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Handwritten initials, possibly 'JL' or 'JD', in dark ink.

PLAINTIFF'S EXHIBIT

UPRC-141

INTER-OFFICE CORRESPONDENCE

TO: R. A. Arthur

OFFICE: FW 2804

FROM: M. A. Hawkinson

DATE: 12/02/86

SUBJECT: M&M Protection Consultants Inspection Reports
November 10, 11, 1986

Enclosed please find copies of subject reports. This office would appreciate management comments concerning Mr. Frisbie's recommendations within about 30 days.

A handwritten signature in dark ink, appearing to read 'Mark A. Hawkinson'.

Mark A. Hawkinson

MAH/pah/77

cc: R. E. Schneck
R. A. Loveless

CH/W-002517



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PROPERTY LOSS PREVENTION REPORT

CHAMPLIN PETROLEUM COMPANY
REFINERY AND CRUDE TERMINAL
Corpus Christi, TX 78400

INSPECTED BY: C. V. Frisbie
DATE: November 10-12, 1986

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PROPERTY LOSS PREVENTION REPORT

CHAMPLIN PETROLEUM COMPANY
REFINERY AND CRUDE TERMINAL
Corpus Christi, TX 78400

INSPECTED BY: C. V. Frisbie

DATE: November 10-12, 1986

CONFERRED WITH: Mr. R. A. Arthur, Superintendent Operations
Mr. J. W. Bryant, Manager Employee Relations
Mr. Robert Loveless, Manager of Safety
Mr. L. E. Rolando, Safety Engineer

DESCRIPTION OF OPERATIONS:

This is a 170,000 barrel per day petroleum refinery. The refinery operations are separated into four areas. These are the East Plant No. 1 and East Plant No. 2, the West Plant, Area 90 Tank Farm, and Area 91 Tank Farm. In addition, docks on the Industrial Canal are separated from exposure by operating facilities. The refinery operates continuously with process areas constantly attended. A total of 585 employees work three 8-hour shifts, 7 days per week. There are 59 employees at East Plant No. 1 and No. 2 and 15 employees at the West Plant reporting on a minimum shift.

CONSTRUCTION:

Buildings are predominantly one story without basement of noncombustible construction. Frame construction is generally limited to cooling towers. Process equipment is located in the open. In East Plant No. 2 and the West Plant, fire proofing material has been provided on the inside and outside of tower skirts as well as along the pipeways. In East Plant No. 1, there are some unprotected supports, or supports having insulation only, installed in these areas. Tanks are located for the most part within standard individual and common dykes. Horizontal bullet-type tanks and pressure storage service such as propane, etc. are not generally provided with dykes, however these are adequately separated from most process areas.

EXPOSURES:

East Plant No. 1 is exposed on the south by an adjacent refinery. East Plant No. 2 has no exposure to the north and west with exposure to the south and east being East Plant No. 1 and Tank Farms. West Plant is surrounded by open fields. Process Units in East

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Plant No. 2 and the West Plant are well spaced with little congestion. Congestion in the older process areas of East Plant No. 1 is considered severe. A truck loading terminal is located well away from process areas at the intersection of Buddy Lawrence Drive and Oak Park Avenue.

PROCESSES AND SPECIAL HAZARDS:

Crude oil and gas condensate are received via pipeline and tankers. It is processed in conventional refining units including crude topping with associated vacuum operation, catalytic cracking, alkylation, reforming together with associated treating units. In addition, aromatic operations are conducted in the East plant as well as coke and sulfur production at the West Plant facilities. Products and crude oil storage is provided in various tanks contained within standard, and individual dykes, excluding pressure storage in isolated incidents. Tanks, for the most part, are gas tight. Products are shipped by pipeline, tanker, truck, and rail. All products, with the exception of coke and sulfur, are shipped to East Plant facilities while coke and sulfur are shipped by truck and rail at the West Plant. Process equipment is of modern design and incorporates basic safety features.

