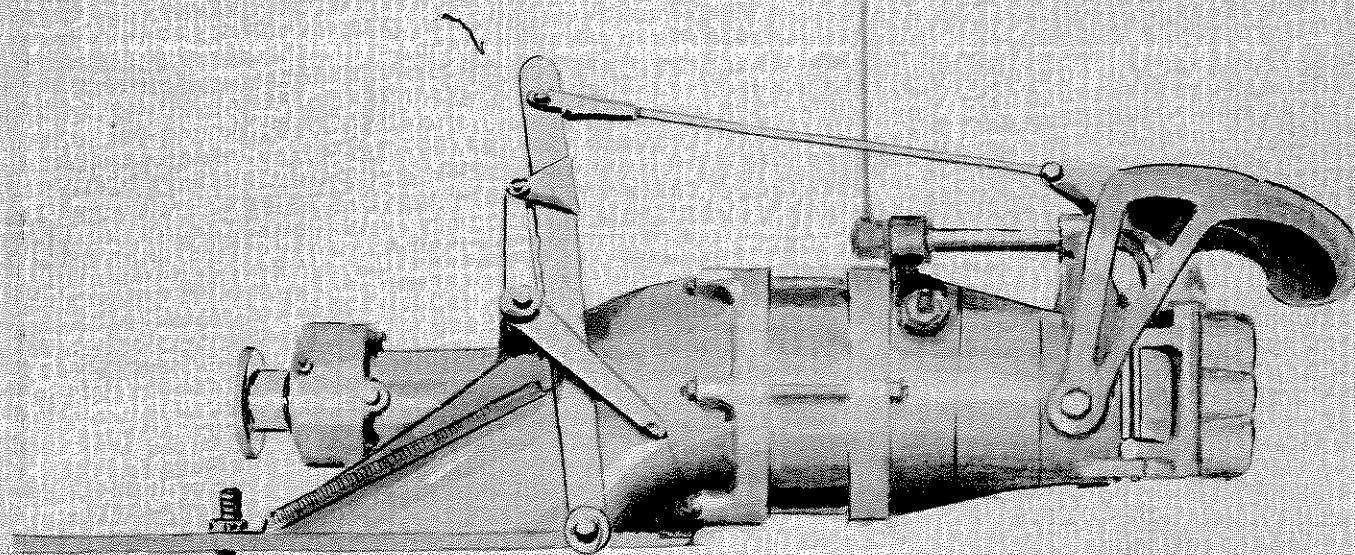




Hamilton Jet



TECHNICAL GUIDE

5 POINT TECHNICAL GUIDE



FOR THE USE OF THE HAMILTON JET COLORADO EXPLORER SERIES.

SCOPE OF USE:

For high speed planing hulls, lengths 12 feet to 24 feet.

Maximum unladen weight with largest engine: 3600 lb.

Maximum laden weight with largest engine: 4500 lb.

Twin units: Boats up to 30 feet, and laden weight 9000 lb.

Engines: Conventional inboard petrol engines, up to 250 b.h.p. Stern-drive or 'Bob-tailed' versions less transmission gearbox. Flywheel adaptor for Hardy-Spicer universal flange required. No raw water pump.

(For further details refer Jet Pamphlet and Manual p.11 and 16.)

HULL SHAPE:

The three main criteria for a good jet hull are:

- (1) Appreciable deadrise, or 'vee-angle' in the bottom.
- (2) Near to constant deadrise over the aft planing sections.
- (3) Rising stemline forward. (Not a deep fine forefoot.)

(For further details refer to Manual P.8-10.)

POWER/WEIGHT RATIO:

For satisfactory acceleration to planing speeds and economical load carrying, there are strict weight limits for a jet boat. Weight calculations, engine choice and speed estimates should be made before starting building a new boat. This is most important.

(For full details refer to Manual P.18 & 19.)

MOULDING A FIBREGLOSS HULL FOR A JET:

Full tooling and moulding instructions with special attention to the intake mounting block are described in the special supplement, with two measurement diagrams:

- (1) Flat Mount: for conventional simple mount.
- (2) 5° Angle Mount: gives extra engine flywheel clearance for most modern engines with large diameter flywheels.

FITTING OUT:

Engine, drive shaft, etc. notes on back pages. Jet fitting details are also included in Owner's Manual supplied with each unit.

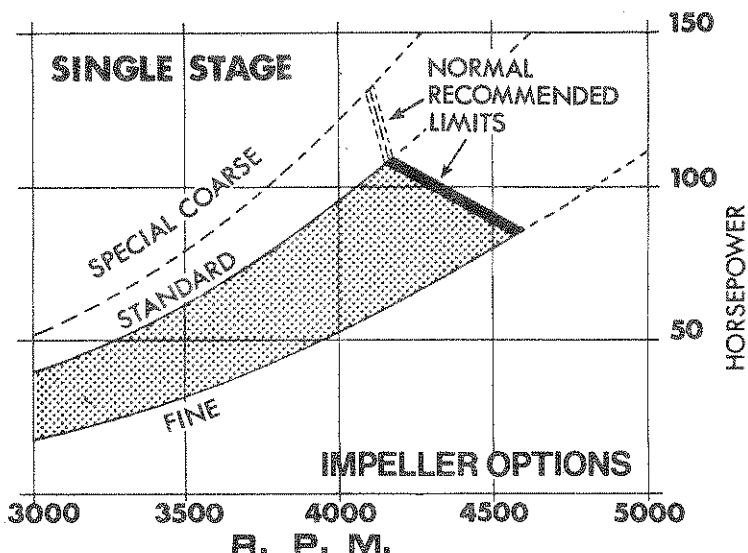
COLORADO EXPLORER MARINE JET



SINGLE STAGE

Power Range: 30-100 bhp
 Engine Size: 90-180 cu.in.
 1.5 - 3.0 litres
 Weight: 90 lb 40 kg
 Boat Size: 12' - 18'
 3.7 - 5.5 m
 Max. Boat
 Weight: 1600 lb 730 kg
 (before loading)
 Hardy-Spicer Coupling:
 1260/1300 Series

Suitable Engines: Cortina, Volvo
 (fine); Falcon; Holden (Std);
 Zodiac V6 (special).



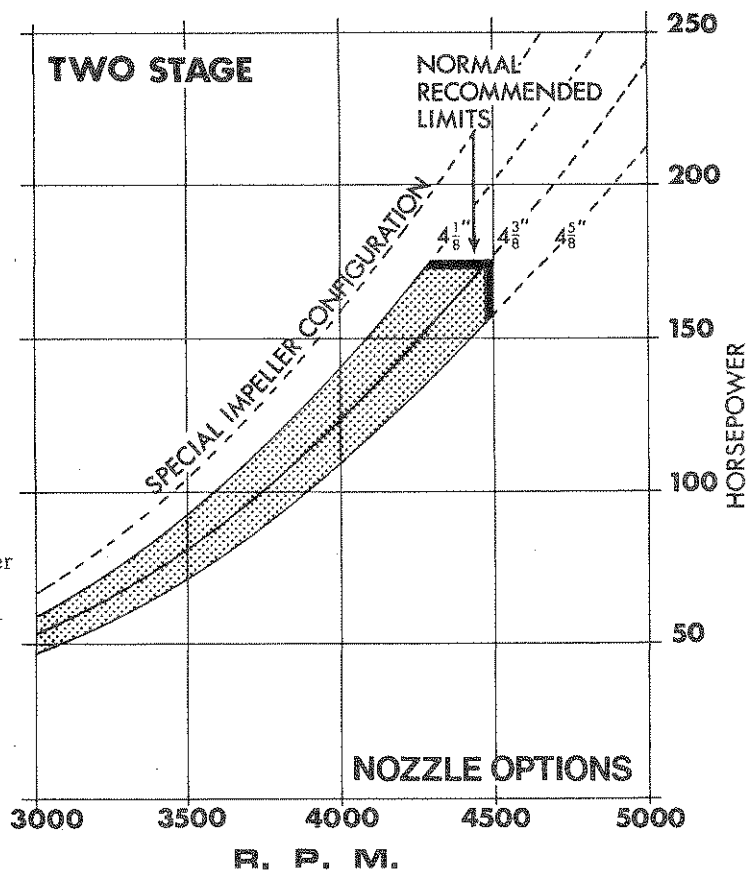
Note: This unit has a fixed $4\frac{3}{4}$ " diameter nozzle and three impeller options: STANDARD pitch for most engines; FINE pitch for smaller and very high speed engines; SPECIAL COARSE (at extra cost) for reduced revolutions or extra high power applications.

TWO STAGE

Power Range: 100-175 bhp
 Engine Size: 150-283 cu.in.
 2.5-4.7 litres
 Weight: 110 lb 50 kg
 Boat Size: 13'-20' 4-6 m
 Max. Boat
 Weight: 2500 lb 1150 kg
 (before loading)
 Hardy-Spicer Coupling:
 1260/1300 Series

Suitable Engines: Ford 3 litre V6;
 Chevrolet & Ford
 V8, (2bbl.)

Note: This unit is designed for larger engines and higher speeds. Nozzle variations from $4\frac{1}{8}$ " to $4\frac{3}{8}$ " diameter assist in matching with the chosen engine. A special impeller combination is available for higher flows.

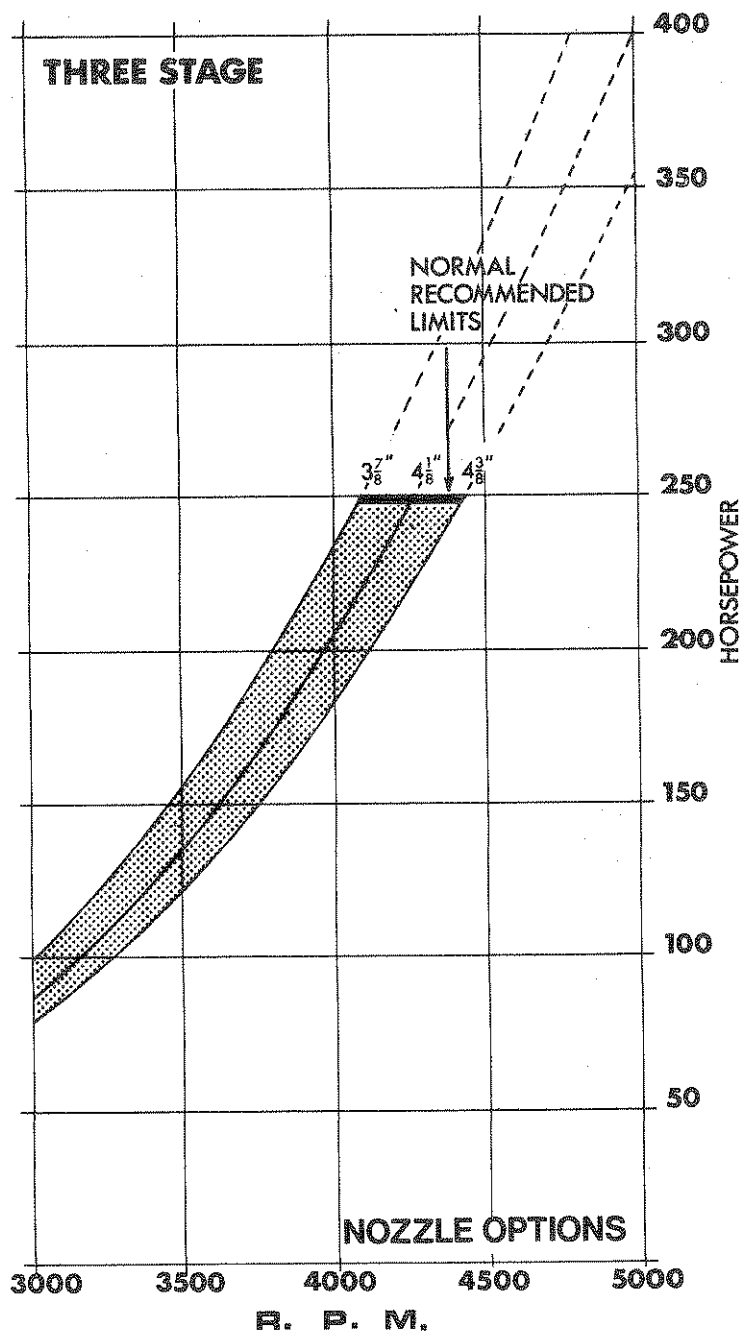




THREE STAGE

Power Range: 175-250 bhp
 Engine Size: 240-350 cu.in.
 4-5.8 litres
 Weight: 120 lb 55 kg
 Boat Size: 16'-24'
 4.9-7.3 m
 Max. Boat
 Weight: 3500 lb 1600 kg
 (before loading)
 Hardy-Spicer Coupling:
 1350/1400 Series
 Suitable Engines: Interceptor 210;
 Holman & Moody
 225; Crusader 250

Note: This top-performance unit is designed for maximum speeds and the largest engines. Nozzle variations 3 7/8" to 4 3/8" diameter. For operation outside the recommended power and speed ranges of any unit, refer to the manufacturers.



