



A. PULL TO OPEN
(Idle Position Shown)

After limit switch collars are adjusted and prior to connecting bridge control cable or cables to the SYNCHRONIZER, bridge control cable overtravel should be checked and adjusted. This adjustment is necessary to insure positive mechanical latching of the control rods to manual operation when the SYNCHRONIZER is switched off.

1) Move engine governor or throttle arm to idle position. (SYNCHRONIZER control rods should now be at idle also)
2) Move slave bridge control lever to idle position.
3) The bridge control cable end at the SYNCHRONIZER should "overshoot" the pivot pin on the SYNCHRONIZER.
4) To attain "overtravel" adjust the length of control cable at the terminal eyes on either end of cable. (at Control Head or SYNCHRONIZER)



B. PUSH TO OPEN
(Idle Position Shown)

With all control cables connected to the SYNCHRONIZER and the slave engine, the slave engine control lever should have a slight "bouncy" feel when pulled back to idle. This indicates the control cable from the bridge to the SYNCHRONIZER has adequate overtravel. It is also desirable to have this overtravel at the high speed position as well to insure maximum R.P.M.

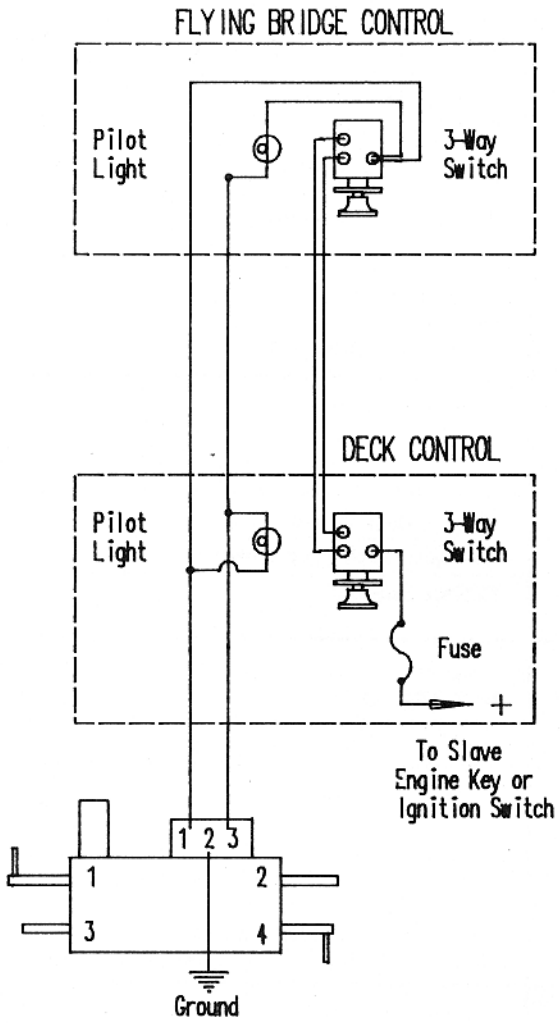
SECTION K - CLUTCH ADJUSTMENT

After first 100 to 200 hours, or when the unit is sluggish in synchronizing the engines, a clutch adjustment is necessary. To check unit for adjustment:

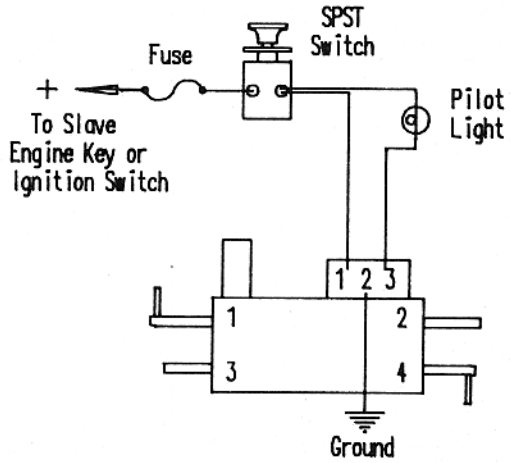
1. Switch unit ON and grasp engine control rod on the Synchronizer (one that controls the engine governor)
2. If rod moves easily under pressure, the clutch needs adjusting.
3. Loosen locknut (7/16" wrench) - see location on Page 3 Fig. 1.
4. Turn allen head screw **COUNTER-CLOCKWISE.**
5. Average adjustment will require 1 to 2 turns.
6. Tighten locknut.

WARNING: OVER-ADJUSTMENT WILL CAUSE SOLENOID PLUNGER TO SEAT IMPROPERLY CAUSING HIGH CURRENT IN PULL-IN WINDING AND PREMATURE SOLENOID FAILURE-USE APPROPRIATE FUSE TO PREVENT SOLENOID BURN-OUT.

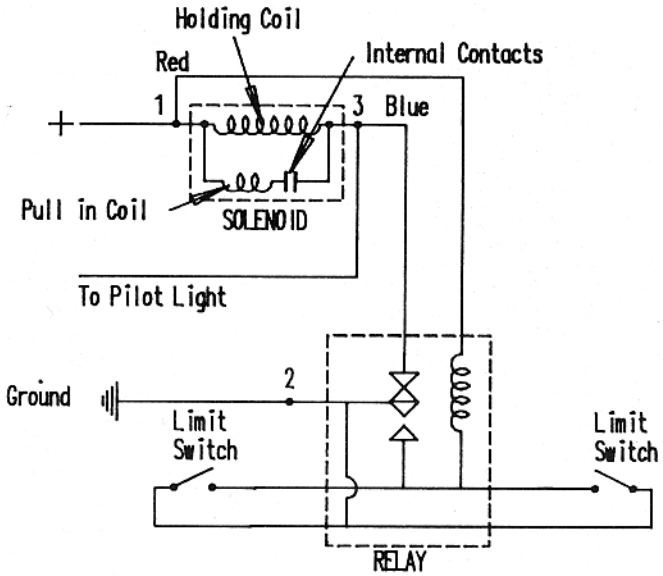
SECTION L - WIRING



DUAL STATION CONTROL



SINGLE STATION CONTROL



SCHEMATIC of SOLENOID and LOCKING RELAY

- Wire gauge and fuse rating:
  12 Volts - 12 Gauge - 10 Amp. Max.
  24 Volts - 14 Gauge - 5 Amp. Max.
  32 Volts - 14 Gauge - 5 Amp. Max.
- Use fuse between SYNCHRONIZER switch and slave engine power switch.
- Connect wire from switch to #1 terminal (Red).
- Connect appropriate ground wire to #2 terminal.
- Connect pilot light ground to #3 terminal (Blue)
- The pilot lights should not be connected to ground other than at the #3 terminal. Activation of either limit switch causes the relay to self-lock, thus opening the solenoid ground. The pilot light goes off indicating to the operator the SYNCHRONIZER is off. To re-engage, switch OFF and ON again.
- NOTE: Grounding pilot lights to any point other than at the #3 terminal will render the automatic cut-off system inoperative. This will cause premature drive cable or pin fracture.