COMMON HAZARDS:

Electricity is received from public utility through a double feed to the East and West Plants. A manual tiebreaker is provided. The largest single users of electricity is the 4,000 horsepower motor on the blower at No. 1 Cat in East Plant No. 1 and the Recycle Gas Compressor in No. 4 Platformer in East Plant No. 1. In East Plant No. 2, the largest single user is a 6,000 horsepower motor on the blower at No. 2 Cat. In the West Plant, the largest user is a 3,500 horsepower motor on the Recycle Gas Compressor of No. 5 Platformer.

Emergency generators for some lights and critical instruments are provided at the West Plant, East Plant No. 2, No. 4 Platforming Unit, No. 1 Crude Unit and No. 1 FCCU. The generators are driven by diesel engines and rated as follows:

West Plant	388 KVA
East Plant No. 2	300 KW
No. 4 Platforming Unit	50 KW
No. 1 Crude Unit	25 KW
No. 1 FCCU	25 KW

Electrical installations at this plant are fairly well maintained and explosion-proof equipment is installed with conduits properly sealed where required.

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In East Plant No. 1 and No. 2 there are two air systems, one for plant air at 100 psi and one for instrument air at 85 psi. In East Plant No. 1, the system is supplied by two motor driven air compressors, one a centrifugal unit and one a reciprocating type unit. In East Plant No. 2, there are two "Centax" compressors, one driven by an electric motor and the other by a steam turbine. All units are equipped with their own dryers. In the West Plant, there are three centrifugal air compressors, two driven by electric motors and one by a steam turbine. Both plant and instrument air systems in the West Plant are rated at 100 psi.

At East Plant No. 1, there are four steam systems rated at 600 psi, 250 psi, 100 psi and 40 psi. Steam is produced at two 67,000 pound per hour @ 250 psi gas fired boilers with water level control. In addition, there are two 35,000 pounds per hour @ 250 psi gas fired manually operated boilers. Waste heat is produced at No. 1 Catalytic Cracking Unit in the amount of 10,000 pounds per hour @ 250 psi. A CO Boiler rated at 100,000 pounds per hour @ 250 psi is operated in connection with Catalytic Cracking Unit No. 1.

In East Plant No. 2, there are three steam systems rated at 450 psi, 175 psi and 65 psi. The fired boilers consist of a 220,000 pounds per hour @ 600 psi, a 130,000 pounds per hour @ 600 psi, and a 145,000 pound per hour @ 600 psi boiler. These units are gas/oil fired and are equipped with complete burner management systems. In addition, waste heat generation is produced at the following units:

Unibon	25,000 pounds per hour at 250 psi
Crude Unit No. 4	85,000 pounds per hour at 100 psi
FCC No. 2, Flue Gas	37,000 pounds per hour at 600 psi
FCC No. 2, Bottoms Cooler	50,000 pounds per hour at 100 psi
FCC No. 2, Slurry Generator	220,000 pounds per hour at 250 psi
Sulfur Units A & B	30,000 pounds per hour each at 50 psi

In the West Plant, the three steam systems rated at 450 psi, 175 psi and 65 psi are supplied from three 75,000 pounds per hour @ 450 psi gas fired boilers with complete burner management systems. Steam is generated utilizing waste heat according to the following table.

Mixed Distillate Hydrotreater	30,000 pounds per hour at 175 psi
Coker Gas Oil Cooler	35,000 pounds per hour at 450 psi
Coker Convection Section	20,000 pounds per hour at 175 psi
Sulfur Plant	65,000 pounds per hour at 65 psi

In all plants produced steam is let down to the lower rated systems utilizing rotating equipment or specifically designed letdown stations.

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Steam produced in waste heat generators at East Plant No. 2 and West Plant in the Sulfur Units is used in the Sulfur Units and associated processes.

Water for cooling and boiler feed comes through a connection to the city water system. The water is received at an average pressure of 32 psi. Make-up for the demineralizer in East Plant 2 comes through Tank No. 65. This is a 40,000 barrel tank is used as a suction source for two fire water pumps No's. 29 and 30. Only 10,000 barrels are used for the demineralizer feed with the remaining capacity reserved for the fire pumps. The East Plants (1 and 2) use 3.8 million gallons/day and the West Plant uses 0.8 million galls/day. Cooling water is recirculated utilizing cooling towers with fans equipped with vibration shut-downs.