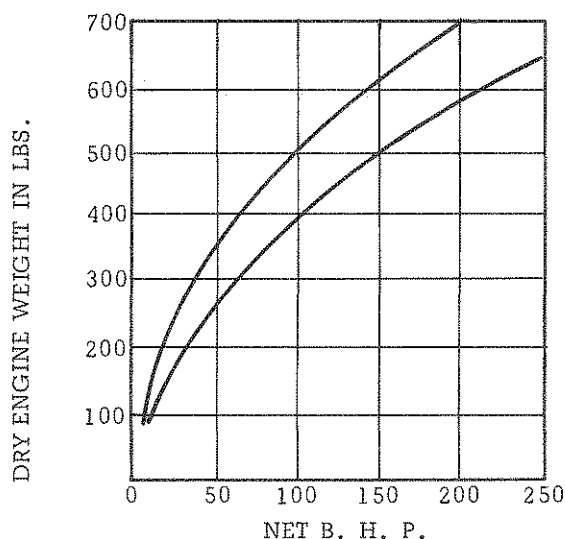
THE CORRECT ENGINE TYPE



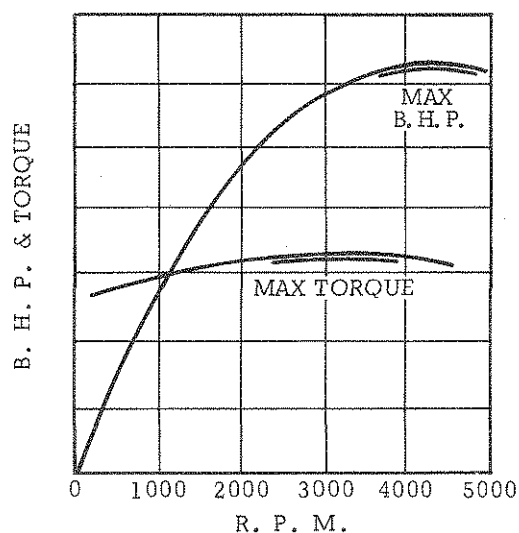
The Hamilton Jet Unit is designed for high speed planing craft, and therefore weight is important, as in an aeroplane.

The units are matched to the average automotive type petrol engine which develops its maximum power at 4000-4500 r.p.m. The weight of the engine should be not greater than 5lbs/developed b.h.p. preferably lighter - around 4lbs/b.h.p. down to 3lbs/b.h.p. for engines up to 250b.h.p.

DESIRABLE POWER / WEIGHT RATIO



DESIRABLE POWER & TORQUE CURVES



Note: Engine powers quoted as "S.A.E. Ratings" should be reduced 10-20% to determine approximate actual net shaft horsepower as installed.

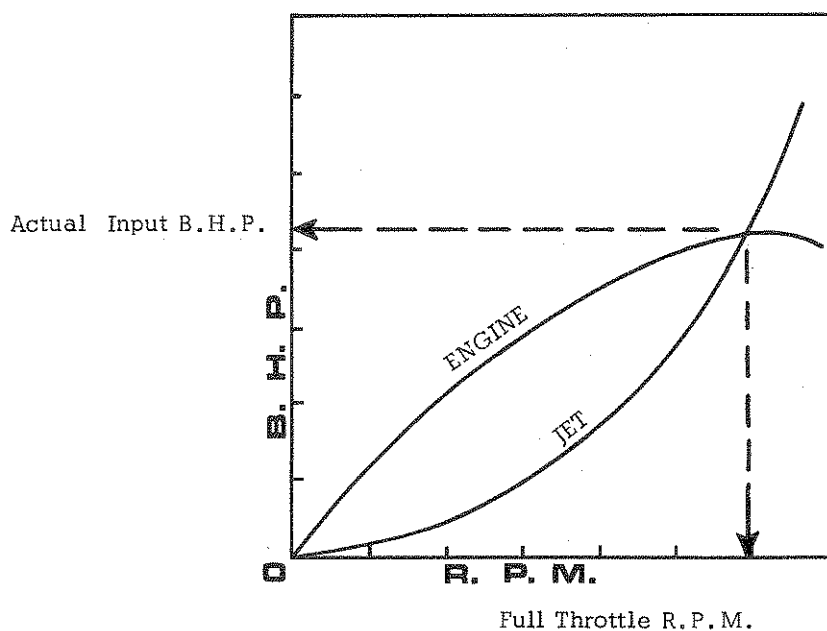
DIESELS

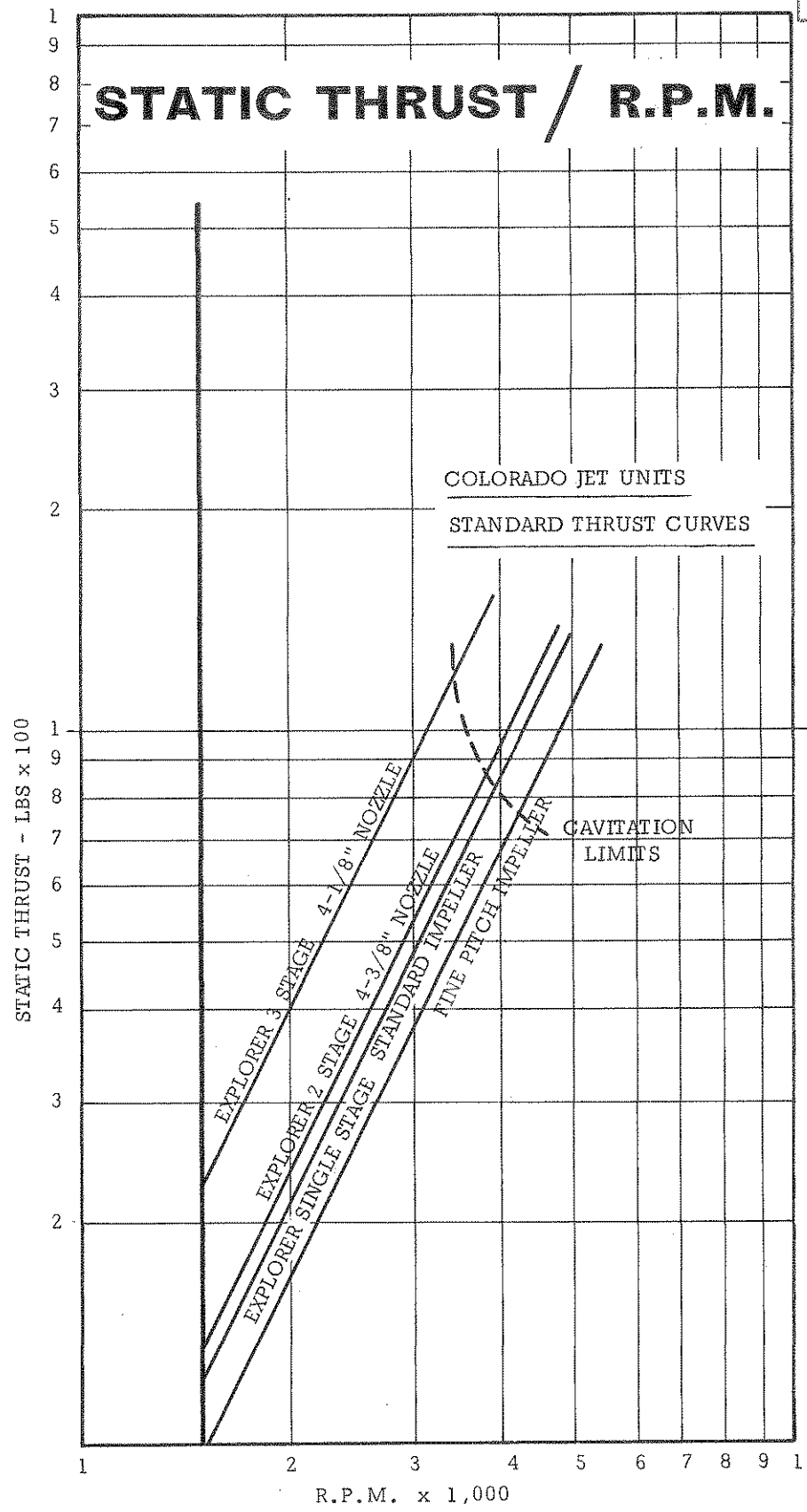
Very few diesel engine specifications can come near these figures, although some automotive diesel conversions are now built with 4000 r.p.m. peak speed and quite good power/weight ratios. But in general few diesel engines or truck engines are suitable for small fast craft.

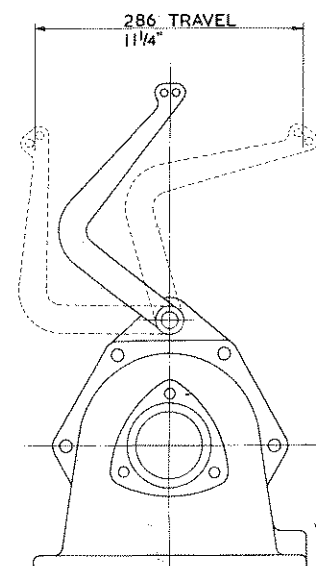
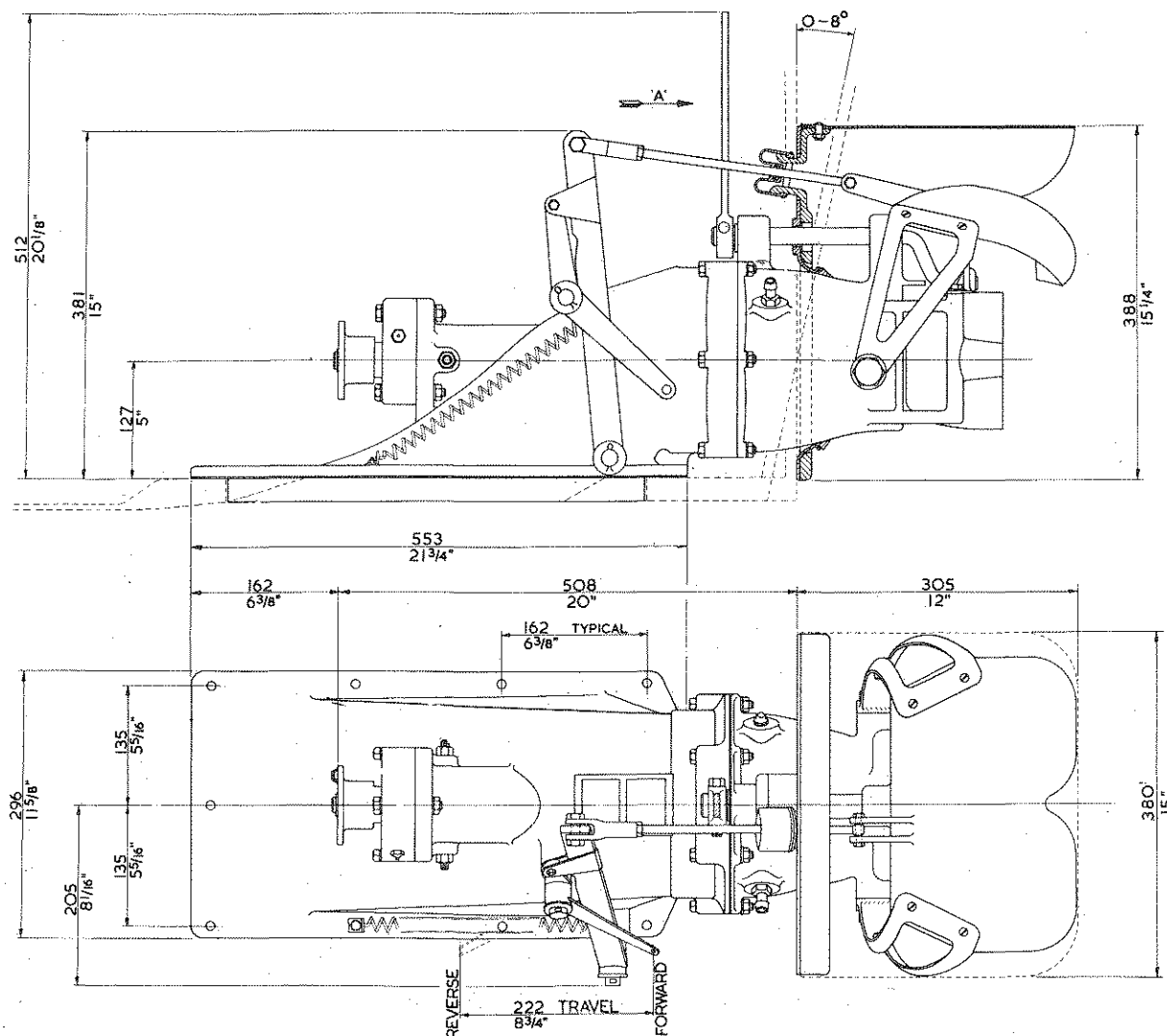


MATCHING ENGINE & JET UNIT

1. Having decided that the chosen engine is suitable for jet drive, (lightweight and suitable top revolutions), determine or estimate its NET SHAFT HORSEPOWER curve against revolutions. Remember that S.A.E. rated horsepowers may be 10-20% higher than that actually obtainable.
2. Knowing the maximum net shaft horsepower, choose the correct matching jet unit for this horsepower - one, two or three stage.
3. Superimpose the engine power curve on the jet unit power requirement curves. The maximum revolutions that will be achieved by the engine will be indicated below the intersection of the curves. (Select impeller and/or nozzle diameter to best match the requirements of the engine so that it can reach, or nearly reach, its maximum design revolutions.)
4. If a poor match results, an alternative jet unit can sometimes be selected, provided it covers the power range. There is some overlap between the units for this purpose.