SECTION M - MAINTENANCE

1) The SYNCHRONIZER has been lubricated internally for the life of the unit under normal pleasure boating conditions. A once a year spraying externally with any water displacing agent such as "WD-40", "CRC" is recommended.
   Mechanical drive adapters or drive joints should be greased once a year at the grease fitting provided.
2) If the SYNCHRONIZER is sluggish in synchronizing the engines, a clutch adjustment is necessary. This is because of normal wear on the internal clutch in the SYNCHRONIZER.
   See section K Clutch Adjustment.
3) If any problems arise - see section N Trouble Shooting Guide.

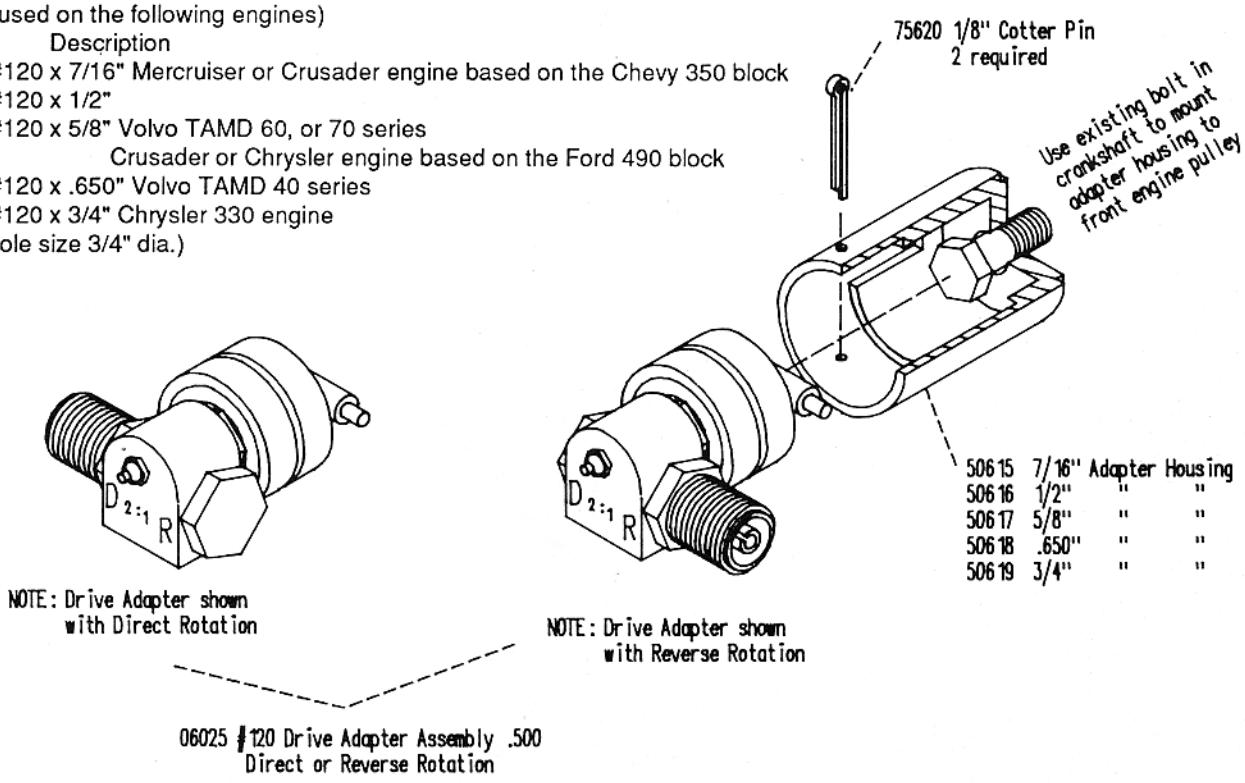
SECTION 0 - # 120 MECHANICAL DRIVE ADAPTER

(normally shipped with 1 - direct rotation and 1 - reverse rotation)

(used on the following engines)

Part #	Description
06020	#120 x 7/16" Mercruiser or Crusader engine based on the Chevy 350 block
06021	#120 x 1/2"
06022	#120 x 5/8" Volvo TAMD 60, or 70 series Crusader or Chrysler engine based on the Ford 490 block
06023	#120 x .650" Volvo TAMD 40 series
06024	#120 x 3/4" Chrysler 330 engine

(Max. bolt hole size 3/4" dia.)



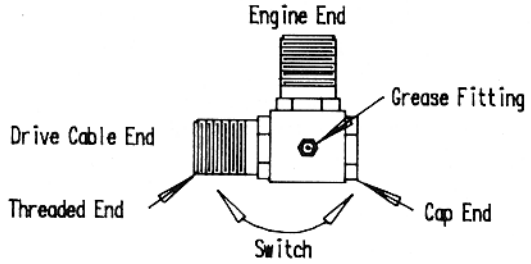
NOTE: Most diesel engines have clockwise rotation.
Most gasoline engines have one clockwise and the other engine counter-clockwise rotation.
Drive adapter output rotation may be varied by using "D" direct or "R" reverse drive adapters. Direction of rotation may be changed by switching drive adapters to suit drive cable routing to the synchronizer. See section E for drive cable connections. If it is desirable to change the rotation on the adapters please refer to section P below.

NOTE: When testing synchronizer at the dock, the engine might "hunt". Once the engines are put under a load, the "hunting" will stop.

