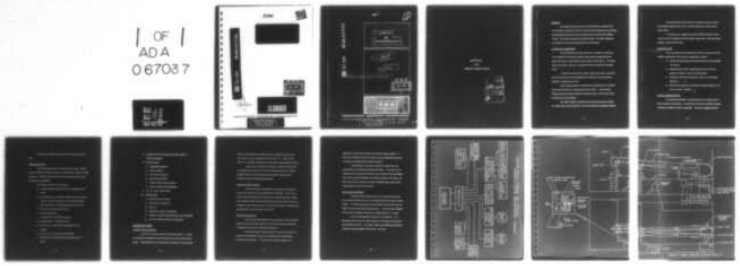
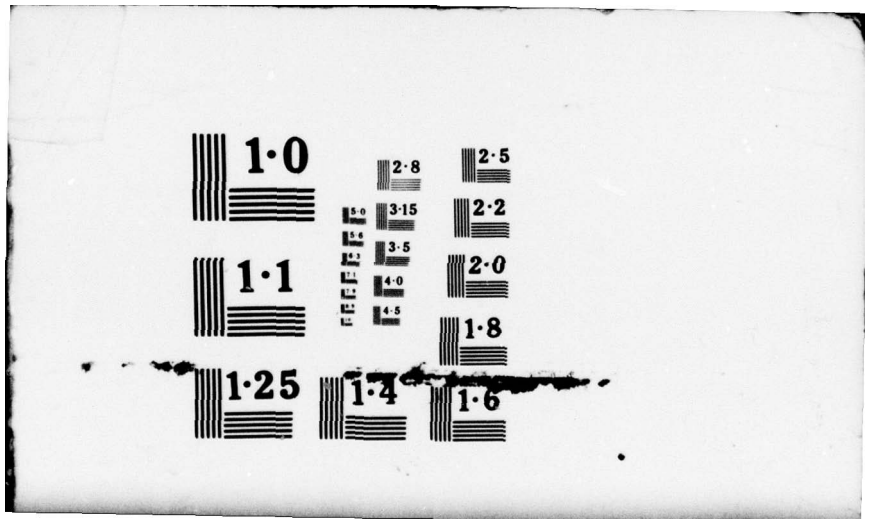
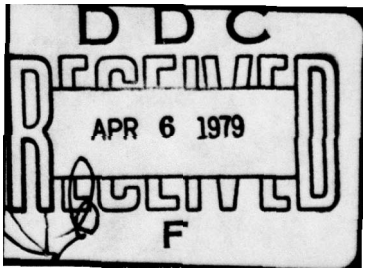
AD-A067 037 INSTRUMENT SYSTEMS CORP HUNTINGTON N Y F/G 17/1
DESCRIPTION VDS TOWLINE FLEXING FACILITY.(U)
1969 N140(62462)77644B
UNCLASSIFIED NL

1 OF 1
AD A
067037



END
DATE
FILMED
6-79
DDC


1·0
1·1
1·25
1·4
1·6
1·8
2·0
2·2
2·5
2·8
3·15
3·5
4·0
4·5


DDC
APR 6 1979
F

LEVEL II

1

AD A067037

DDC FILE COPY

(6) DESCRIPTION

VDS

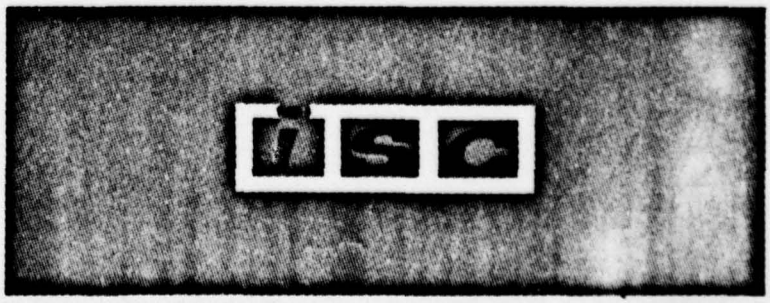
TOWLINE FLEXING FACILITY.