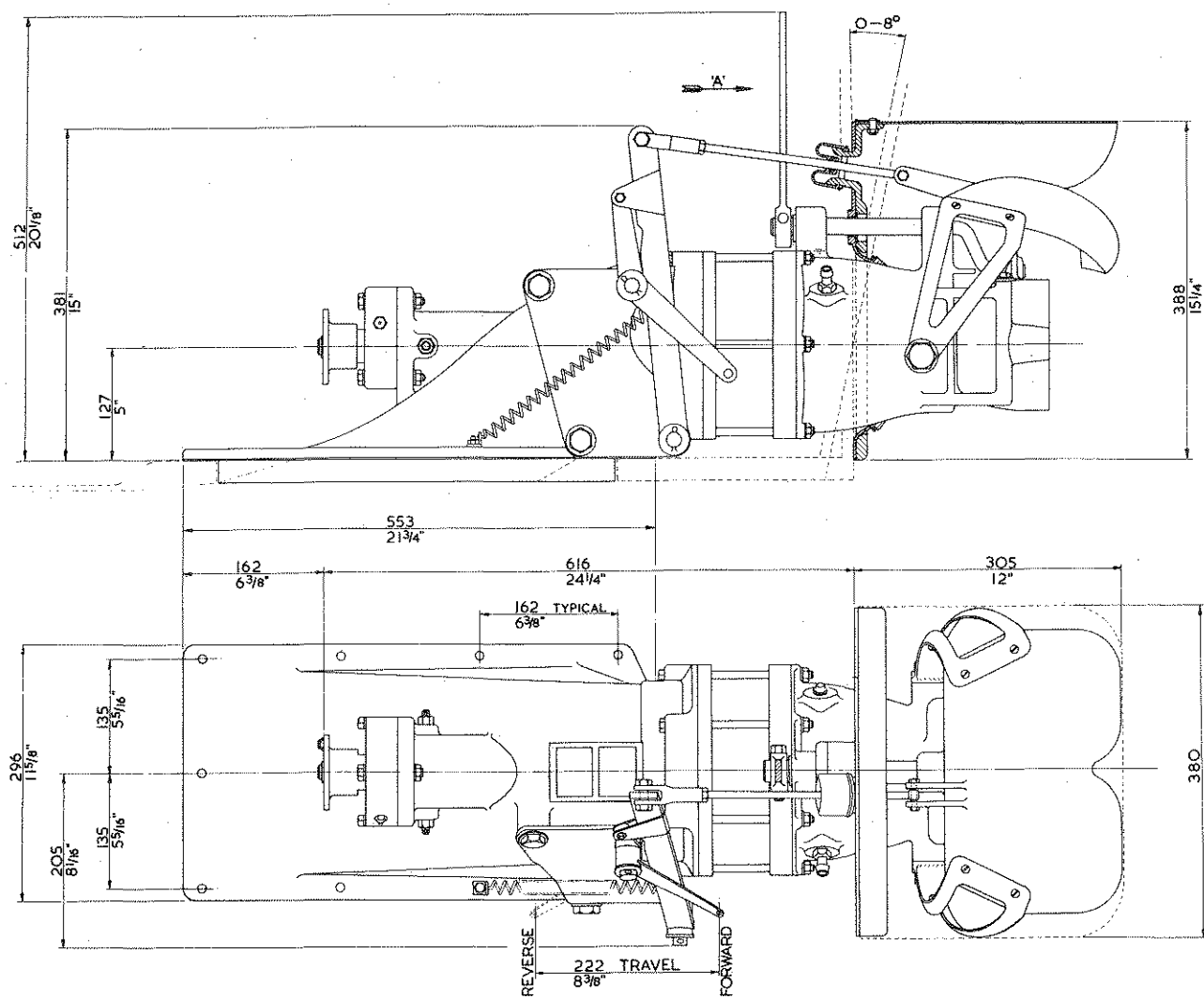






VIEW ON ARROW 'A'
SHOWING MOVEMENT OF
STEERING ARM

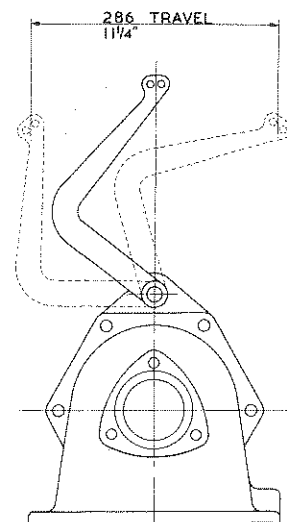
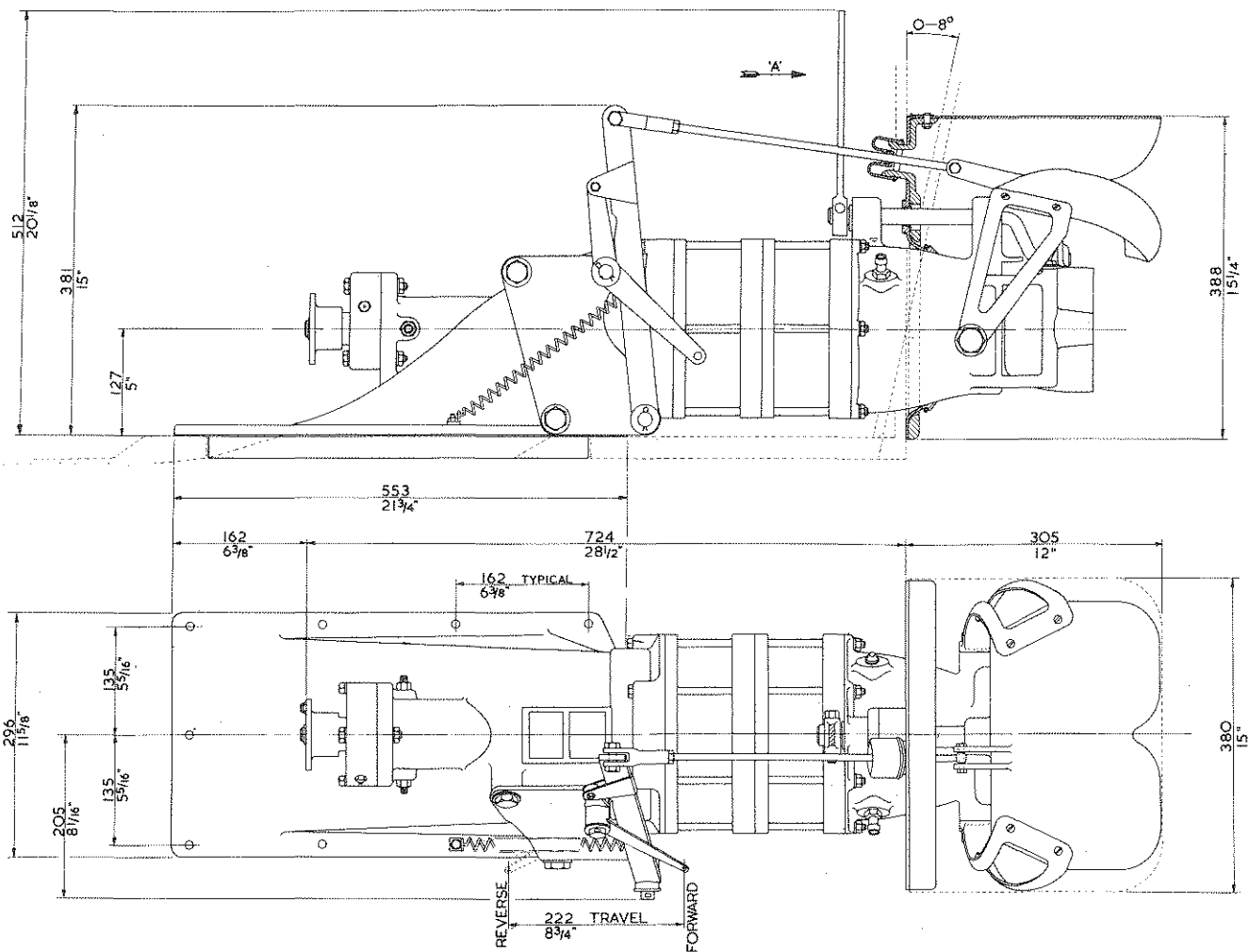
HAMILTON JET EXPLORER SINGLE STAGE