INSTALLATION:

1) Remove crankshaft bolt on each engine. The aluminum adapter housing should fit the crank bolt with little or no play.
2) Install adapter housing on each engine using crank bolt. To minimize run-out, clean paint from the front pulley where the adapter housing will contact the pulley.
   Avoid the use of pipe wrenches, etc. to hold the adapter when tightening the crank bolt. This will distort the housing.
3) Before installing the drive adapter assembly into the housing, check run-out of the housing by turning over the engine at idling speed. Run-out should be kept under .02". Excessive run-out can often be decreased by loosening the crank bolt and turning the housing 90 or 180 degrees and then re-tightening.
4) Install adapter assembly into the housing, this is a push-fit. This is retained into the housing by using two cotter pins shipped with the unit.
5) The drive cable routed to each adapter should be securely strapped or fastened approximately 9" - 12" away from the adapter. This will act as an anti-rotation support for the drive adapter.
6) At least once a season or 200 engine hours the drive adapter should be greased at the grease fitting provided.

SECTION P - DRIVE ADAPTER ROTATION CHANGE



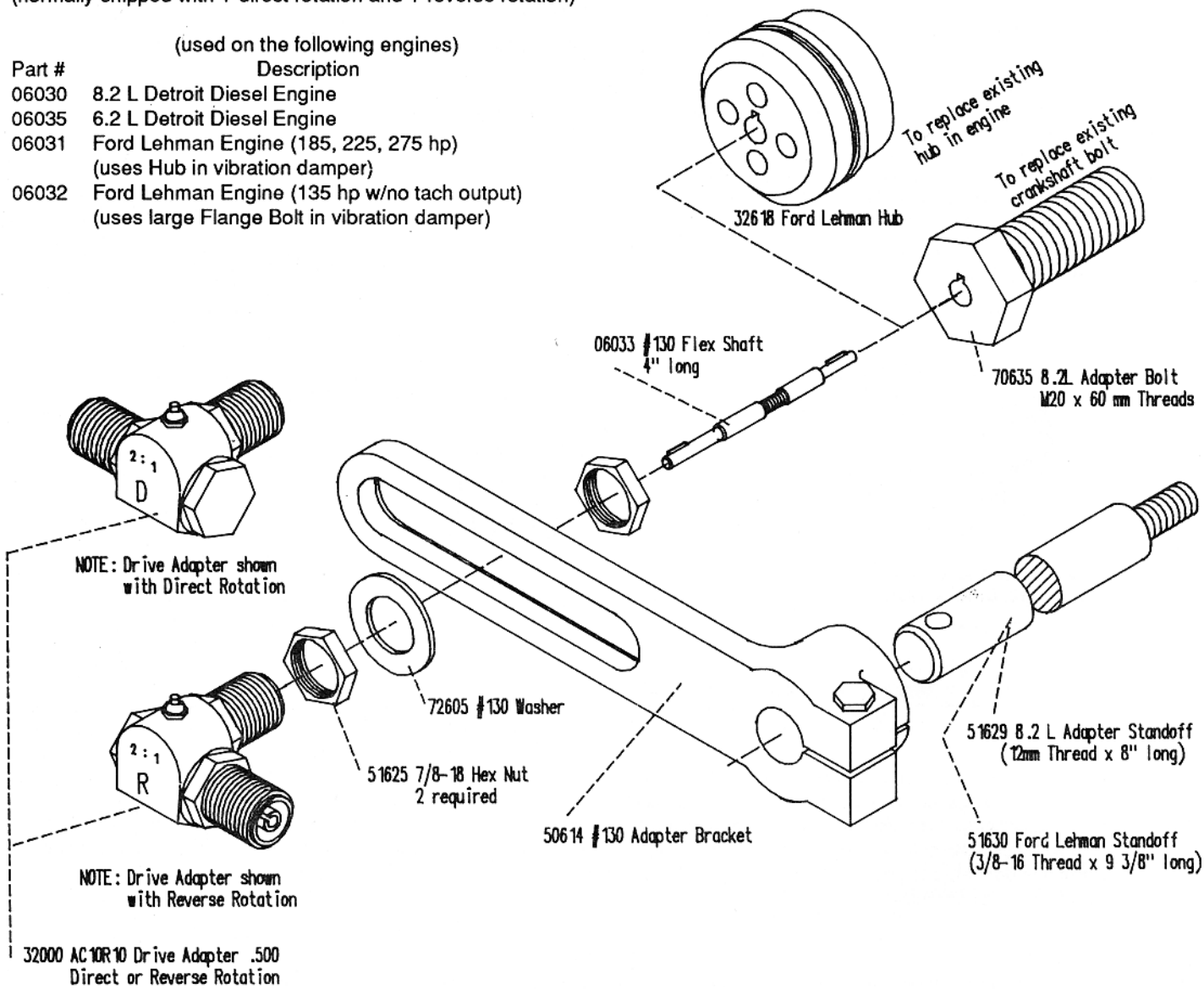
To change drive adapter outlet rotation:

1) Remove threaded end and internal shaft
2) Remove cap end and install on threaded end side
3) Install threaded end and shaft on cap end side

SECTION Q - #130 MECHANICAL DRIVE ADAPTER

(normally shipped with 1-direct rotation and 1-reverse rotation)

Part #	(used on the following engines) Description
06030	8.2 L Detroit Diesel Engine
06035	6.2 L Detroit Diesel Engine
06031	Ford Lehman Engine (185, 225, 275 hp) (uses Hub in vibration damper)
06032	Ford Lehman Engine (135 hp w/no tach output) (uses large Flange Bolt in vibration damper)



NOTE: Most diesel engines have clockwise rotation.
Drive adapter output rotation may be varied by using "D" direct or "R" reverse drive adapters. Direction of rotation may be changed by switching drive adapters to suit drive cable routing to the synchronizer. See section E for drive cable connections.

NOTE: Please do not remove inside locknut from the threaded fitting as the adapter has a one half reduction ratio. This threaded end with the nuts should be towards the engine. Refer to the drawing above. Please refer to section P for change of rotation procedure.

NOTE: When testing synchronizer at the dock, the engine might "hunt". Once the engines are put under a load, the "hunting" will stop.

INSTALLATION:

1) Remove crankshaft bolt from each engine and install bolt shipped with adapters. Please return original crank bolts or hubs to receive a full credit of the surcharge.
2) Install standoff on each engine. This normally replaces a cap screw on the front engine block convenient to the front pulley. Use 3/8" hole in standoff for tightening. "Loctite" or equivalent is recommended to be used on standoff threads.
3) Install flex shaft in capscrews. Install adapter bracket on standoff as shown, Install drive adapter in bracket and locate both so that the flex shaft has:
   - approximately 3/16" - 1/4" of end play
   - proper alignment, flex shaft must be true on center

   Correct alignment can be verified by using long nose pliers to check if flex shaft moves freely in and out.
4) Tighten adapter bracket lock bolt and locknuts on drive adapter when centered.
5) At time of assembly, lubricate the flex shaft ends especially the tip at the crank bolt. It is recommended that these ends should be lubricated once a season or every 200 engine hours.
   Use a good molybdenum base lubricant or other metal adhering lubricant such as "Never Seez", etc.