MANAGEMENT PLANNING AND CONTROL:

(a) Housekeeping, Maintenance: Housekeeping is considered generally very good. Maintenance practices are satisfactory for refineries of this size.

(b) Smoking Control: Smoking regulations are enforced and smoking is restricted to designated areas only.

(c) Self-Inspection Programs:

Fire Equipment: All fire extinguishers and other fire protection equipment receive regular inspection and records are kept indicating the status of the equipment along with corrective action taken. Hydrostatic tests are being conducted at required intervals.

Process Equipment: An equipment inspection program consisting of the use of outside services, together with plant personnel, is in force and records are kept concerning these inspections. This program involves periodic turnarounds of the process areas with some on-stream inspections and analysis being conducted by plant personnel.

(d) Fire Brigades: The plant has organized an Emergency Response Team setting up specific individuals with specific duties to be performed in case of emergency. Individuals chosen for the fire brigade have received training at industrial fire schools or locally at locations of the company. All employees receive some training in connection with the use of hand extinguishers and hose streams annually.

(e) Cutting and Welding: When these operations are conducted outside of the shop area, combustible gas tests are conducted and a written hot work permit issued. A fire watch is provided during all operations of this type.

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- (f) **Emergency Planning:** An emergency plan has been developed and is posted at several locations throughout the refinery. Employees have been instructed as to their specific duties. This plan is reviewed annually and updated as required.

PRIVATE PROTECTION:

- (a) **Water Supplies:** There are two 1,500 gpm @ 150 psi diesel driven fire pumps located near the east gate taking suction from a 16-inch city water main in Nueces Bay Boulevard. Two 1,500 gpm @ 150 psi diesel driven fire pumps are located on the west side of the plant and take suction from a 16-inch water main in Oak Park Avenue or from a 40,000 barrel fire water tank. The pumps are manual start and require attendance to be placed in operation. Two 2,000 gpm @ 150 psi diesel driven fire pumps take suction from the 40,000 barrel fire water storage tank. These pumps are equipped with automatic controllers and will start on pressure drop in the fire system. The fire water storage tank is supplied through a 16-inch main from the city water system in Poth Lane.

Three 3,000 gpm @ 150 psi diesel driven fire pumps located at Area 90, take suction from a 3 million gallon resevoir. These pumps provide protection for the Crude Oil Terminal (Area 90) and the West Plant. These pumps are equipped with automatic controllers and designed so that on pressure drop, one pump comes on immediately with the other two pumps set on timers.

Two 3,000 gpm @ 150 psi diesel driven fire pumps provide protection for the Tank Farm Area 91. These pumps take suction from a 5 million gallon resevoir and are manual in operation.

One 3,000 gpm @ 150 psi diesel driven fire pump is provided at Dock No. 3 and provides protection for this dock and Dock No. 6. The pump is manual start or may be remotely started from Dock No. 6. This pump takes suction from the Navigational Channel and has an unlimited supply.

- (b) **Yard Mains And Hydrants:** The fire main system in East Plant No. 1 and No. 2 consists of a good network of looped 6, 8, 10, 12, and 16-inch buried mains. The 12 and 16-inch size mains are located in the East Plant No. 2 area. A dead-end 8-inch line from the plant to Dock No. 1 and No. 2 feeds hydrants, monitor nozzles and hose stations in the dock areas.

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The fire main system in Area 90, consists of looped 16-inch mains. This system has been extended to provide protection in the West Plant utilizing 6, 8, 10, 14, and 16-inch looped mains. These mains supply numerous fire hydrants, monitor nozzles, and hose stations together with water spray systems.

Area 91 has a looped main consisting of 16-inch buried line supplying hydrants well distributed around the tank farm.

All systems have good sectional control provided and relief valves are provided on the fire pumps.