HAMILTON JET EXPLORER TWO STAGE

98389

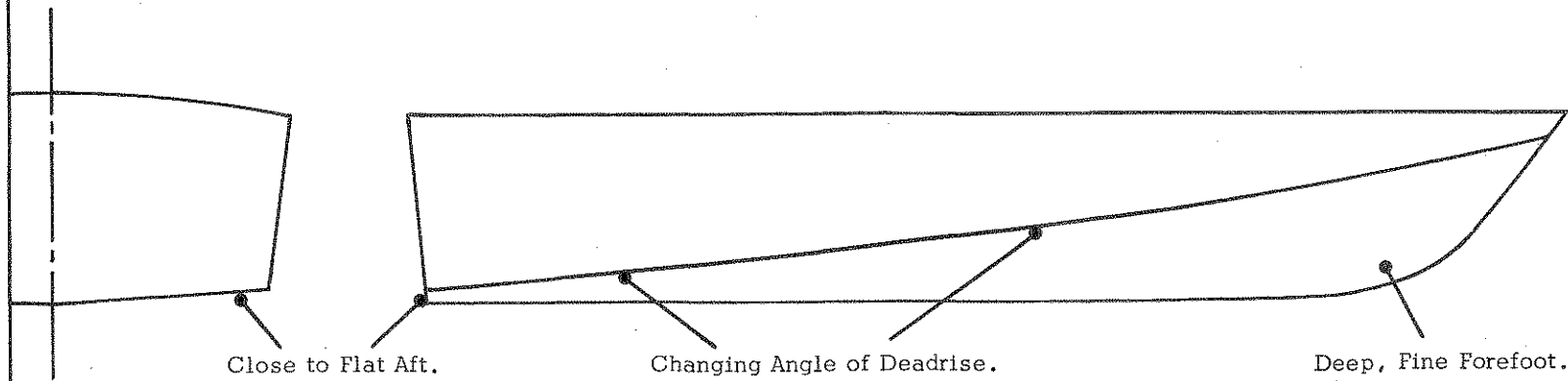




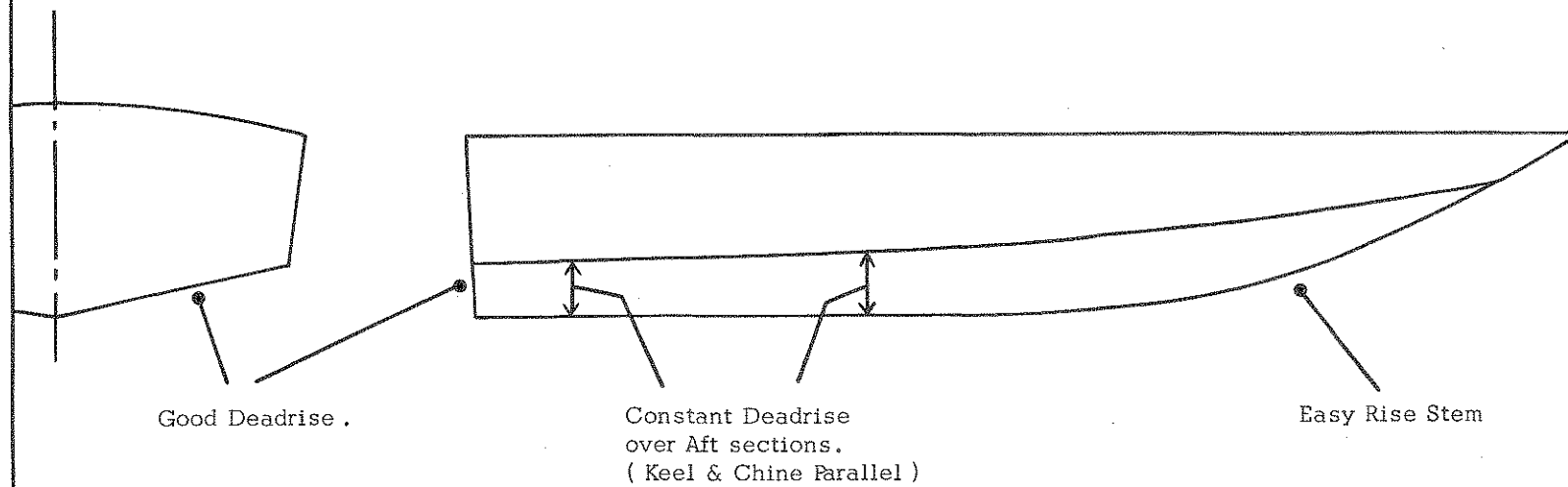
VIEW ON ARROW 'A'
SHOWING MOVEMENT OF
STEERING ARM.

HAMILTON JET EXPLORER THREE STAGE

POOR JET HULL



IDEAL JET HULL



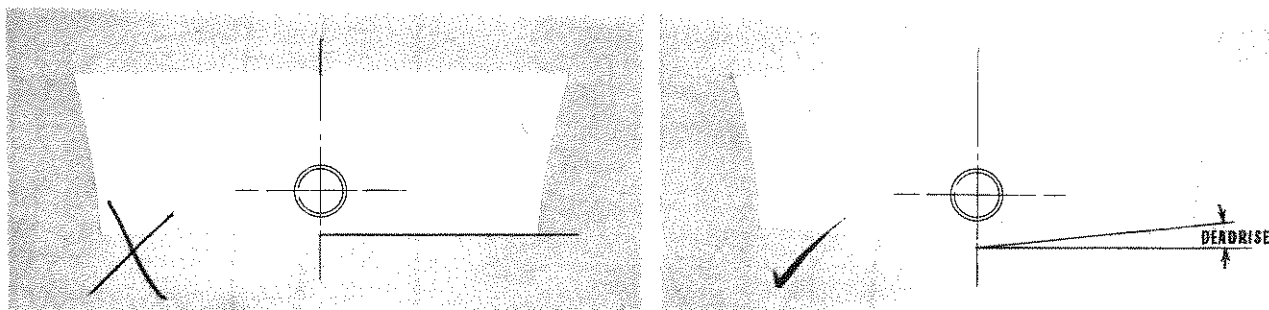


JET BOAT HULL SHAPES

Discussed here are the main features of the shape of the planing hull, leaving the layout, constructional possibilities, and building materials for later. Most of the information is based on a distillation of experience with a wide range of boats over the past ten years. It should be clearly understood that many other types of hulls either have, or could be used and that this dissertation is a summary of the present jet boats generally found most successful.

DEADRISE

With jet boats up to about 20 feet in length, it is preferable to have some "deadrise", or vee-angle in the bottom carried back to the transom. There are three reasons for this, namely -



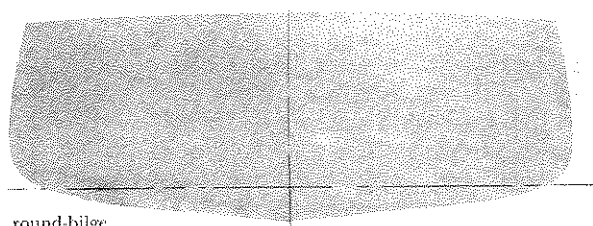
1. Some vee-angle makes sure that the centrally-mounted jet unit is well immersed, thus quick priming is ensured when the engine is started. (The unit should be at least half full of water when standing idle).
2. At speed the vee-bottom divides entrained air away from the intake in choppy conditions, thus avoiding excessive engine racing. This is not, incidentally, cavitation, as it is commonly called.
3. The more deadrise angle there is, the greater the banking in turns. This is probably safer, and generally more comfortable.

In long boats, the bottom angle is of less consequence and even flat bottoms are quite successful provided immersion is sufficient for the jet unit to prime. In any case, provided the boat has a good flat running trim, and does not squat, air entraining is usually not a worry. The new "deep-vee" designs are particularly suitable for jet propulsion, but have more draught than average.

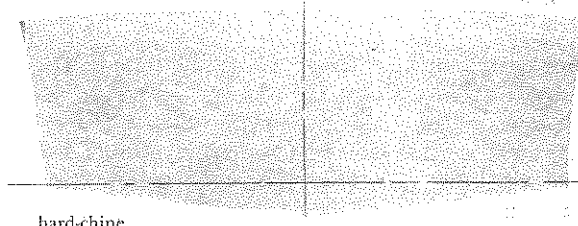
HARD CHINE OR ROUND BILGE?

The hard-chine is the most efficient planing surface, has the best wave-flattening properties, and gives the most planing area for a given size of boat. The round-bilge gives pronounced banking in turns, and is the more manoeuvrable of the two types. Handling is excellent, provided the bank is not so extreme as to bare the jet intake to the air.

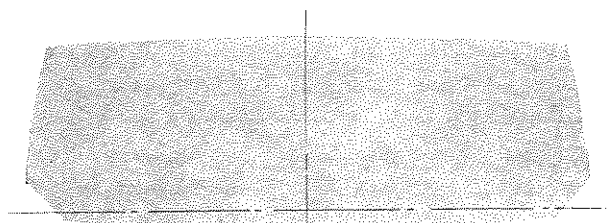
A small "hardened" step over the aft sections to improve efficiency is desirable. In either case some deadrise angle in the bottom is recommended. "Non-trip" chines do not do the job the name indicates, but give increased bank in the turns. They can be used if desired.



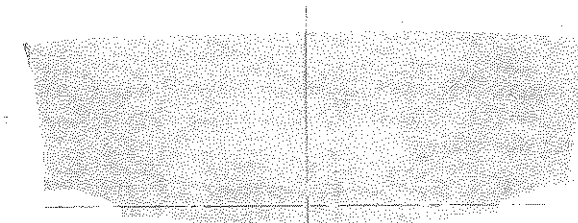
round-bilge



hard-chine

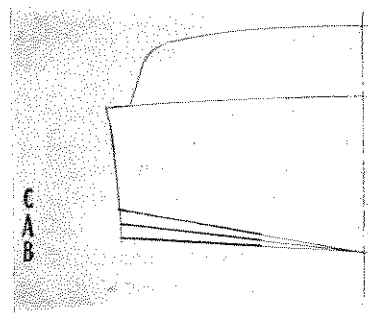
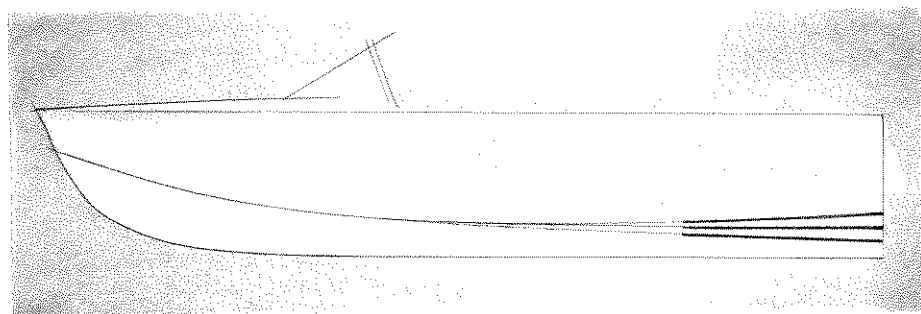


on-trip



deep-vee

A "MONOHEDRON" bottom (A) is really the simplest shape, the aft sections having constant deadrise angle for some distance. This is easily seen by sighting along the bottom. They are best for high speed craft, the trim angle remaining constant as the speed rises in the planing range. They are not so good for medium speed, or lower powered craft as mentioned below.



The "DROPPING-CHINE" lines (for want of a better name), have the chine continuously dropping from the bow to the transom, the deadrise angle thus reducing all the way back (B). This gives the boat a "flaps-down" effect, and a flat planing attitude is obtained. This shape is preferable for lower-powered craft, and all boats where nice running in the 18-28 m.p.h. range is required. It is excellent for load-carrying boats, and gives improved riding in choppy conditions due to a generally flatter trim angle at normal cruising speeds. However, as the speed rises, the trim becomes over-flat, the bow may "plough", wetted area increase instead of decreasing and a limitation of speed results. Also in the case of jet boats, bad handling and spinning out can occur at the higher speeds.

The "WARPED-PLANE" (C) is roughly the opposite of the above, the deadrise running down to a minimum about amidships, and increasing again towards the transom. The bottom is something like a banana. This shape is easily driven in a displacement condition and is suitable for a slower craft that may operate below planing speeds, or in a semi-planing condition. If driven fast, the bow rides high due to suction at the stern and "grip" in turns may be inferior. The "hooked-chine" is an exaggeration of the dropping-chine and actually curves downward at the transom. This makes a boat plane quickly and adopt a very even trim angle on accelerating. The effect is similar to having flaps on the transom. However, it is not good to have hook in the bottom at higher speeds.



BEAM

Plenty of beam is good, but don't overdo it. The wide beam boat is a great load carrier, can plane at low speeds, is roomy and very manoeuvrable. The worst feature is the excessive change of trim on accelerating onto a plane. It will also run with a greater angle of trim at cruising speeds and is generally inferior for sea-going conditions. The long thin boat will give the best ride in a sea, can have a flat, even take-off, and a wide cruising speed range. A compromise is probably the best for general use, a rule of thumb being : beam = $1/3$ length.

BOW SECTIONS

A hard chine boat should have a deadrise of about 25° at $1/4 - 1/3$ back from the bow for a reasonably soft ride. The angle should be measured from a keel to the chine, ignoring the intermediate shape.

The normal developable convex achieved with a plywood boat is satisfactory for a jet boat. Avoid hollow sections and a deep fine forefoot. The stemline should rise from well back along the keel and a full rounded bow maintained. Have a smooth radius on the stem for preference, without any capping that can cause keeling in sharp turns. Due to the lack of rudder, etc. at the stern of a jet boat, surplus keeling effect forward must be avoided to ensure proper handling in turns.

Note that on round bilge or deep-vee boats, the shallow bow shape does not seem necessary for satisfactory handling. Thus these latter shapes may be the best choice for a sea-going jet boat.

KEELS

Jet boats tend to yaw wander at low speeds. This is due to the lack of underwater appendages, which is a must for craft used in rough river conditions with severe cross-currents. Thus the real river boat generally has little or no keel at all. If more "grip" is required in turns, to reduce oversteering tendencies, a keel can be fitted $\frac{1}{2}$ in. - 2 in. deep along the keel, tapering off to nothing forward, and smoothly into the intake aft. Avoid any keel at all behind the intake. Another possibility is twin "sister" keels either side of the intake about 2-4 feet apart, from the transom forward to amidships of the hull. These should probably be used (quite deep) in larger sea-going boats to aid true-running in rough conditions, and to improve slow speed manoeuvring. An alternative arrangement to sister keeling and often more effective for larger craft used in open sea conditions, is twin fixed rudders aft. This has a profound steadying effect when coming alongside in a crosswind, and will make the clean-bottomed sea-going boat as easy to handle at slow speeds as the best propeller craft.

SUMMARY

Almost any shaped hull can be used for jet propulsion in the larger sizes, but some deadrise angle is desirable for small boats. Hard-chine boats need some attention to the bow shape.