(11) 1969

(12) 19p

(15) N140(62462)77644B

DDC
RECEIVED
APR 6 1979
F



instrument systems corporation

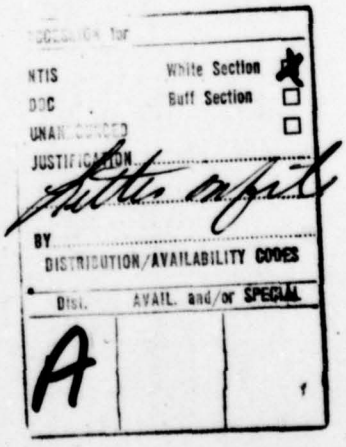
770 Park Avenue, Huntington, L.I., New York 11748 Telephone: 516-HAmilton3-6200 TWX: 516-421-4042

401 603

DESCRIPTION

VDS

TOWLINE FLEXING FACILITY



GENERAL

The UNITED STATES NAVAL APPLIED SCIENCE LABORATORY VDS TOWLINE FLEXING FACILITY was built by ISC/Telephonics in accordance with design plans prepared by ISC/Telephonics under contract N140-(62462) 77644B. New Government owned and furnished AN/SQA-8 VDS Hoist equipment was modified by ISC and incorporated into this test facility.

FUNCTIONAL DESCRIPTION

The VDS TOWLINE FLEXING FACILITY is capable of subjecting VDS TOWLINES to controlled variable tensions while simultaneously this cable is driven in a reciprocating motion around a driven sheave. The linear travel of the cable, under test, is adjustable within controlled and specified limits. → (cont on p. 2)

To enable the test facility to handle various size cables, provisions have been made for the interchangeability of sheaves of various diameters, adapted to a standard type of hub.

Cable cycling direction is automatically controlled by cam operated limit switches which are actuated by the drum rotation. These switches energize solenoid operated hydraulic directional control valves which control the direction of drum rotation.

The Cable Tension is controlled by the hydraulic pressure setting of a relief valve and the "head end" area of the hydraulic Tensioning Cylinders.

Several protective safety devices are provided to prevent system and personnel damage in the event of critical component or control mechanism failure.

An enclosed area, separate from the FLEXING FACILITY is provided for by ISC/Telephonics for the storage of space parts, cable specimens, fairings, instruments and tools.

SPECIFICATIONS

(cont fr p 1)

The test facility has been designed and built in accordance with the contract requirements which provides a capability as follows:

(a) Varying and maintaining cable tension loads up to and including 100,000 lbs;

(b) Adjustable cable stroke, depending upon size of cable and diameter of sheaves, from 5 to 20 foot stroke;

(c) Handling various sheave diameters, from 3 to 10 feet pitch diameters; and

(d) Subject cable samples to reciprocate at linear speeds up to 60 feet per minute, maximum.

FUTURE CONSIDERATIONS

The existing test facility is located adjacent to an outdoor pool 25 feet by 15 feet by 12 feet deep. An overhead 6 ton crane is provided to handle TOWLINE FLEXING FACILITY equipment. The pool is equipped with the

necessary pump and filtering equipment required for the proper operation of such facility.

To provide for such possible future use of the pool in testing of VDS Towlines underwater, the driving drum has been located within the test facility at a point close to the pool.

DETAIL DESCRIPTION

VDS TOWLINE FLEXING FACILITY

The test facility consists of the following major components and assemblies:

a) Drum

b) Cable Tensioning Cylinders

c) Sheave and Sheave Supports

d) Hydraulic Power Unit

e) Motor Controllers, 10 H.P. and 40 H.P.

f) Control Station and Mechanism

g) Cable Assembly

h) Component Support

i) Junction Box

j) Electric Power Supply

115V AC 1ø 60~

220V AC 3ø 60~

DESIGN PHILOSOPHY

The basic design philosophy of the flexing facility was to provide a machine capable of subjecting VDS TOWLINES to tensile loads of up to 100,000 lbs. and to maintain all loads, motions and reactions internal to the machine. Therefore, no loads, motions or reactions will be induced into the already existing structure.

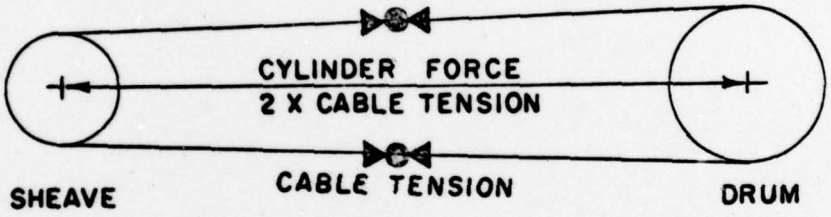


DIAGRAM SHOWING $\Sigma_F = 0$

DRUM

The Drum is a modified AN/SQA-8 which is supported at both ends by large ball bearings which carry all imposed loads into their respective supporting stanchions.