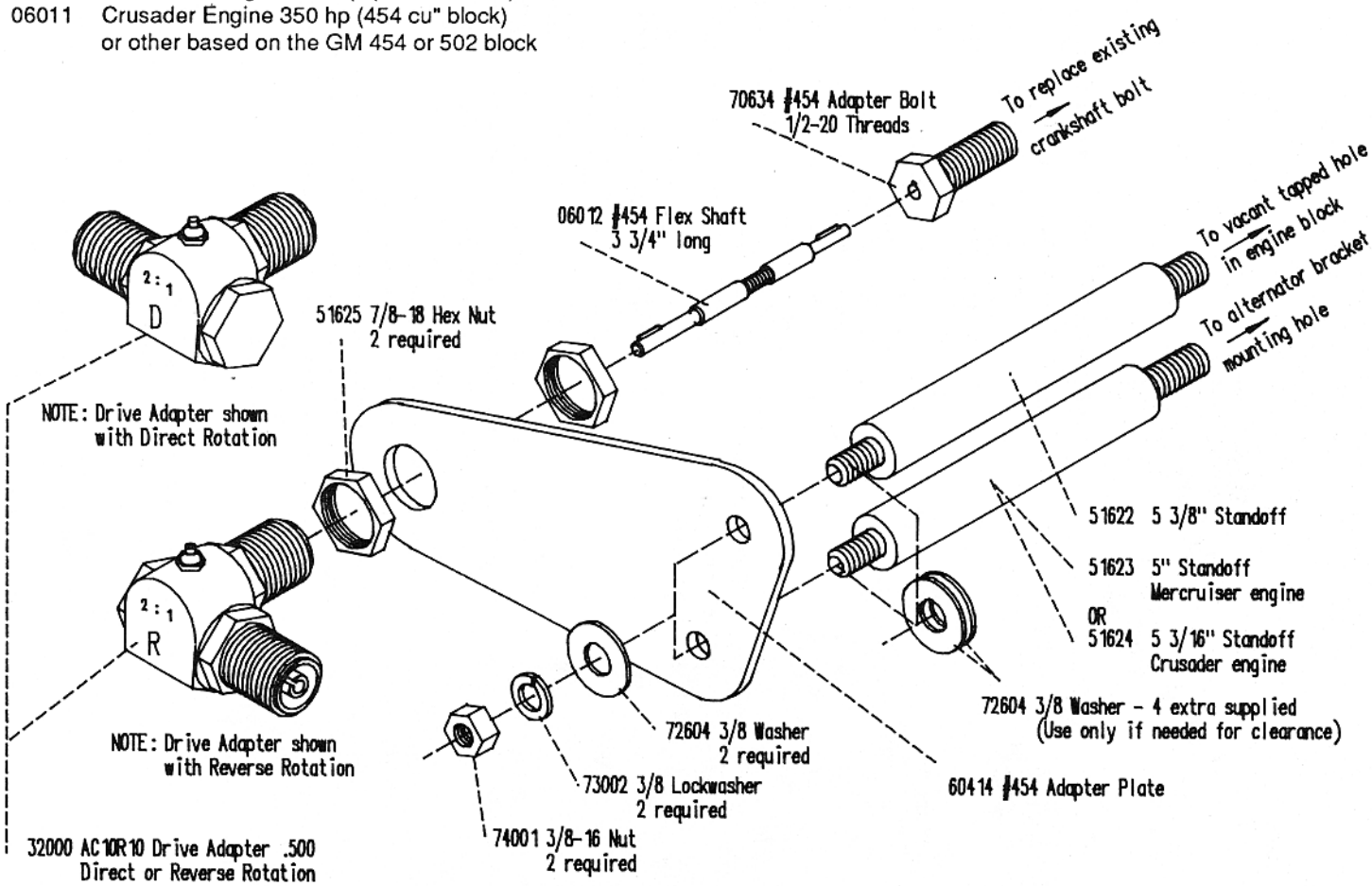
NOTE: When replacing belts on engine, alignment of flex shaft might change and must be realigned. Keep alignment tool for future use.

SECTION R - #454 MECHANICAL DRIVE ADAPTER

(Normally shipped with 1-direct rotation and 1-reverse rotation)

(used on the following engines)

Part #	Description
06010	Mercruiser Engine 330 hp (454 cu"block)
06011	Crusader Engine 350 hp (454 cu" block) or other based on the GM 454 or 502 block



NOTE: Most gasoline engines have one engine clockwise and the other engine counter-clockwise rotation. Drive adapter output rotation may be varied by using "D" direct or "R" reverse drive adapters. Direction of rotation may be changed by switching drive adapters to suit drive cable routing to the synchronizer. See section E for drive cable connections.

NOTE: Please do not remove inside locknut from the threaded fitting as the adapter has a one half reduction ratio. This threaded end with the nuts should be towards the engine. Refer to the drawing above. Please refer to section P for change of rotation procedure.

NOTE: When testing synchronizer at the dock, the engine might "hunt". Once the engines are put under a load, the "hunting" will stop.

INSTALLATION:

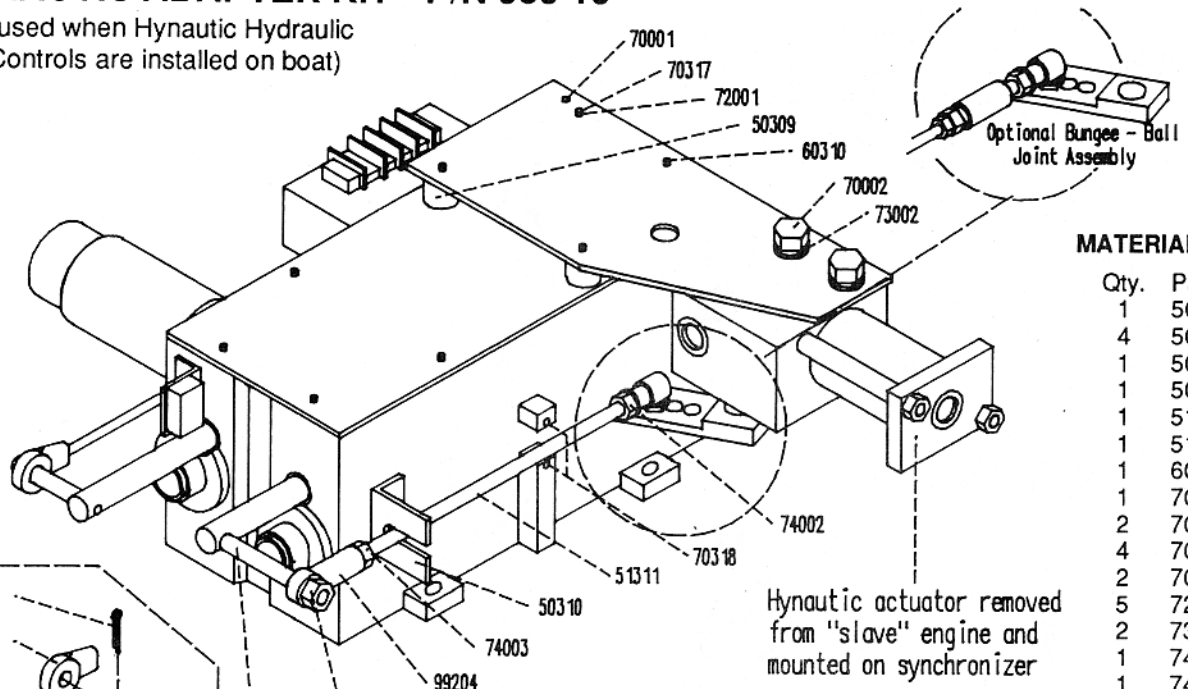
1) Remove 1/2" SAE cap screw from crankshaft and replace with drilled cap screw from adapter kit.
2) Install longer 5 3/8" shoulder standoff in top hole in engine block (hold unused on Mercruiser and Crusader engines) Do not use any lockwasher on this end.
   (The alternator bracket on newer Mercruiser engines might have to be shortened.)
3) Remove alternator adjusting bar cap screw; install shorter (5 3/16" shoulder on Crusader, 5" shoulder on Mercruiser) stand-off with adjusting bar in place. Do not use any lockwasher on this end.
4) Install mounting plate on standoff as shown and tighten in place.
   (To lengthen plate for engine pulley clearance, use two flat washers on each stand-off between stand-off and plate.)
5) Using mandrell from kit, check plate alignment with cap screw. Elongate 3/8" holes in plate to correct alignment.
6) Install flex shaft in cap screws.
7) Install drive adapters in mounting plates, adjust the locknuts so that the flex shaft has:
   - approximately 3/16" - 1/4" of end play
   - proper alignment, flex shaft must be true on center

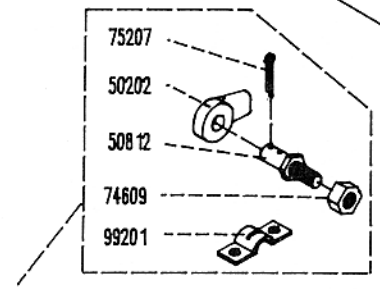
   Correct alignment can be verified by using long nose pliers to check if flex shaft moves freely in and out.
8) At time of assembly, lubricate the flex shaft ends especially the tip at the crankbolt. It is recommended that these ends should be lubricated once a season or every 200 engine hours.
   Use a good molybdenum base lubricant or other metal adhering lubricant such as "Never Seez", etc.

NOTE: When replacing belts on engine, alignment of flex shaft might change and must be realigned. Keep alignment tool for future use.

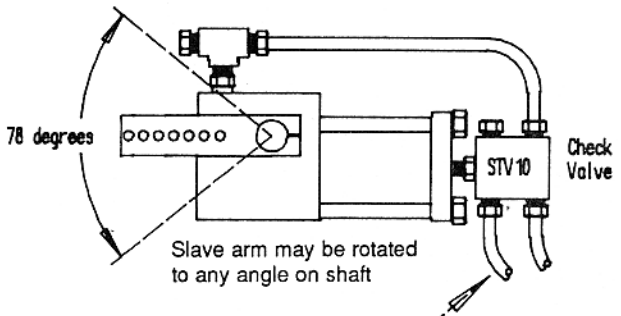
HYNAUTIC ADAPTER KIT - P/N 080 10

(used when Hynautic Hydraulic Controls are installed on boat)





Installed at slave engine governor



To change direction of slave arm movement - switch input hoses at check valve

MATERIAL LIST - 08010 Hynautic Adapter Kit

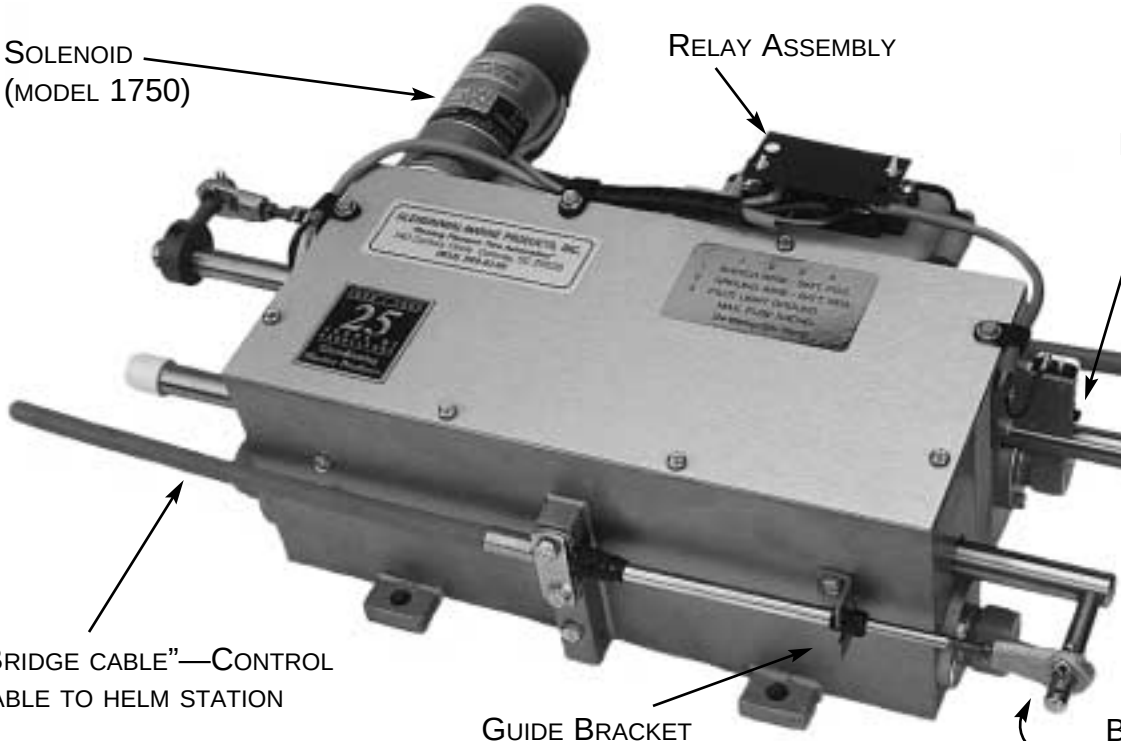
Qty.	Part #	Description
1	50202	33c Terminal Eye
4	50309	Hynautic Spacer
1	50310	Hynautic Guide Bracket
1	50812	Brass Pivot Pin
1	51311	Hynautic Rod
1	51312	Hynautic Pin
1	60310	Hynautic Adapter Plate
1	70001	8/32 x 1/4 Pan Head Screw
2	70002	3/8 - 16 x 3/4 Hex Head Bolt
4	70317	8/32 x 1 1/4 Socket Head Screw
2	70318	10/24 x 1/4 Set Screw
5	72001	#8 Flat Washer
2	73002	3/8 Lock Washer
1	74002	1/4 - 20 Nut
1	74003	1/4 - 28 Nut
2	74609	1/4 - 28 Nylon Locknut
1	75207	3/32 x 7/8 Cotter Pin
1	99201	33c Cable Clamp
1	99204	Hynautic Ball Link