Jet propulsion is perfectly satisfactory in the sea, but keeling may be desirable aft to improve behaviour in open-water conditions. The round bilge or deep-vee hulls may be best for the latter, or adjustable transom flaps for fast hard-chine designs.

Keep a clean bottom for river conditions.

If heavy loads are to be carried, and good behaviour required at medium cruising speeds, some measure of dropping-chine is desirable in hard-chine boats, but always use the monohedron bottom for high speed craft. These findings should not be considered the be-all and end-all of jet boat hull design, but may be of assistance to those having difficulty choosing a suitable hull shape for their jet boat.

SELECTING ENGINE & JET UNIT



This most important diagram can be used in two ways:

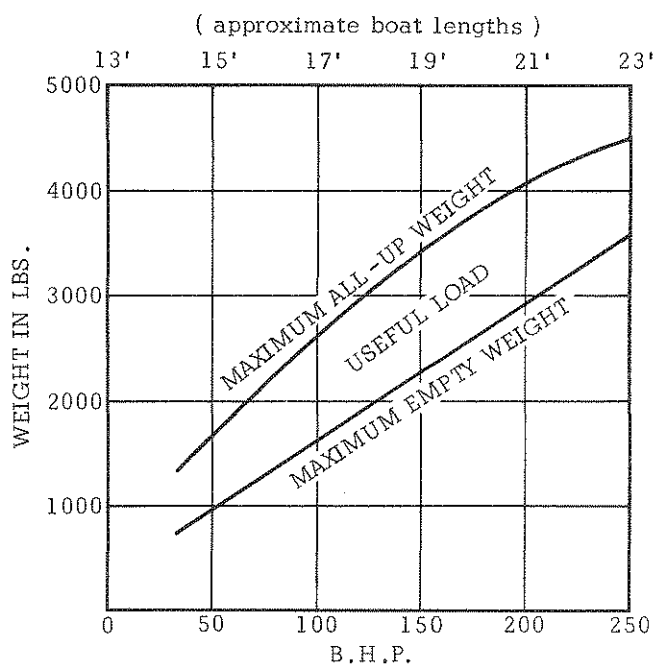
- (a) Knowing the size and weight of the craft, the net shaft horsepower required and the correct model of jet unit can be determined.
- (b) Having a certain size of engine and matching jet unit, the largest size of craft can be determined and its payload.

The diagram indicates "maximums" for boat lengths and weights, which will result in satisfactory acceleration onto a "plane", reasonable cruising speed and top speeds around 30 mph. Greater weights or less horsepower may give disappointing performance and difficulty reaching planing speed. Attempt to keep the weights below the maximum, then extra bright performance will result.

It should be clearly understood that this diagram is an APPROXIMATE GUIDE ONLY and may not be followed too closely in practice due to the wide variation in hull design.

After selection of engine and jet to suit chosen hull, recheck boat weight again. Size, loading, or power may require adjustment.

Another good "rule-of-thumb" is to limit the All-up Weight of the craft to within 3 x STATIC THRUST LB. for good performance.



NOTE: The diagram is for single installation. Weights can be approximately doubled for twin engines and jets.

SAMPLE CALCULATION:

- (a) Assuming we have a conventional 16 foot planing boat, and we require to know the necessary engine power and jet unit.
- (b) Weight of hull, complete with hardware, windscreen, steering, seats and all usual fittings (but without engine) 800lb.
- (c) Estimated weight of other items: Engine - 450lb., Jet Unit - 100 lb. (say), Battery - 50lb., Allowance for drive shaft, fuel system, instruments, controls, engine cover, strengthening for inboard - 150lb.



- (d) Approximate total boat weight: $800 + 450 + 100 + 50 + 150 = 1550\text{lb.}$
- (e) Referring to the diagram, a boat of this weight requires 95 b.h.p. From the jet unit information, this means a Single Stage Explorer is suitable.
- (f) Say we choose a light 95 b.h.p. marine engine that weighs 420lb.
- (g) Recalculate boat weight: $800 + 420 + 90 + 50 + 150 = \underline{1510 \text{ lb.}}$ with this particular engine and jet unit.
- (h) Maximum desirable laden boat weight for this power from the diagram is 2500 lb.; therefore, passenger and fuel load should not exceed 990 lb. if economical and efficient performance are desired.

SPEEDS OF PLANING HULLS

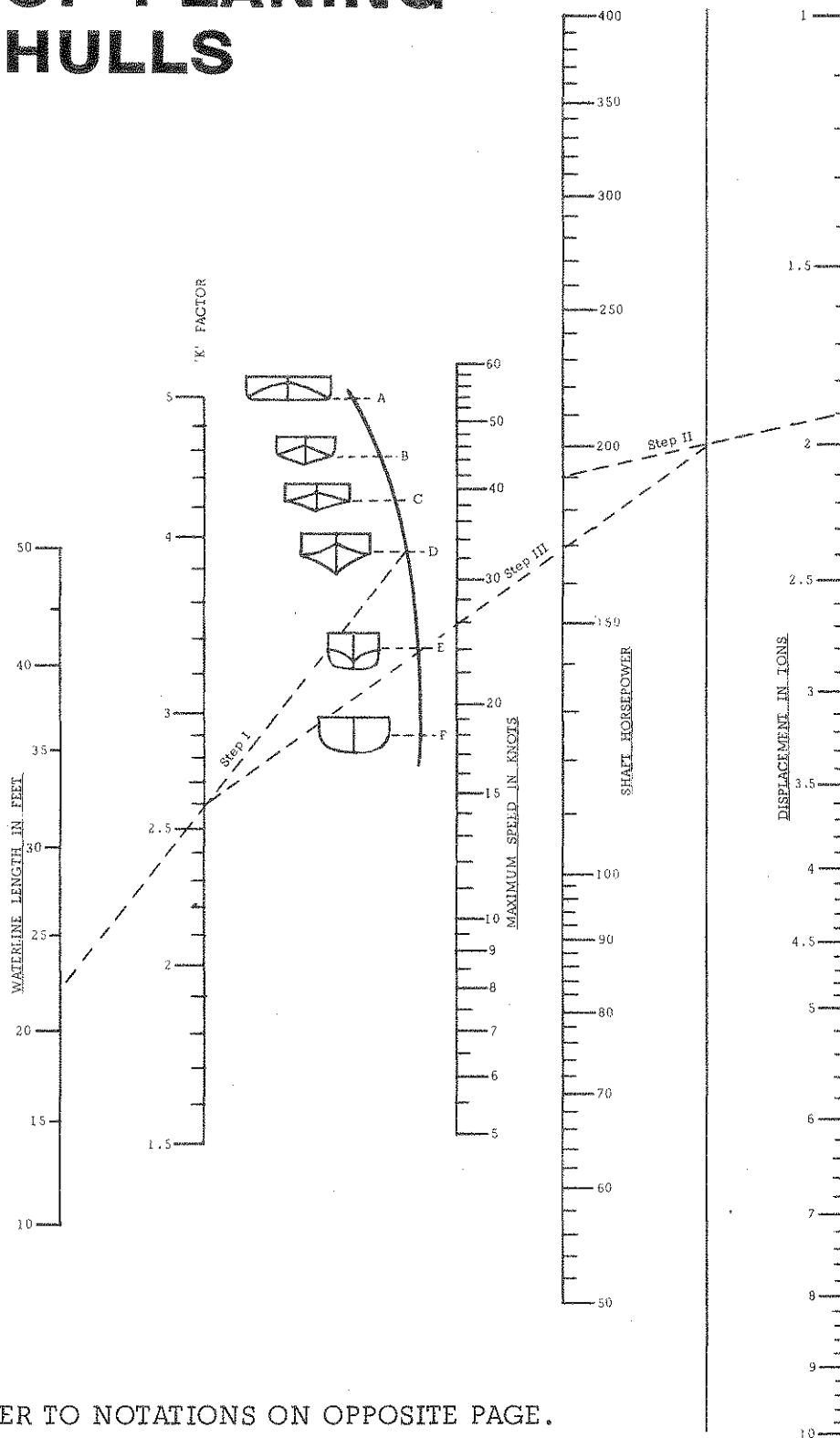
NOTATION FOR GRAPH OPPOSITE:

- A: Highly efficient, hard chine, beamy, near flat bottom.
B: Less efficient hard chine, narrower, more trim angle.
C: Hard chine, more deadrise; also best deep-vee hulls.
D: Normal deep-vee, also moderate beam, hard chine hulls.
E: Softer shapes, narrow, semi-hard chine planing hulls.
F: Round bilge planing hulls.

HULL FORM

- STEP 1: Line across hull form - Length in feet to determine "K" factor.
- STEP 2: Line across horsepower - Displacement in tons giving intersection on plain line.
- STEP 3: Join to intersections; gives speed in knots.

SPEEDS OF PLANING HULLS



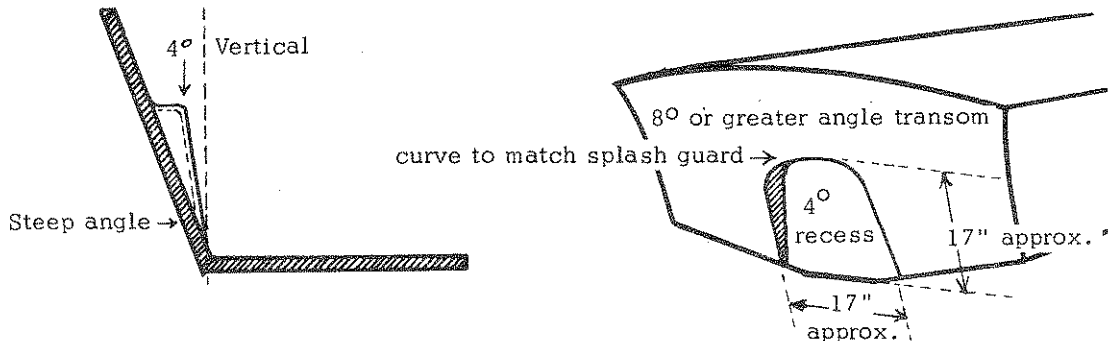
REFER TO NOTATIONS ON OPPOSITE PAGE.

GENERAL RECOMMENDATION TO FIBREGLASS HULL MOULDERS FOR INSTALLATION OF HAMILTON JETS



TRANSOM ANGLE

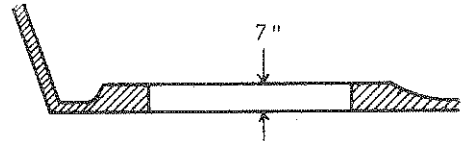
0° - 8° preferred for ease of fitting. If angle over 8° use moulded recess to revert angle to about 4° for preference.



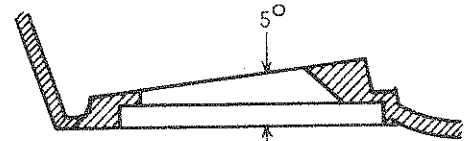
(Note: If using 5° angled block, transom angle can be up to 13° without the necessity for a transom recess).

JET MOUNTING BASE

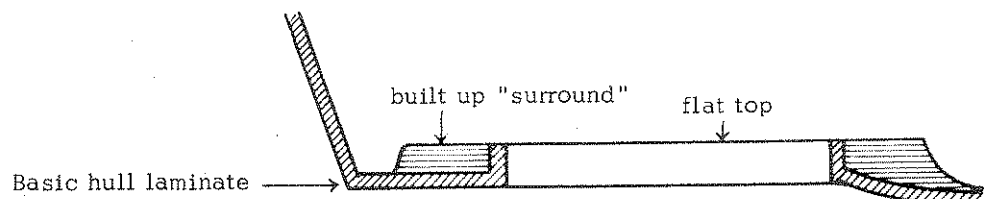
- (a) For most Single-Stage, and Explorer installations in larger boats, use standard flat mounting base, 1" thick as per diagram. (Flat mount usually satisfactory in most fibreglass boats with some deadrise, as flywheel can be lowered into keel recess to keep drive shaft angles down even when short-coupled on standard drive shaft).



- (b) For close-coupling engines with large diameter flywheels, e.g. most V8's and Falcon, it is desirable to use the 5° angled mounting arrangement. Refer to diagram J675, (Sec. 4 Page 7.) and use intake screen to suit. (JH218SY and JH244SY)

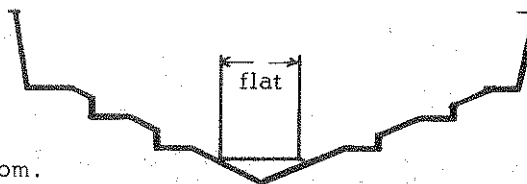


- (c) In both cases, mould fibreglass hulls with a "mould block" the right shape fixed to the bottom of the mould, and build-up a strong fibreglass surround to make the required flat area for mounting the jet unit.