- (c) Automatic Sprinklers: In East Plant No. 1, an automatic pilot head operated deluge system protection is provided over the weigh tank at the Inline Blending Facility. Manual water spray systems are provided over pumps in the BTX Unit, over pumps and under air coolers at No. 4 Platformer and Unifiner. This protection is also provided for the pumps in the Alkylation Unit. At the Cumene Unit remote operated water spray protection is provided over pumps, cabletrays and under air coolers. The pumps in No. 3 Vacuum Unit are provided with manual water spray system. In East Plant No. 2, manual water spray systems have been provided under fin fans and over pumps in all areas with the exception of area 50, the Sulfur Plant, and Area 60, the Utility Section. A manual water deluge system is provided for the Butane Surge Drum located south of Dock. No. 1. A pilot head operated automatic water spray system is installed over pumps and under the air cooler in the MTBE Unit. In the West Plant, there are 19 individual pilot operated deluge systems located in the Mixed Distillate Hydrotreater, No. 5 Platformer and Coker. In addition, the cooling tower is equipped with an automatic deluge system.

- (d) Detection And Alarm Systems:

Smoke Detection System: A Smoke Detection System of the ionization type is installed in selected areas of the laboratory.

- (e) Extinguishers, Standpipes and Hose: There is a good supply of portable and wheeled extinguishers for plant protection, well distributed throughout each area.
- (f) Other Protection: Foam hose stream protection, together with snuffing steam for Process Units, is provided. Fixed foam chambers and laterals with risers are provided on Light Oil Storage Tanks at the refinery, in Area 90 and 91. Manual water spray protection is provided for three

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spheres located north of the Vacuum Unit and old boiler area. In addition, water weir spray protection is provided for Sphere No's. 174, 175, and 176 located north of the MTBE Unit. Light oil tanks are equipped with high level alarms sounding in the Inline Blending Control Room.

A 300 lb. Halon 1301 system is installed at the Inline Blending Facility in the Engine Knock Room. The system is actuated by products of combustion detectors, heat detectors and flammable gas detectors.

A 1963 pumper rated at 1250 gpm 150 psi and carrying 500 gallons of foam concentrate is kept in the open near the control room in the West Plant. A 1980 "Telesquirt" with a 1000 gpm 150 psi pump and 1000 gallons of foam concentrate is stationed at the Safety Office in the East Plant.

PUBLIC PROTECTION:

Protection from 3rd class city of Corpus Christi is considered good. The fire department will respond if called.

The refinery belongs to the Refinery Terminal Fire Company with a station located approximately 1/2 mile from the East Plants and 5 miles from the West Plant.

REMARKS:

During this visit to the refinery the fire equipment, maintenance records, together with management programs, were reviewed during the inspection. The plant was inspected physically and tests of the fire pumps were witnessed.

Subsequent to the previous inspection a major turn-around has been conducted on the majority of the processing units at the refinery. During the maintenance procedures, modification to No. 4 Crude and Vacuum Unit was accomplished. This was to improve the liquid recovery from the vacuum towers. The vacuum heater was changed from a four pass heater to an eight pass heater with additional instrumentation provided.

Two of the 35,000 pounds per hour, 250 psi gas fired manually operated boilers located in East Plant No. 1 have been retired.

A new fin-fan cooler and associated equipment has been installed at the splitter near No. 4 Platformer with fire proofing material applied to the supporting members. In addition, two ready hose reels have been installed with 100 feet of 1 1/2 inch hose on each with a combination nozzle.

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The Demex Unit in East Plant No. 2 has not operated during 1986 and is still idle today.

Tank No. 1005 has been razed and a new 80,000 barrel tank insulated with fiberglass is being erected and will be placed in coker feed service. A circulating hot oil heater previously used with Tank No. 1005 will remain for use with the new tank. On completion of this construction, Tank No. 1004 is to be taken out of service.

All fire pumps were tested during this inspection and the results are indicated on the attached fire pump test data sheets. A review of the results compared to those obtained previously on these pumps indicates satisfactory operating conditions. The tachometer on Pump No. 29 and Pump No. 31 were not functioning and results could not be corrected to the rated RPM. Pump No's. 33 and 34 located at the east gate to the plant indicated initial results below the rated capacity of the pumps, however when the results are corrected for head loss, satisfactory operations are indicated. Pump No's. 31 and 32 indicated improved results, however there was considerable blow by of oil on the exhaust manifold causing the units to smoke badly due to the exterior oil. It is understood that a work order has been issued and it has been reported that these two engines need to be overhauled.