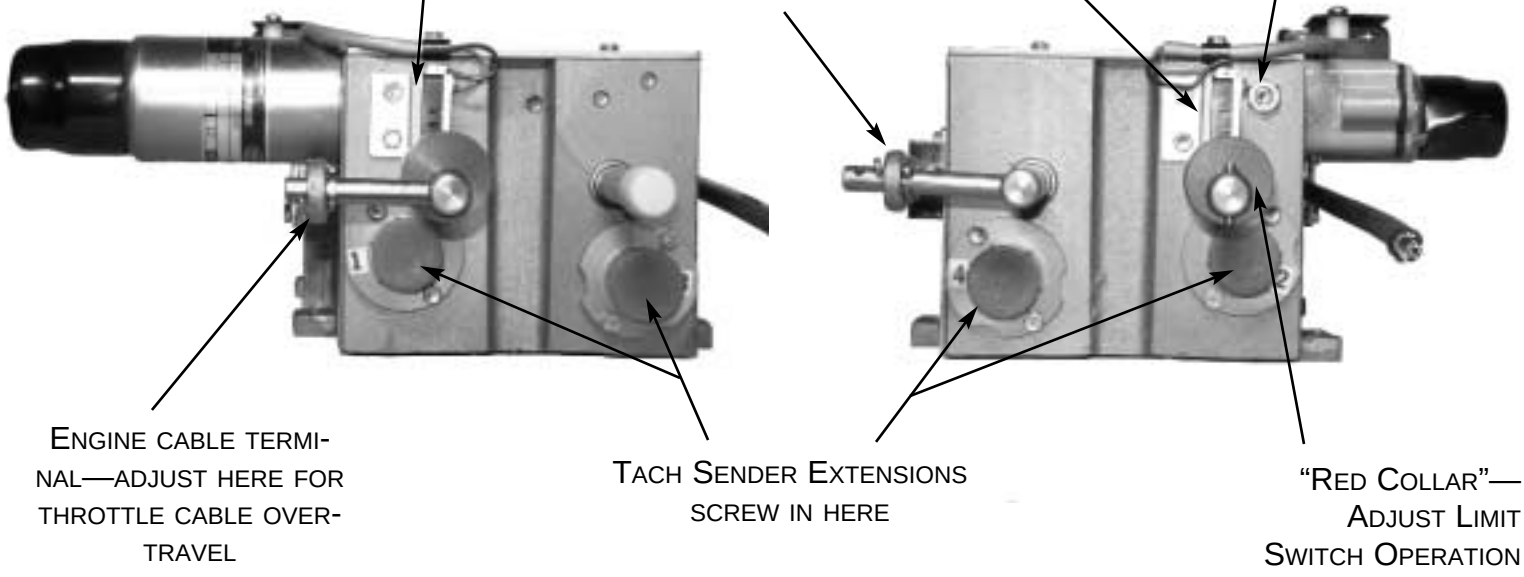
NOTE: In locating the synchronizer keep in mind the slave actuator on one of the engines has got to be moved to the synchronizer. This does not apply to new boat construction. Therefore in selecting the "slave" engine, check for "excess" tubing on both engines to determine ease of moving the actuator without having to lengthen the tubing. Also keep in mind a push-pull control cable is required between the synchronizer and the "slave" engine. Note the emphasis about using a short control cable and minimum bends as detailed in section C.
A mounting bracket is necessary to support this cable at the "slave" engine end.

1) Mount the Hynautic actuator on the synchronizer using the Hynautic Adapter kit as shown above.
2) After mounting the Hynautic actuator on the synchronizer check for correct control lever operation, that is, when the Hynautic bridge control lever is at idle (all the way back) the engine governor should be at idle also. If not, the tubing conections at the STV 10 check valve (shown on the left) should be reversed. To do this it is necessary to de-pressurize the Hynautic system. See Hynautic owners manual for instructions for de-pressurizing, filling and bleeding the system.
3) The rod connecting the Hynautic actuator arm to the synchronizer pivot pin is 9" long. If the Hynautic Bungee is used the rod should be cut to 6 1/4" long and then rethread.
4) Disconnect this rod from the Hynautic actuator arm in order to check limit switch collar adjustment. See section H.
5) Check for overtravel as detailed in section J.
Proper overtravel is generally indicated by a spongy control lever feel at extreme ends of the bridge control lever. The Hynautic actuator arm has seven holes, in order to obtain correct overtravel it may be necessary to move the ball-joint on the arm out one hole. (toward the end)
Please adjust the ball-joint one hole at a time.

AUTOMATIC SYNCHRONIZER

TROUBLESHOOTING GUIDE





General Guidelines for Troubleshooting

1) As a first step, verify that synchronizer is working electrically. If necessary apply voltage directly to solenoid.