- (d) Also merge intake hole forward into hull bottom smoothly and extend flat aft of intake hole back to the transom.

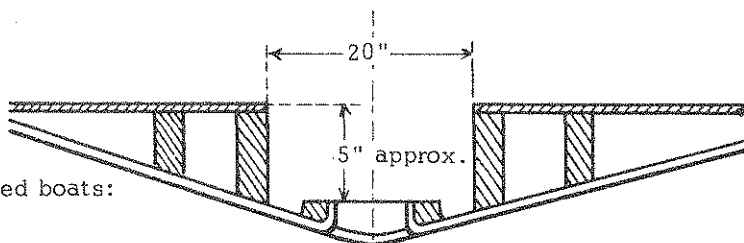


ENGINE COMPARTMENT

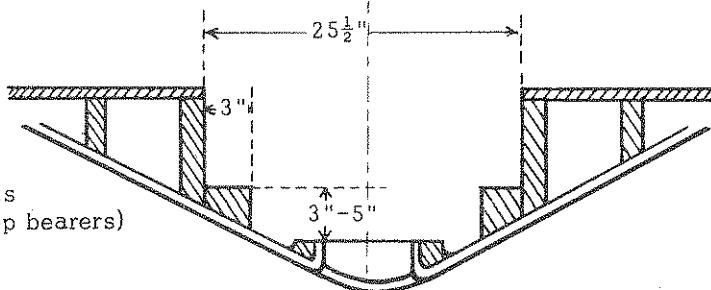
With moulded hulls, it is necessary to keep an area clear of frames and floorboards for the engine and jet down the centre of the boat, and longitudinal engine bearers each side to suit the engine.

- (a) Length of Recess: Check exactly what engine/jet combination is to be used, and if it is short-coupled on the usual short Hardy Spicer shaft. Common examples are:-
1. Holden-Single-Stage Turbopack, length 5'6" from transom.
 2. Interceptor V8 - Explorer 3-stage, length 6'0" from transom.
- (b) Engine Bearer Spacing: Again this may vary, but common examples are:-

1. Flatter bottomed boats:

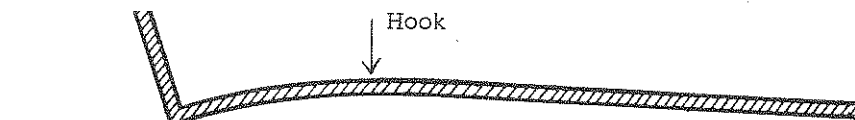


2. Deep Vee boats
(with very deep bearers)



BOTTOM LINES

Monohedron, or straight bottom lines suit the jet very well. Avoid any "HOOK" near the transom; lines must be true and straight over the aft planing area.

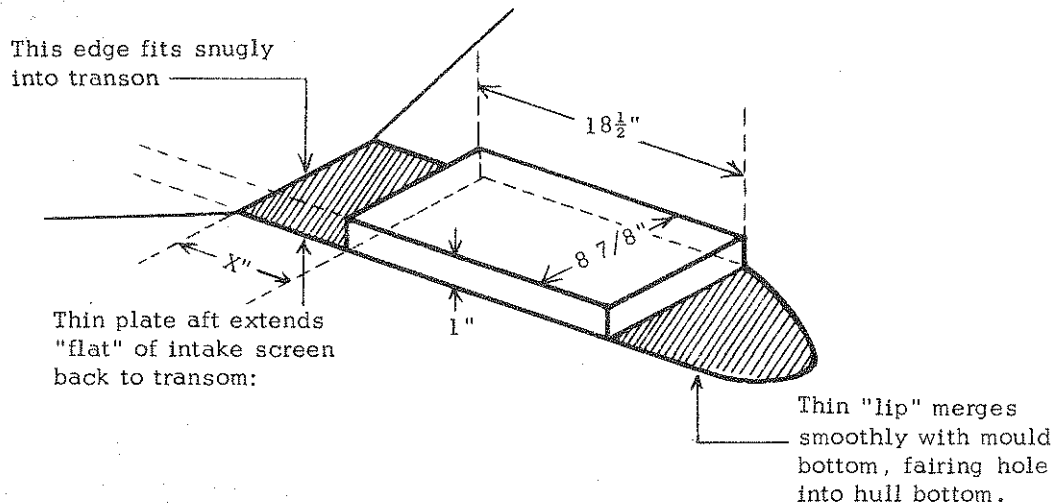




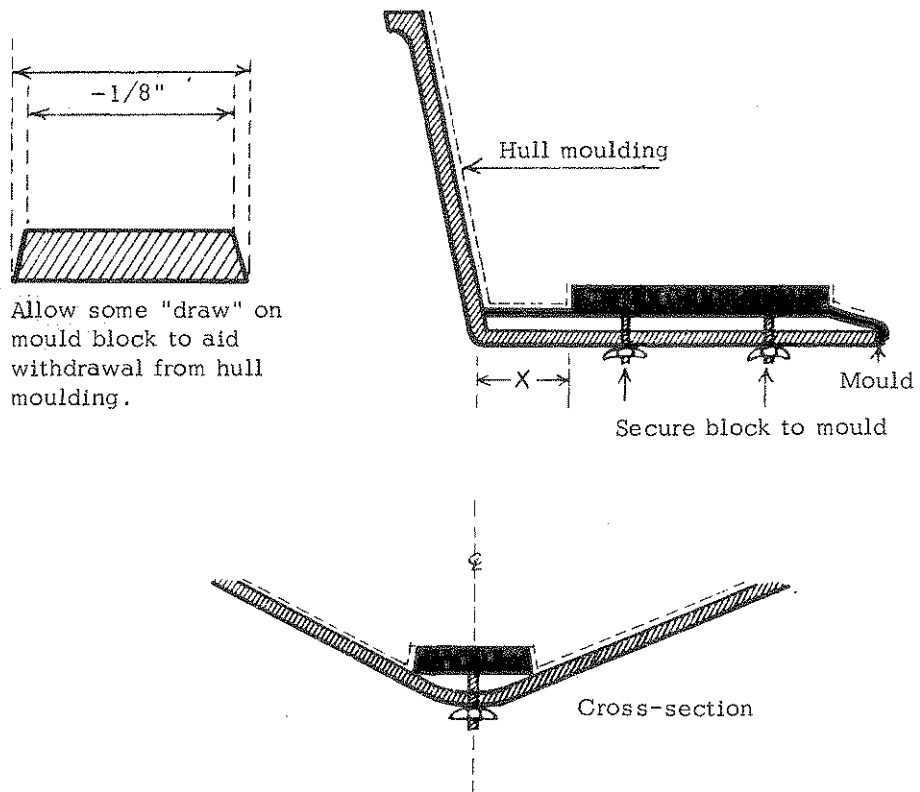
HamiltonJet

SUITABLE TOOLING FOR PRODUCTION OF FIBREGLASS HULLS FOR HAMILTON MARINE JETS

INTAKE HOLE MOULD BLOCK (made out of steel for best production results)

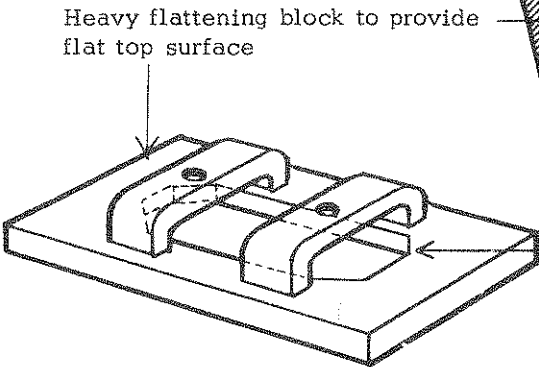


FITTING TO HULL MOULD



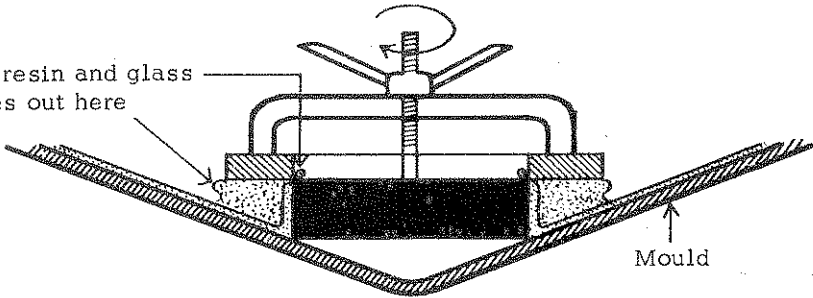
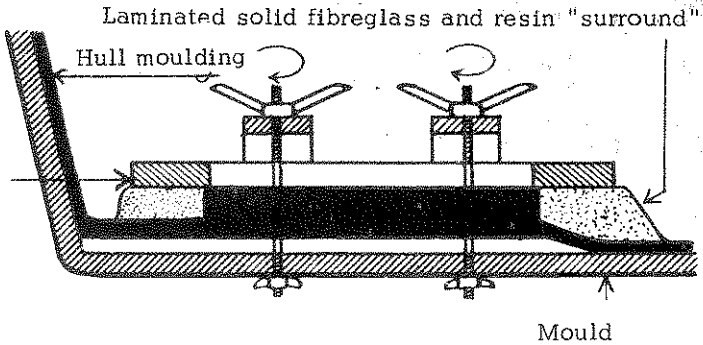


INTAKE SURROUND



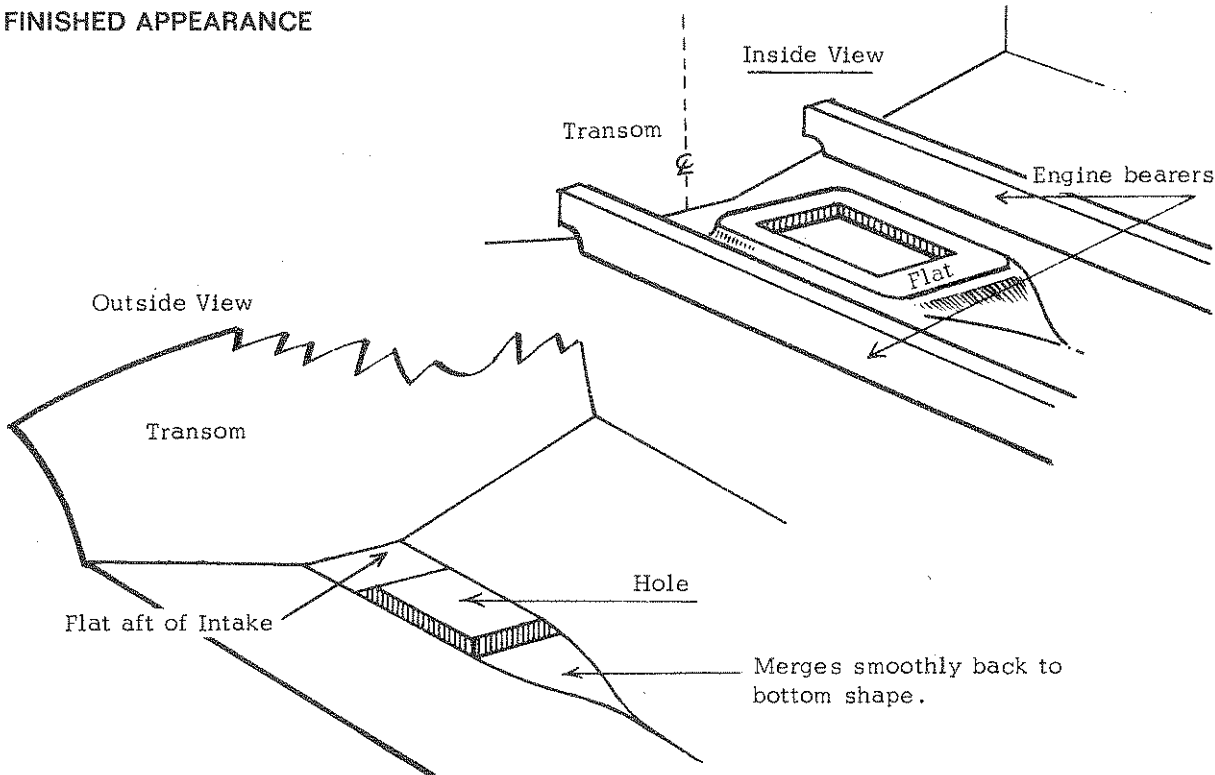
Heavy flattening block to provide flat top surface

Bevelled corners to just catch on mould block only, leaving space for surplus resin escape.