The starboard stanchion houses the cable travel limit switches and cams. The port stanchion houses a compound gear assembly 9.2 to 1 reduction and supports an external planetary gear box assembly 50 to 1 reduction. The external gear box supports on its input shaft end an emergency drive

system for use in the event of power failure, a torque limiter and the hydraulic drive motor.

Specifications of the drum and drive are as follows:

a) Distance between flanges 25-5/8 inches

b) Drum O.D. 67.71 inches

c) Torque limiter 50 foot lbs. maximum

d) Hydraulic motor

1600 RPM maximum

5.98 cu.in. Displacement/rev.

40 H.P.

953 in lb. Torque at 1000 psi

2500 psi maximum pressure

TENSIONING CYLINDERS

Tension loads are applied to the test cables by hydraulic pressure at the head end of the cylinders. Applied loads are in direct proportion to the area of the hydraulic cylinder and the hydraulic pressure applied. Variability of cable test tensions are simply accomplished by adjusting the pressure setting of the hydraulic system pressure.

The two hydraulic rensioning cylinders are pinned at both ends by universal type fittings to accommodate racking effects.

Specifications for the tensioning cylinders are as follows:

a) Sheave Weldment

b) Hub Weldment

The Hub is an annular shaped weldment with a pressed in bronze bearing. Six machined pads are provided along the outer surface of the weldment which mates with similar pads of the sheave weldment.

The sheave weldment is formed by an outer and inner ring secured to each other by means of a stiffener and ribs. Machined pads are welded to the inner surface of the inner ring to mate with the hub. The hub and sheave are then bolted together to form an integral sheave assembly.

The specifications of the sheave provided under this contract are as follows:

a) 50 inch pitch diameter

b) 1-9/16 inch cable groove diameter

c) 4 inch groove flange height

Due to the possibility of sheave support racking, the sheave support is constructed in two parts. The upper portion containing the shaft, bearing and sheave is free to swivel in relationship to the lower support structure. In the event of tension cylinder racking, torsional stresses will not be induced into the support structure or transferred to the supporting deck structure.

HYDRAULIC POWER UNIT

The hydraulic power unit contains all of the hydraulic valves, solenoids, pump, motors and safety devices to provide hydraulic power

to the drum and cable tensioning cylinders. It houses a self contained 150 gallon reservoir for the hydraulic system. The hydraulic power unit consists of the following major components:

a) 150 gallon oil reservoir

b) Tension cylinder manifold

c) Drum drive manifold

d) Auxiliary device manifold

e) 10 H. P. motor and pump for control and replenishing pressure

f) Junction Box for electrical interconnection

g) 40 H. P. motor and pump for drum drive and tension cylinder pressure and flow

h) Pump stroking control

i) Hydraulic piping

j) Electrical circuitry

The two variable displacement pumps are driven by the 40 H. P. electric motor. These pumps supply hydraulic fluid to the drum drive and cable tensioning cylinders. Pump delivery can be varied from zero flow to maximum flow by stroking the control stem of either pump, changing the internal pump piston displacement.

The stroking of the pumps is remotely controlled from the Control Station and form part of the automatic control system governing the cable tension and cycling.

The specifications of components of the hydraulic power unit are as follows:

a) 40 H. P. Pumps

9.48 cu. in/rev. displacement

1150 RPM

2500 psi maximum

31 GPM at 1500 psi

b) 40 H. P. Electric Motor

Squirrel cage, induction

1150 RPM

220/440 V AC 3Ø 60 ~

c) 10 H. P. Electric Motor

Squirrel cage, induction

1150 RPM

220/440 V AC 3Ø 60 ~

d) 10 H. P. Replenishing and Control Pressure Pump

Double tandem design fixed displacement

Vane type

1000 psi maximum pressure

20 GPM at 1000 psi

MOTOR CONTROLLERS

Two motor controllers are used; size 3 controller is used for starting and protecting the 10 H. P. electric motor and the size 4

controller is used for starting and protecting the 40 H. P. electric motor.