2) When testing Synchronizer operation, move control handles to mid-travel position before turning Synchronizer ON. Some problems, such as idle speed limit switch or lead engine drive cable failure can be hidden if Synchronizer is turned ON at idle engine speed.

3) If Synchronizer does not appear to be matching engine speeds exactly, manually synchronize engines (by ear). Observe tachometer readings. Turn ON Synchronizer and observe changes in slave engine speed.

4) If mechanical drive adapter fails very radpidly (less than 4-6 months), mechanical drive adapter is misaligned.

5) If Synchronizer has suddenly stopped operating, determine if other work was performed on boat recently. Sometimes other work—such as engine governor repairs or control cable replacements, can change Synchronizer cable adjustments causing problems with Synchronizer operation.

6) If slave engine speed varies, determine if lead engine speed is also varying. When Synchronizer is operating, it will attempt to continuously match slave engine to lead engine speed. If lead engine RPM varies or fluctuates, Synchronizer will strive to repeat variation / fluctuation in speed of slave engine. Of course, Synchronizer has no control of lead engine RPM; the Synchronizer only controls slave engine speed.

7) **IF** Synchronizer has been electrically activated, and **IF** Synchronizer is receiving RPM signal from both engines with correct input rotation, and **IF** Synchronizer clutch is not slipping->Synchronizer must operate; unit will attempt to exactly match slave engine speed with lead engine.

Problem / Symptom:	**Synchronizer does not activate when control switch is turned on.**
Additional symptoms:	1) Pilot light may not illuminate 2) Synchronizer solenoid doesn't make any noise 3) When moving slave engine handle after turning on switch, engine accelerates. Slave engine is not "disengaged" from slave engine control.
Description of Operation:	*When Synchronizer control switch is turned on, power should be applied to synchronizer solenoid input terminals. When power is applied to solenoid input terminals, it will make a sharp, metallic, sound and slave engine handle will be "disconnected" from slave engine control.*
Possible Problem	Recommended actions
Fuse is blown	A fuse is typically installed at the control switch. Check and / or replace fuse. (10 amps at 12 VDC; 5 amps at 24 or 32 VDC)
Broken power supply or ground connection wire	Power supply to synchronizer (relay box terminal #1) or ground wire (relay box terminal #2) connections may have broken or become disconnected. Check for voltage across relay box terminals #1 and #2 when switch is turned on; if none; verify wiring connections.
Relay assembly / limit switch failure	Change ground wire connection at relay box from terminal #2 to terminal #3. If unit becomes operational, replace relay box assembly 12 VDC relay – PN 03312 24 or 32 VDC relay – PN 03324 NOTE: Synchronizer may be used temporarily with ground wire connected to terminal #3. Limit switches will be disabled; avoid using synchronizer at idle or full throttle speed when limit switches are disabled.

Limit switch collars ("red collars") are not set correctly	Move slave engine control handle away from idle speed position. Turn switch off and on. If synchronizer now activates, idle speed limit switch is incorrectly set.
Solenoid failure	Disconnect wires from solenoid and apply correct voltage directly to solenoid terminals. If solenoid does not make any noise, solenoid has failed.

PROBLEM / SYMPTOM:	**SYNCHRONIZER SOLENOID "CHATTERS" OR REPEATEDLY CLICKS WHEN CONTROL SWITCH IS TURNED ON.**
Additional symptoms:	1) Pilot light is dim 2) Solenoid may hum instead of clicking or chattering 3) Fuse may blow after short time
Description of Operation:	*When Synchronizer control switch is turned on, the solenoid requires a large amount of power (approximately 20 amps) to pull in its internal plunger.*
POSSIBLE PROBLEM	RECOMMENDED ACTIONS
Low voltage	Check voltage applied to solenoid terminals when synchronizer is turned on. At least 90% of full rated voltage must be applied to solenoid terminals during startup. Voltage may be reduced due to corroded or too small power supply or ground wire connections, low battery, etc. To test solenoid, use wire jumpers to apply battery voltage directly to solenoid terminals.
Hold-in coil of solenoid defective.	Replace solenoid
Synchronizer clutch is over-tightened	If the synchronizer clutch is overtightened, the solenoid will not be able to completely pull in the internal plunger. Readjust clutch (see manual Section K).

PROBLEM / SYMPTOM:	**AFTER TURNING ON SYNCHRONIZER, PILOT LIGHT GOES OUT AFTER SEVERAL SECONDS.**
Additional symptoms:	None
Description of Operation:	*When Synchronizer control switch is turned on, the pilot light should remain on. Synchronizer should be able to operate at any speed between idle and full throttle. If slave engine idle is set at a speed higher than lead engine idle, synchronization will not be possible at idle speed.*
POSSIBLE PROBLEM	RECOMMENDED ACTIONS
Synchronizer turning off automatically on idle speed limit switch.	Advance lead engine to 50 – 100 RPM above idle before turning on Synchronizer. If desired to operate Synchronizer with lead engine at idle speed, have engine technician reset lead engine idle speed to 25 RPM above slave engine idle speed.
Idle speed limit switch is improperly set	Readjust idle speed limit switch, obtaining 1/16" to 1/8" gap between limit switch button and red collar when engine governor / throttle is at full throttle mechanical stop.
Slave engine tach input to synchronizer has failed	Check for failure in tachometer drive input from slave engine to Synchronizer. Problem can occur in drive cable, engine outlet drive joint, or in mechanical drive adapter.