Surplus resin and glass squeezes out here

FINISHED APPEARANCE



Inside View

Transom

Engine bearers

Flat

Outside View

Transom

Hole

Flat aft of Intake

Merges smoothly back to bottom shape.

INSTALLATION MOUNTING BASE DETAILS



COLORADO EXPLORER SERIES:

FLAT MOUNT:

This is the simplest to install, the jet shaft line being parallel to the keel. It can be used for most small and moderate power engines with moderate flywheel diameter.

In fibreglass hulls, the distance from the engine crankshaft centreline down to the outside of the flywheel housing should not be greater than about 6 inches if the flat mount is to be used and drive shaft universal angles kept within recommendations.

5° ANGLE MOUNT:

This angled installation has no effect whatever on performance, but has been introduced to allow the use of modern engines which tend to have larger diameter flywheels. Almost all American V8 engines require the angle mount to obtain flywheel clearance, as do many other engines.

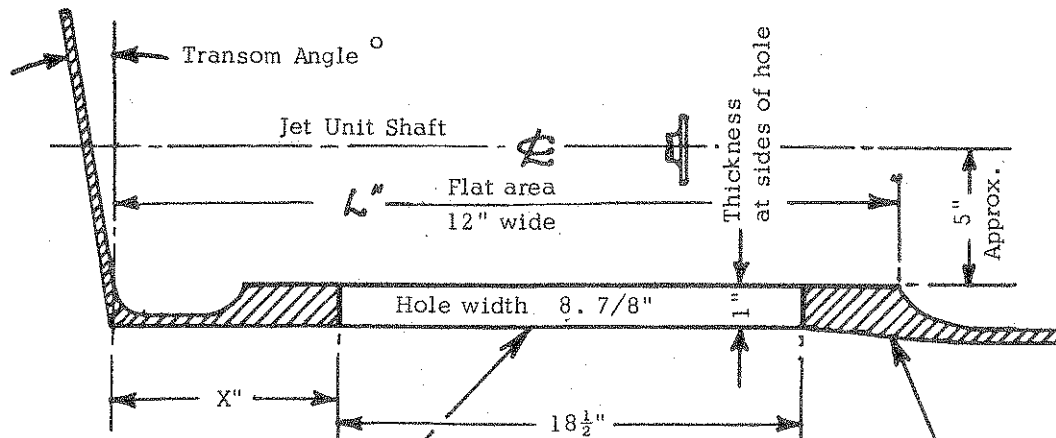
INTAKE SCREENS:

Note that the intake screens for the flat mount and the angled mount are different. Specify which mounting method is being used when ordering the jet unit. (Also, whether "stone" or "weed" screen is required).



MOUNTING BASE DETAILS

STANDARD FLAT MOUNTING

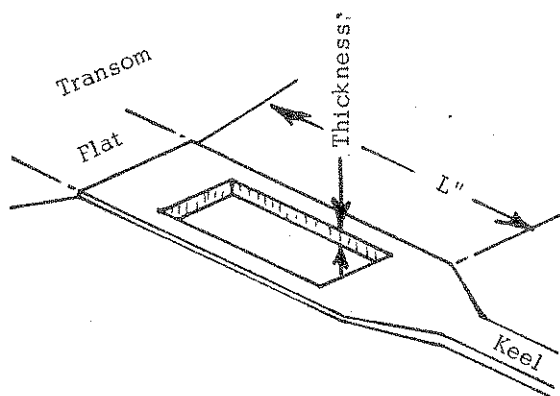


INTAKE SCREENS:

For stones use JE118SY

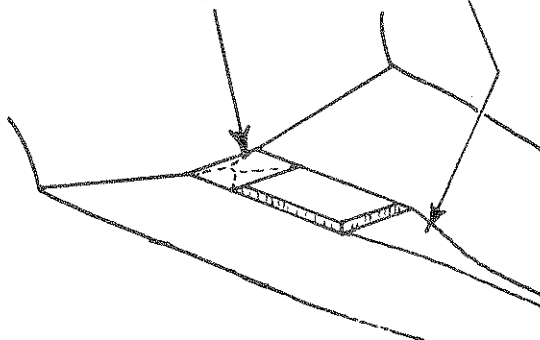
For weeds use JE 241SY

MERGE SMOOTHLY INTO BOTTOM



INSIDE VIEW

Flat Aft of Intake, or merge with bottom vee as desired.



VIEW OUTSIDE

TABLE FOR DISTANCE X"

TRANSOM ANGLE $^{\circ}$

Forward sloping
transom not
recommended.

Recommended
Range.

Reverse fitting
difficult. Not
recommended.

Recommended:					Recommended:					Recommended:				
L"	-8 [°]	-6 [°]	-4 [°]	-2 [°]	0 [°]	2 [°]	4 [°]	6 [°]	8 [°]	10 [°]	12 [°]	14 [°]	16 [°]	
26"	7½"	7¼"	7"	6¾"	6½"	6¼"	6⅛"	5⅞"	5⅝"	5½"	5¼"	4⅞"	4⅝"	

X" EXPLORER
Short 2-stage (2C)

30 1/4"

ADD 4 1/4" to above Single Stage Dimensions

X" EXPLORER
3-stage (3C)

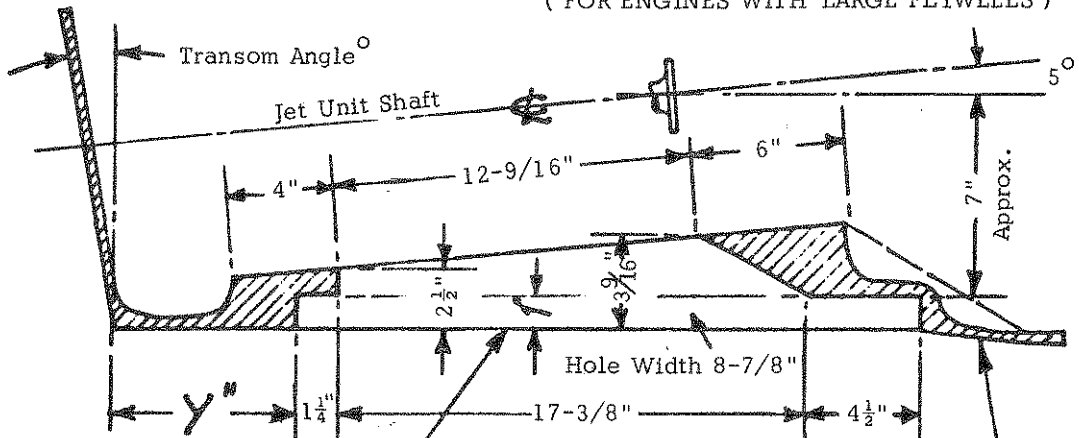
34 1/2"

ADD 8 1/2" (Also suits long 2-stage 2B)

MOUNTING BASE DETAILS

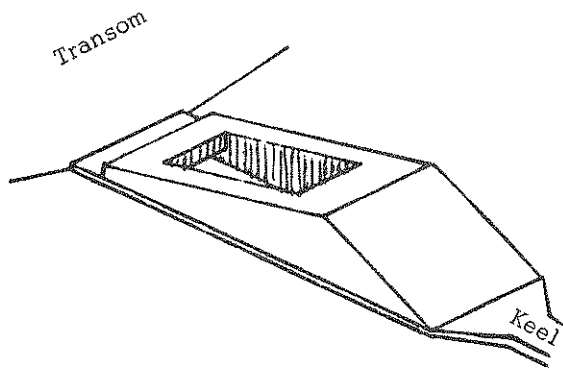


5° ANGLE MOUNT:
(FOR ENGINES WITH LARGE FLYWHEELS)



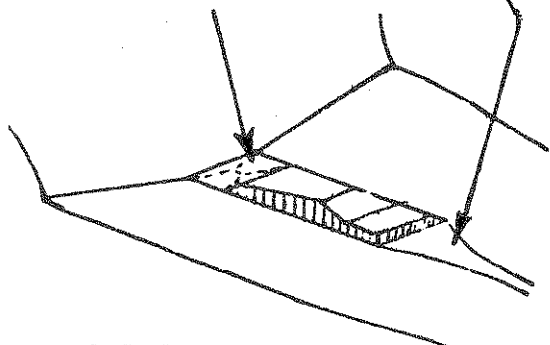
INTAKE SCREENS:
For Stones use JH218SY
For Weed use JH244SY

MERGE SMOOTHLY INTO BOTTOM



INSIDE VIEW

Flat Aft of Intake, or merge with bottom vee as desired.



VIEW OUTSIDE

TABLE FOR
DISTANCE Y"

(x - 1 1/4")

TRANSOM ANGLE °

Forward Sloping
Transom
not recommended

RECOMMENDED
RANGE

Reverse fitting
difficult
Not recommended

-8°	-6°	-4°	-2°	0°	2°	4°	6°	8°	10°	12°	14°	16°
8 1/2"	8 1/4"	8"	7 3/4"	7 1/2"	7 1/4"	7 1/8"	6 7/8"	6 5/8"	6 1/2"	6 1/4"	5 7/8"	5 5/8"

EXPLORER
SINGLE STAGE (1B)

Y" EXPLORER
SHORT 2-STAGE (2C)

Y" EXPLORER
3-STAGE (3C)

ADD 4 1/4" to above Single Stage dimensions.

ADD 8 1/2" (Also suits long 2-stage 2B)

ENGINE INSTALLATION

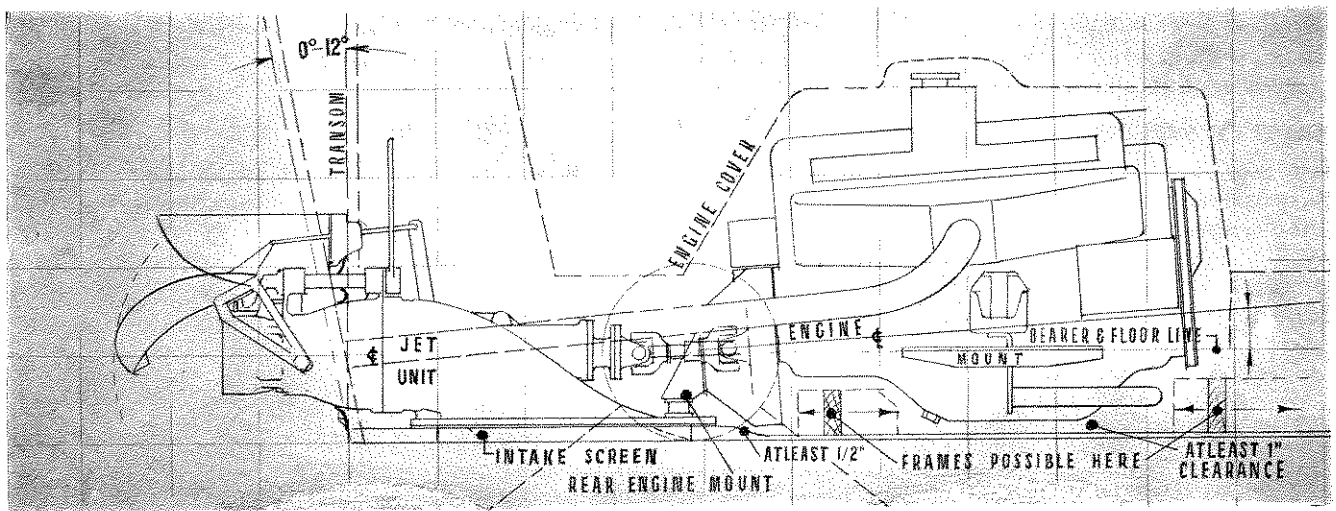


POSITION

The engine should be mounted where recommended by the hull designer, or astern of this position. The latter may improve priming when starting, will give more forward cockpit space, and may improve top speed. The closest possible position to the jet unit will be the length of the standard Hamilton drive shaft (available as an extra). This shaft is approximately 12in. long.

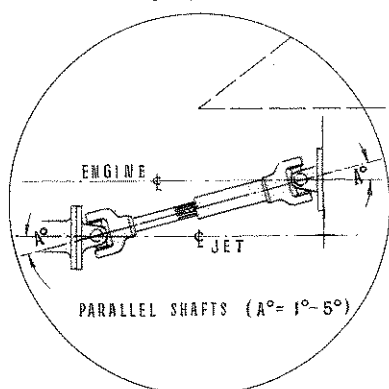
LEVEL

Mount engine on longitudinal bearers so that the crankshaft line is preferably level with the keel, and with a small clearance of about 1in. under the oil sump.