A review of the previous recommendations indicates that Recommendation 76-1 concerning redesign of the water spray systems in the No. 4 platformer has been accomplished with water spray of adequate capacity provided over the pumps under the fin-fans and over the lube oil console at the recycle gas compressors. A review of the oil handling and movement system (OHMS) was conducted and after discussions, it was determined that Recommendation 84-3 is no longer valid and this recommendation has been removed from the report. The remaining recommendations appearing on the previous report have partially been completed and are repeated at this time until the work is finished. Additional suggestions resulting from this inspection are included.

RECOMMENDATIONS:

- 82-5 (Revised) In the Cumene Control Building, the Control Building at the West Plant and East Plant No. 2 Control Building, computer equipment provides the control for several units. It is suggested that smoke detection be installed under the raised floor in these buildings so that an alarm can be received and hand Halon type extinguishers be used to discharge under the floor space in event of fire in these areas. Experience has shown that it is the under floor areas where considerable cables are where most of the problems in respect to fire occurs in computer installations.

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(Note: It was indicated that the computers were originally used to obtain optimum results and some changes have occurred whereby the computer equipment is actually doing some processing directions. A detection system in East Plant No. 2 Control Building has been taken out of service due to the extensive maintenance needed on the equipment. In compliance with this recommendation, the system should be replaced.)

- 82-7 Fireproofing material had been installed on the legs of the spheres located north of the Alkylation Unit. In a number of instances it was noted that the fireproofing has been broken away and is deteriorating. It is suggested that the fireproofing material on these spheres be repaired and sealed to prevent the corrosion of the supporting members of these spheres behind the fireproofing material.

(Note: Some fireproofing has been corrected with some still left to do. This recommendation is repeated until the areas covered have had the work completed.)

- 83-1 Extensive water spray systems have been provided throughout the West Plant. It was noted in the Coker that all fin fans have not been protected nor have all pumps been protected. It is suggested that the water spray systems in the Coking Unit be extended to include all hydrocarbon pumps and all fin fans over the main pipeway. It is felt that the fin fans on the east west pipeway on the north side of the unit are not seriously exposed and would not require water spray protection.

- 84-4 (Revised) The motor control centers and rack rooms in East Plant No. 2 and the West Plant are provided with pressurization systems to maintain the pressure at 1/10th of an inch of water. During this inspection, it was noted that the majority of air pressurization systems were not functioning properly. In addition, the instrumentation indicating a lack of pressure was not functioning. All pressurization systems and motor control centers and rack rooms are important due to the ordinary classification of the wiring methods in these buildings and their proximity to areas where accidental release of flammable vapors is possible. It is suggested that the pressurization systems in these areas be returned to functional status.

(Note: A review of the various pressurization systems in the motor control centers and rack rooms indicates that the systems are not maintaining one tenth of an inch of water. This is the pressure which should be maintained in these structures.)