Both controllers are AC magnetic across the line starting devices used for energizing and de-energizing the electric motors on the hydraulic power unit. These controllers are activated by depressing push buttons on the Control Station. Both controllers are designed for 220/440 V AC 3ø 60~ power supply operation and consist of contactors which are electrically and mechanically interlocked to prevent accidental closing of contactors under conditions of shock, vibration and tilt.

The overload relays used are inherently compensated so that tripping and resetting times are not affected by variations in the ambient temperatures.

The controller relays are remotely operated from the Control Station by 115 V AC 1ø 60~ power. When the contactors are energized, they apply 220 V AC power to 10 and 40 H. P. electric motors on the hydraulic power unit.

Interlock devices are provided in the motor controller circuitry to prevent accidental starting of the 40 H. P. electric motor prior to starting of the 10 H. P. electric motor. Further, this interlock assures that the 40 H. P. electric motor will be stopped prior to stopping of the 10 H. P. electric motor thus assuring air free hydraulics and adequate hydraulic pressure.

These motor controllers also provide for low voltage protection.

CONTROL STATION

The Control Station has been provided so as to start, stop and run the FLEXING FACILITY in either the AUTOMATIC or MANUAL MODE operations. Within the console itself, the necessary automation relays and devices are assembled.

The console provides for the following:

a) Accurate hydraulic pressure which is maintaining cable tension

b) Hand control lever to manually operate the Cable Tension and flow of oil to the head end of the Tension Cylinders

c) Hand control lever to oscillate the drum and test cable

d) OFF-ON-OFF Master power switch

e) Mode Selector Switch.
AUTOMATIC-OFF-MANUAL operation

f) Sequence Switch - AUTOMATIC-OFF

g) 40 and 10 H.P. START-STOP-EMERGENCY RUN switches

h) 40 and 10 H.P. START BY-PASS switches

i) MAINTAIN CABLE TENSION (H_1) solenoid ON-OFF switch

j) WARNING BUZZER indicating that cable tension is not being maintained

k) Pressure gages:

1) Replenishing pressure

2) Control pressure

3) Cable Pay out pressure

4) Cable Haul in pressure

5) Tension Cyliner extend pressure

6) Tension Cylinder retract pressure

l) 115 V AC 1ø 60~ power fuses

m) Indicator lights

1) DRUM PAY OUT direction

2) DRUM HAUL IN direction

3) Power on

4) TENSION CYLINDER EXTENDING

5) TENSION CYLINDER MAINTAINING CABLE TENSION

6) LOW OR LOSS OF HYDRAULIC PRESSURE

CONTROL MECHANISM

CABLE CYCLING CONTROL

The drum is cycled by means of the hydraulic power. A means for automatic reversing the drum direction has been incorporated into the design. Fundamentally, the reversing system consists of a cam operated

switch, which energizes a latching relay that energizes the proper solenoid valve K_A or K_B of directional control valve "K". Pump Control Valve C-C is returned to minimum stroke thereby avoiding hydraulic shock.

In the event of a hydraulic line failure, a HYDRA-GUARD Pressure Gauge Switch will detect the pressure drop and secure the complete hydraulic power unit thus preventing the possibility of damage to the FLEXING FACILITY and operating personnel.

CABLE TENSION CONTROL

Cable test tension is maintained by the application of hydraulic pressure to the head end of the TENSIONING CYLINDERS. Due to the attendant leakage present under the high system operating pressure, a small rate of hydraulic fluid flow is required through directional control Valve H_1, to maintain cable tension; therefore, the pump must be kept at minimum flow, approximately 5 GPM while cable is under test.

PROTECTIVE DEVICES

Due to the high loads imposed on the equipment, and the automatic operation of the test facility, protective devices which detect malfunctions or departures from normal operation are required.

The two basic types of motion involved in the test facility are the extension and retraction of the tension cylinders and the reciprocating rotary motion of the drum. Over travel of the tension cylinders are

detected by a limit switch mounted on the sheave support bracket. In the event of actuation of the limit switch, the entire hydraulic power unit is secured, preventing further cylinder extension.

The prevention of excessive rotary drum motion will be accomplished by a compression actuated limit switch. The switch will be mounted on the drum and will be preset so that whenever the cable fittings come within a specified distance from either the sheave or the drum, the limit switch will be actuated, securing the hydraulic power unit and preventing further travel of the test cable.