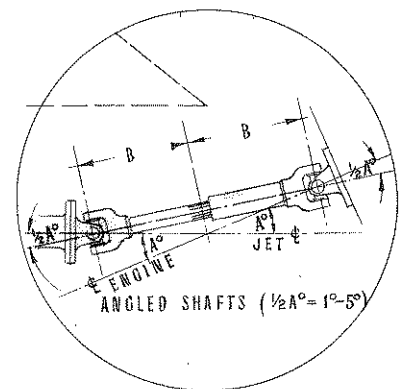


DRIVE SHAFT

The drive coupling on the jet is made to take the Hardy-Spicer universal joint used on most small and medium cars. Use a double universal joint shaft with a sliding spline of a length to suit the chosen engine position. The standard Hamilton drive shaft assembly is approximately 12in. long. Run the universal joint at a slight angle, to avoid vibration, but not too great an angle which would cause wear. Make sure that the two centre yokes are in the same plane, the outer yokes in the same plane to avoid torsional vibrations. No special care is required in lining up the engine; the universal will take care of small differences.



ALTERNATIVE UNIVERSAL ARRANGEMENTS



IMPORTANT Limit universal angles to a maximum of 5° on each joint, which is about $\frac{3}{4}$ " offset on the usual short shaft.



STEERING

Good quality steering is of paramount importance in a jet boat. Their cat-quick response and fine control lead the boater into tight corners where reliable steering is essential.

The most adaptable and lightest method of connecting the steering wheel forward to the unit steering arm aft is the cable and pulley system. It is almost completely frictionless, quite positive, and allows the normal self-centering feature similar to a motor-car.

DRUM STEERING

Connected with four single pulleys and a standard marine steering unit incorporating a cable drum, steering is obtained at minimum cost.

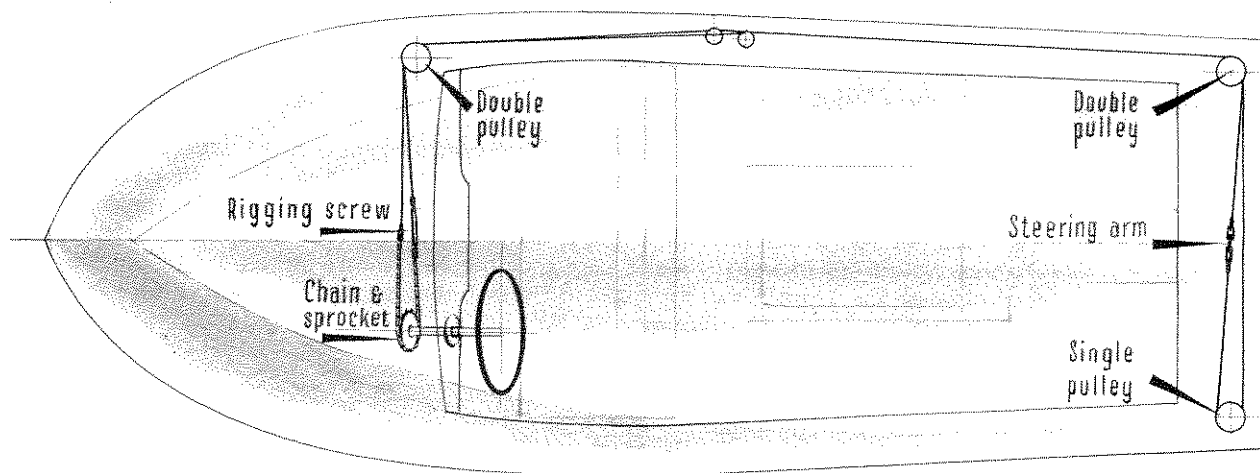
CHAIN & SPROCKET

A better system is to use a chain and sprocket forward on the steering wheel shaft, and a cable arrangement as shown. (See diagram).

RATIO OF STEERING

In either case, a steering ratio giving about $\frac{3}{4}$ - $1\frac{1}{2}$ TURNS from lock to lock should be aimed at for small craft, slightly more for larger craft with bigger engines. Do not use any springs in the run of cable - the cable should be solid throughout.

If propriety push-pull cable steering units are used, the cable should be attached part way down the steering arm to achieve the desired steering ratio.



Ensure that the propriety push-pull cable system is of sufficient strength to get maximum movement from the deflectors while in the hard over lock position under power. Some push-pull steering systems will achieve full lock on the steering while under power, but only $\frac{1}{2}$ full lock on the deflectors as the cable just buckles in the middle.

Do not economise on the steering equipment. Use first quality workmanship and parts only.

REVERSE CONTROL



A good solid frictionless bell-crank system is recommended. The final arrangement will depend largely on the hull layout, but links should be made of light gauge tubing and be as straight and direct between pivots as possible, axles should be of ample diameter to stand the torque, and pivot brackets sturdily mounted on the hull structure with no flexibility. A suitable hand lever should be arranged so that the driver's hand moves through a distance of about 12-18in. This will give a satisfactory mechanical advantage. A quicker acting lever will be too heavy, and a longer movement too slow and unwieldy. After fitting the reverse hand control, always check on the correct movement of the reverse deflector aft. There may be many other satisfactory methods of operating the reverse deflector, such as a push-pull cable, or wire rope setups, but the above well tried arrangement is recommended.

PUSH-PULL SINGLE CABLE FOR REVERSE CONTROL

Although the reverse control lever on the Hamilton Colorado Explorer Series of Jet Units is primarily designed to be operated by a solid push-pull control rod through to the driver's position, many boat-builders will prefer to use propriety single cable controls commonly on the market. In many cases this eases installation because of the flexible cable between unit and driver.

If this is done, we recommend the following arrangements;

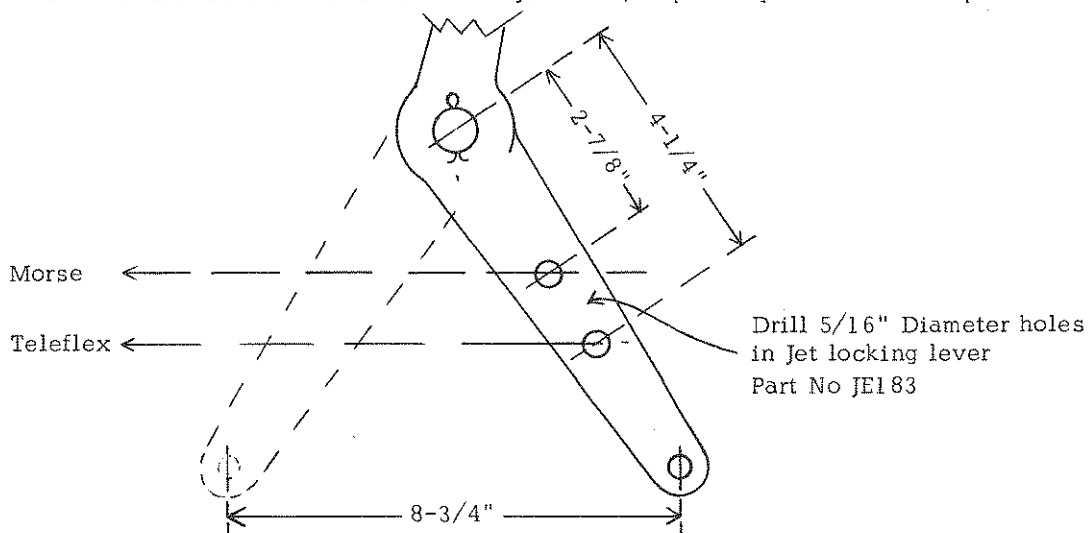
TELEFLEX QUADRANT MARINE CONTROL:	Hand lever:	Model K 11
	Cable:	Model K 30
	Stroke:	6 inches
	Pin diameter:	5/16in.

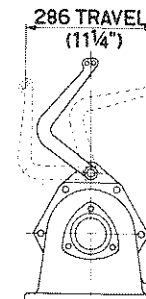
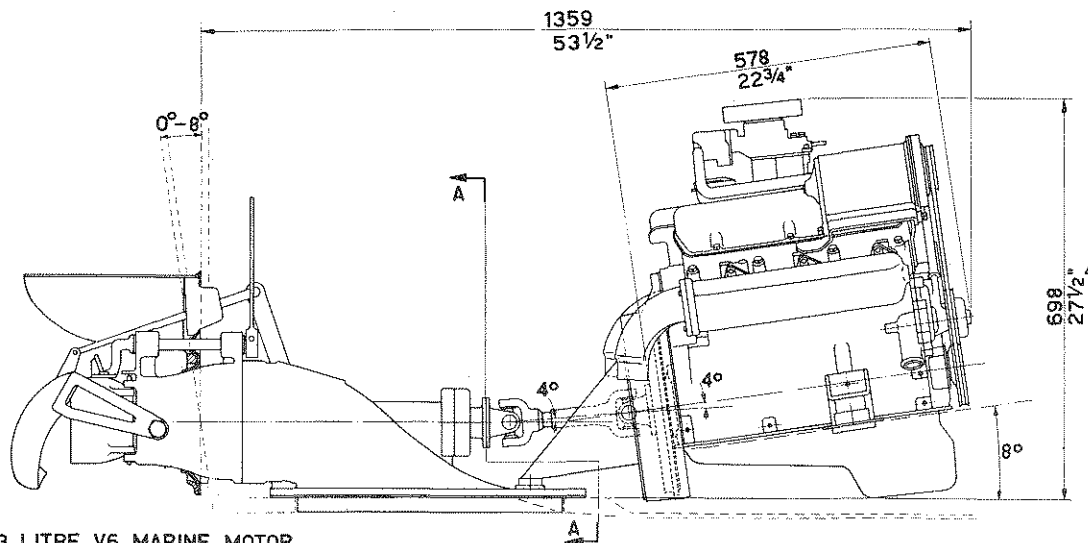
This is the preferred unit due to its long stroke. For further details ask your Teleflex stockist for information sheets MA 12 and MA 9.

MORSE MARINE CONTROL:	Hand lever:	Model MC. (with throttle, use MJ)
	Cable:	Model 64-C
	Stroke:	4 inches
	Pin diameter:	5/16in. Use clevis A29132

For further details refer to the Morse Marine Control and Accessories Catalogue available from your nearest dealer.

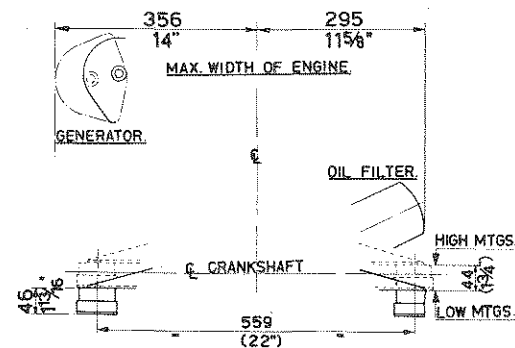
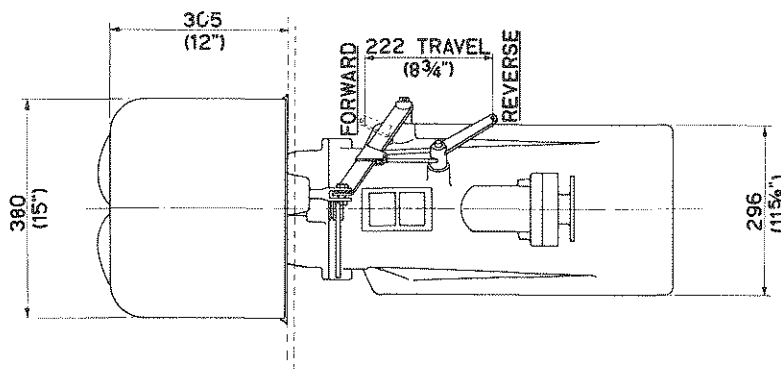
NOTE: The outer cable anchor mounting should be arranged horizontally, and at such a height that the scope of movement of the swivel end of the cable (usually 8° - 10°) is not exceeded over the travel of the jet lever, especially in the reverse position.





VIEW ON A-A
SHOWING MOVEMENT
OF STEERING ARM.

FORD 2 1/2 & 3 LITRE V6 MARINE MOTOR
WITH
HAMILTON COLORADO EXPLORER JET
SINGLE STAGE.



END VIEW SHOWING ENGINE
MOUNTINGS.

TYPICAL INSTALLATION

98378