Problem / Symptom:	**While operating with Synchronizer on, or immediately after turning on Synchronizer, slave engine RPM moves quickly to idle.**
Additional symptoms:	1) Pilot light may go out when slave engine speed reaches idle. 2) If lead engine tach input to Synchronizer has failed, helm station tachometer for lead engine may indicate 0 RPM.
Description of Operation:	*When Synchronizer is operating, speed of slave engine will be matched with speed of lead engine. If tachometer information from lead engine to Synchronizer indicates that lead engine has slowed or stopped, Synchronizer will try to match slave engine RPM, reducing slave engine speed to minimum (idle) speed.*
Possible Problem	Recommended actions
Lead engine tach input to Synchronizer has failed	Check for failure in tachometer drive input from lead engine to Synchronizer. Problem can occur in drive cable, engine outlet drive joint, or in mechanical drive adapter. Be sure to check the following: DRIVE CABLE – cable core failure, cable end tip failure DRIVE JOINT – on many engines, a drive joint provides tachometer information to the Synchronizer. Disconnect the tachometer cable from the drive joint, start the engine, and verify that the outlet of the drive joint is rotating. MECHANICAL DRIVE ADAPTER – if a mechanical drive adapter has been installed on the engine, check the flex shaft for failure (broken cable, missing tip tang). Flex shafts will fail due to misalignment or lack of lubrication. Reinstall the flex shaft following the instructions contained in the technical manual.
Improper tachometer cable rotation	The Synchronizer is sensitive to the direction of the input tach cable rotation. For new system installations, or after work is done to the engine, it is possible that the tachometer cable rotation input is incorrect. Verify that the cable input rotation is installed per the matrix chart in the Technical Manual (Section E).
Problem / Symptom:	**While operating with Synchronizer on, or immediately after turning on Synchronizer, slave engine RPM moves quickly to full throttle.**
Additional symptoms:	1) Pilot light may go out when slave engine speed reaches full throttle. 2) If slave engine tach input to synchronizer has failed, helm station tachometer for slave engine may indicate 0 RPM.
Description of Operation:	*When Synchronizer is operating, speed of slave engine will be matched with speed of lead engine. If tachometer information from slave engine to Synchronizer indicates that slave engine has slowed or stopped, Synchronizer will try to match slave engine RPM, increasing slave engine speed to full throttle speed.*
Possible Problem	Recommended actions
Lead engine tach input to Synchronizer has failed	Check for failure in tachometer drive input from lead engine to Synchronizer. Problem can occur in drive cable, engine outlet drive joint, or in mechanical drive adapter. Be sure to check the following: DRIVE CABLE – cable core failure, cable end tip failure DRIVE JOINT – on many engines, a drive joint provides tachometer information to the Synchronizer. Disconnect the tachometer cable from the drive joint, start the engine, and verify that the outlet of the drive joint is rotating. MECHANICAL DRIVE ADAPTER – if a mechanical drive adapter has been installed on the engine, check the flex shaft for failure (broken cable, missing tip tang). Flex shafts will fail due to misalignment or lack of lubrication. Reinstall the flex shaft following the instructions contained in the technical manual.
Improper tachometer cable rotation	The Synchronizer is sensitive to the direction of the input tach cable rotation. For new system installations, or after work is done to the engine, it is possible that the tachometer cable rotation input is incorrect. Verify that the cable input rotation is installed per the matrix chart in the Technical Manual (Section E).

Problem / Symptom:	**While operating with Synchronizer on at or near wide open throttle (WOT), Synchronizer turns off by itself / pilot light goes out.**
Additional symptoms:	None
Description of Operation:	*The Synchronizer should be able to operate at any speed between idle and full throttle. If the lead engine is able to operate at a higher top end speed than the slave engine can run at, the Synchronizer may turn itself off since it will not be possible to synchronize at this speed.*
Possible Problem	Recommended actions
Synchronizer turning OFF automatically on full speed limit switch. (This is a normal function of the Synchronizer).	Turn Synchronizer control switch OFF and ON to reset Synchronizer. If pilot light turns OFF again, it is likely that the full speed limit switch is being activated—it is not possible for the Synchronizer to operate at this RPM. If it is necessary to run at wide open throttle, operate engines manually (Synchronizer OFF). If it is desireable to operate the boat with the Synchronizer ON, reduce the speed of the lead engine by 50-100 RPM and turn Synchronizer back ON.
Full speed limit switch is improperly set	Readjust full speed limit switch, obtaining 1/16” to 1/8” gap between limit switch button and red collar when engine governor / throttle is at full throttle mechanical stop.
Slave engine tach input to Synchronizer has failed	Check for failure in tachometer drive input from slave engine to Synchronizer. Problem can occur in drive cable, engine outlet drive joint, or in mechanical drive adapter.
Problem / Symptom:	**Synchronizer operation is sluggish; slave engine speed does not always match lead engine speed.**
Additional symptoms:	None
Description of Operation:	*If the Synchronizer is turned ON with a 100 RPM differential between the two engine speeds, approximately 5-6 seconds will be required to synchronize the engine speeds. If there is a larger speed difference when the Synchronizer is turned ON, a longer time will be required to match engine speeds. For a 900-1000 RPM speed differential between engines, perhaps seen when making large changes in the lead engine RPM, approximately 10-12 seconds will be required to adjust and match engine speeds.*
Possible Problem	Recommended actions
Synchronizer clutch is slipping.	Adjust Synchronizer clutch as described in the manual — Section K.
Problem / Symptom:	**After turning Synchronizer OFF, slave engine control handle is not able to control slave engine speed.**
Additional symptoms:	None
Description of Operation:	*When Synchronizer control switch is turned OFF, manual control of the slave engine must be reestablished. This is normally accomplished by moving the slave engine control handle back to the idle speed position, allowing the bridge control cable to be reconnected mechanically to the engine control cable.*
Possible Problem	Recommended actions
Lack of bridge cable overtravel—terminal eye on the control cable from helm station control is incorrectly adjusted.	Readjust the terminal eye on the bridge control cable at the Synchronizer to achieve proper over-travel — see Section J of the manual. NOTE: 1) If the overtravel adjustment is slightly OFF, slave engine control may be regained by very rapidly pulling the slave engine handle back to the idle position. On a 2-station boat, try regaining manual control at the other helm station. 2) The overtravel adjustment can be thrown off by improper adjustment of the stop screws at the control head.

Synchronizer Parts List

Part Number	Item Description	Part Number	Item Description
21202	Solenoid 12 volt - 1750 (new style)	99203	43C Cable clamp
21204	Solenoid 24 volt - 1750 (new style)	99202	Cable shim
21203	Solenoid 32 volt - 1750 (new style)	50202	Term eye (33C - 43C)
21205	Solenoid 12 volt - SL (old style)	50206	Red - Stop collar
21207	Solenoid 24 volt - SL (old style)	50204	Bearing retainer (1-2-3)
21206	Solenoid 32 volt - SL (old style)	51201	Long control rod
03312	Relay assembly - Sync 12 volt	51202	Short control rod
03324	Relay assembly - Sync 24 volt	52201	Sync worm shaft
03332	Relay assembly - Sync 32 volt	60208	Guide bracket
03900	Clutch cable assembly	60205	Switch bracket
99201	33C Cable clamp	03201	Tach sender extension