DRIVE CABLE ASSEMBLY

The drive cable assembly consists of a closed loop formed by the test cable assembly and a wire rope assembly linked by means of cable fittings. The wire rope assembly is permanently secured to the drum by means of the lead lined cable clamp assembly. To prevent cable slippage, the wire rope is wrapped around the drum approximately 5 1/2 wraps.

The wire rope assembly consists of 2 1/4 diameter, 6 x 19 galvanized monitor steel wire rope-regular lay, with open wire rope sockets and links at each end. The cable, socket, and socketing joint develop a minimum tensile strength of 390,000 lbs. (195 tons).

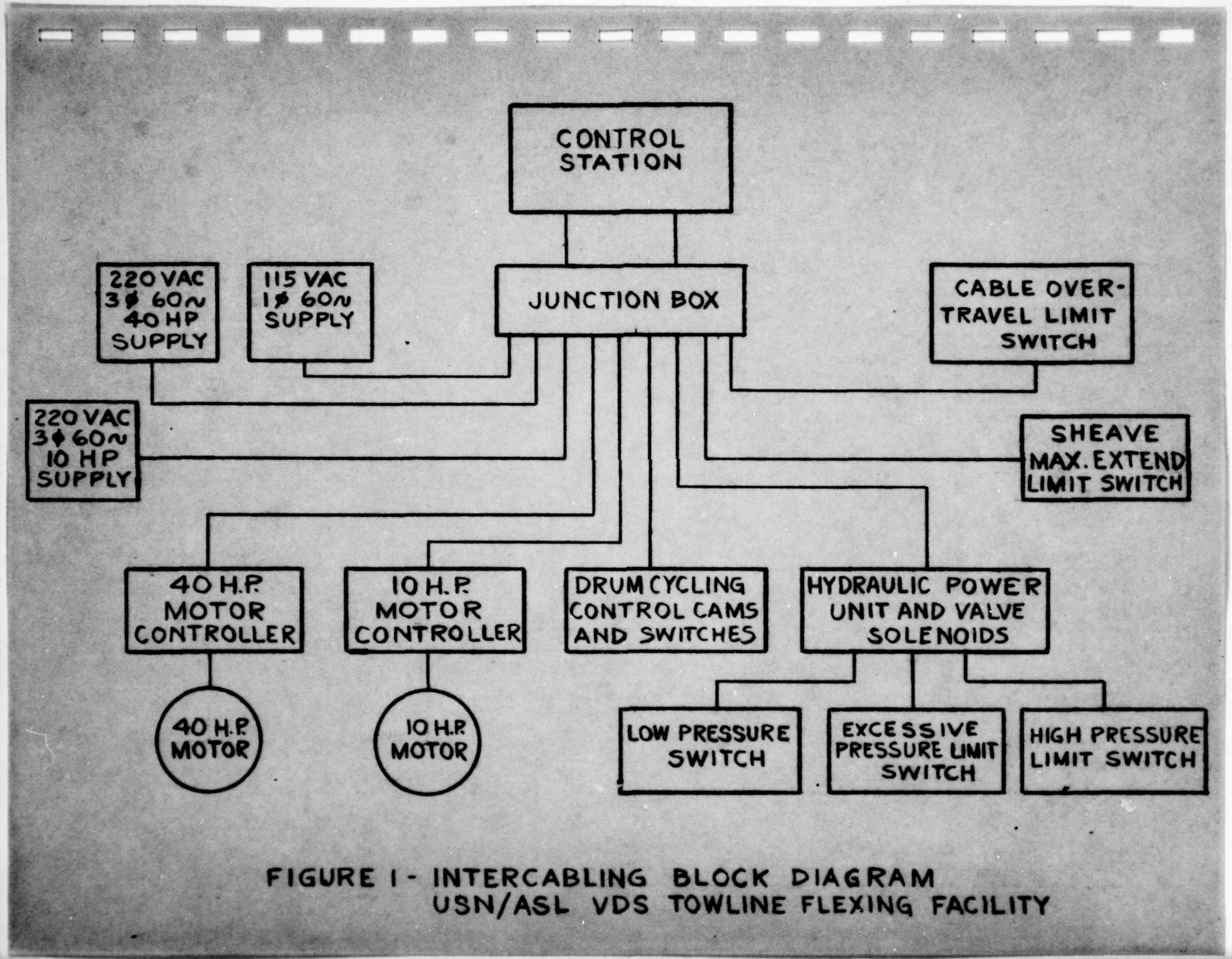
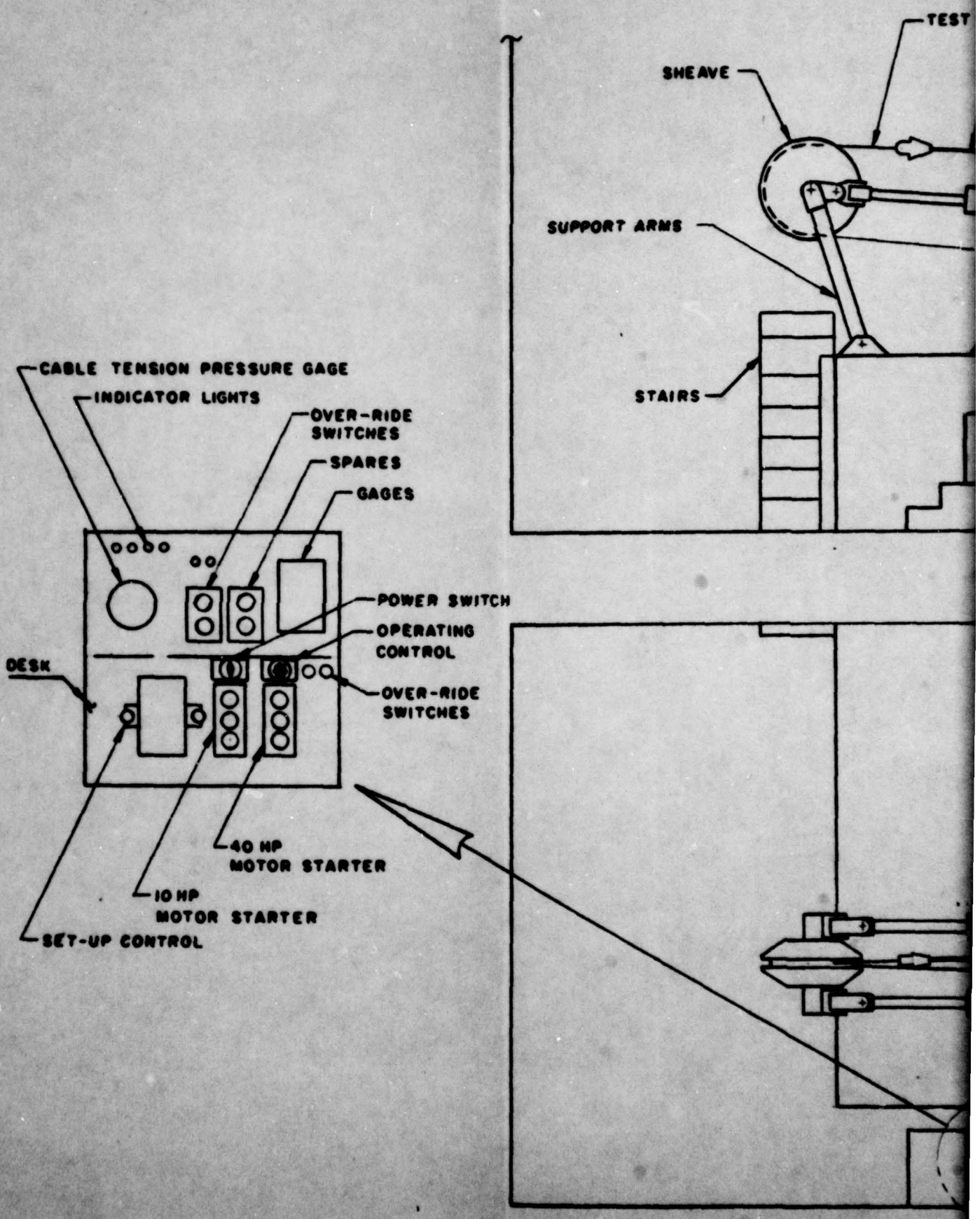


FIGURE 1 - INTERCABLING BLOCK DIAGRAM
USN/ASL VDS TOWLINE FLEXING FACILITY


TEST
SHEAVE
SUPPORT ARMS
STAIRS
CABLE TENSION PRESSURE GAGE
INDICATOR LIGHTS
OVER-RIDE SWITCHES
SPARES
GAGES
POWER SWITCH
OPERATING CONTROL
OVER-RIDE SWITCHES
DESK
40 HP MOTOR STARTER
10 HP MOTOR STARTER
SET-UP CONTROL

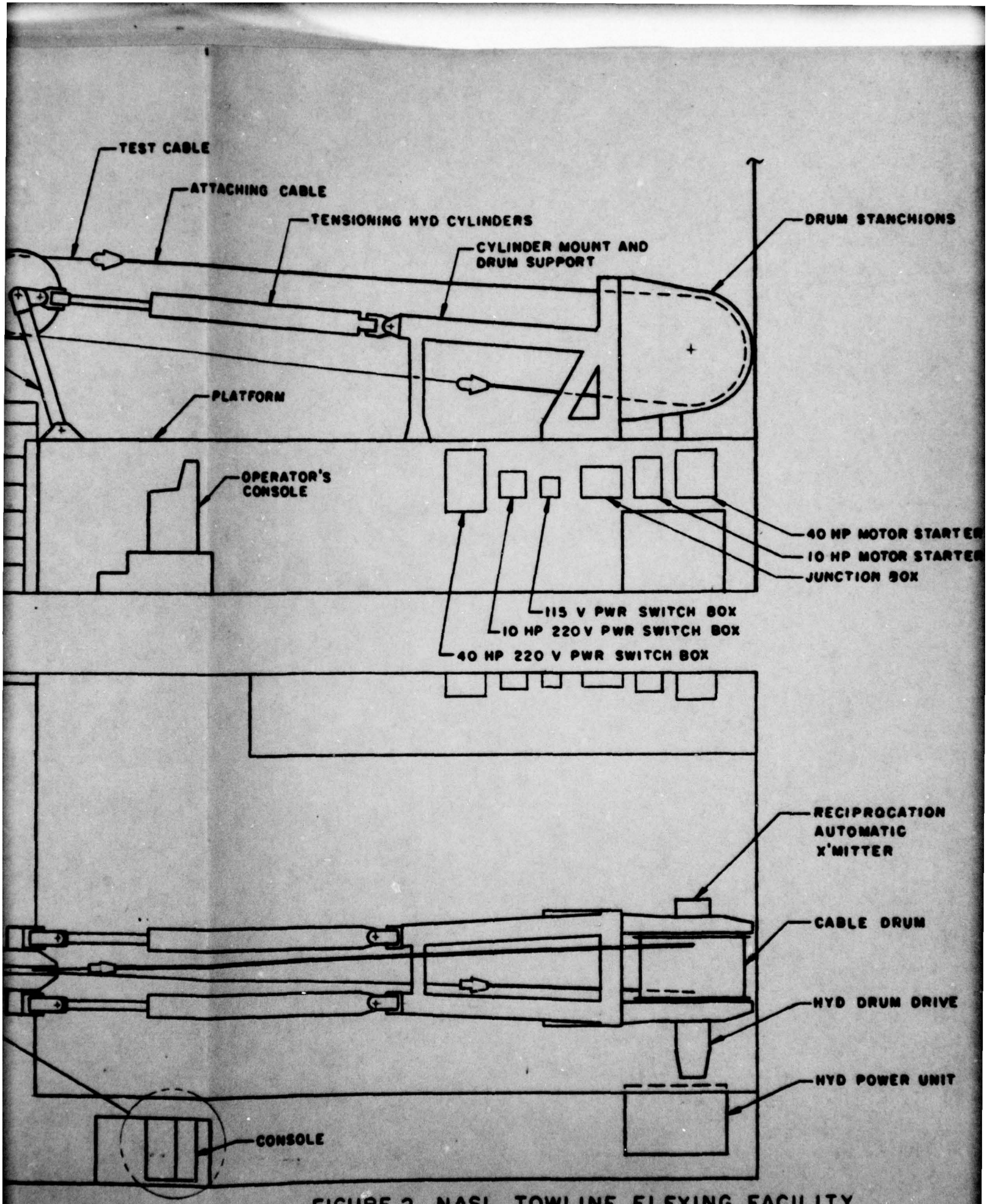


FIGURE 2 NASL TOWLINE FLEXING FACILITY