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- 85-1 (Revised) In the warehouse buildings at the East and West Plants flammable liquids are stored on open shelves. Also at the East Plant Warehouse laboratory storage consisting of MIBK, Tri methyl pentane, methanol, etc. was noted. Flammable and/or combustible liquids should be stored in a separate cut-off room so as not to become involved in a possible incident. An alternative would be to provide an outside building separate from the main warehouse and in the event of small containers such as aerosols, etc., a flammable liquid storage cabinet should be provided.
- 85-2 The dyke surrounding Tank Nos. 53, 54, 52, 72, 70, and 71, which are in aeromatic service, has eroded to the point that an accidental rupture involvement of these tanks could spread throughout the area in the vicinity of the warehouse. It is suggested that dyking around these tanks be reviewed and erected so that the dykes will contain the capacity of the largest tank plus ten percent of the capacity of the remaining tanks.
- 85-3 In the Alkyation Unit and No. 5 Platformer Rack Room, it was noted that considerable combustible storage is in the motor control centers. These motor control centers are designed with pressurization systems and all combustible storage should be eliminated from these areas.
- 86-1 A positive pressurization system is provided in the BTX Control Room. The audible alarm does not function. It is suggested that the alarm situation be reviewed and that audible alarms be repaired.
- 86-2 In East Plant No. 1 at the FCC No. 1, No. 1 Crude, and other older units on the plant, the fireproofing material is not designed for three hour protection. It is suggested that the supporting members of major towers, fin-fans, and pipeways, where pumps are located beneath the pipeway, be provided with fireproofing material capable of maintaining the steel at a temperature of 1000°F under an exposing fire of 1800°F for a period of three hours.
- 86-3 A satellite laboratory operation is conducted in a plywood building near No. 4 platformer. The flare drum, balance drum and air compressor in this area seriously expose this laboratory. It is recommended that the laboratory building be removed and that a building of noncombustible construction be provided for these operations.
- 86-4 The Hydrar heater is located at a higher grade than the balance of the Hydrar Unit. It is suggested that 6-inch curbs with drains be provided around the heater to prevent the accidental flow of oil throughout the unit.

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- 86-5 Manual water spray systems have been provided over some LPG bullets in the area north of the Alkylation Unit. It is suggested that water spray systems be provided over bullet No's. 203 - 209 and 213 - 214 as well as 131 - 136. The water spray systems should include all horizontal pressure vessels in the refinery. The water spray systems should be designed for a density of 0.25 gpm/sq. ft. of surface area.
- 86-6 A positive displacement pump to transfer LPG from sphere 102 to sphere 101 has developed leaks at the cylinder. This pump was used to move liquids from one sphere to the other. Due to the difficulty of maintaining a good seal with a positive displacement pump, it is suggested that other type equipment be used in the future for this service and that this positive displacement pump be removed from the area.
- 86-7 It was noted at the LPG bullet storage area that the plate and chain used to lock the block valves beneath relief valves has been removed in a number of instances. A chain and lock program should be provided on all block valves beneath relief valves and the locks and chains should be maintained in position so that the block valves cannot be closed without adequate notification. It is suggested that the block valves be checked since they are wrench operated to be sure they are in the open position and the locking plates and chains be replaced.
- 86-8 There are a number of pump pads such as pad No. 1 and the LPG transfer pumps which are outside the range of monitor nozzle protection. It is suggested that at least two monitor nozzles be installed at all pump pads so that the stream from the monitor can cover the pump pad. The monitor should be located approximately 50 feet from the nearest edge of the pump or transfer pit.
- 86-9 The fire truck at the West Plant is kept in the open. This results in exposure to the weather with accelerated corrosion and resulting additional maintenance required over a period of time. It is suggested that the fire truck be housed to reduce the damage due to this exposure to the weather and climatic elements.

ITEMS OF INTEREST:

Certain conditions do not comply with accepted standards, but may be considered impractical to correct under present conditions. These are valid recommendations and are listed here as a matter of record. Each recommendation should be reviewed periodically and considered when changes in construction or occupancy are contemplated.

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1. A test of the water spray systems under the elevated fin fan coolers indicates that each system should be extended one head beyond the edge of the cooler to reduce the effect of wind on the discharge pattern of water under the fin fan coolers.
2. To provide protection of the splitter tower from the heater, the monitor nozzle at the northeast corner of the heater should have hydraulic controls installed. This will also provide protection for the horizontal vessels at the No. 4 Platformer. An alternative would be to install a water curtain between the splitter tower and the heater. To be effective, the water curtain should be capable of delivering 0.25 gpm/square foot of wetted area.
3. Provide water weir protection for spheres located north of the Alkylation Unit.
4. Provide water spray under the fin-fans at the BTX Units.
5. Separation of the fire water system from the service water system. This would be particularly beneficial in East Plant No. 2.



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FIRE PUMP TEST REPORT

Client Champlin Petroleum Co.

PUMP

No. 29

DRIVER

Mfg. _____

Near Tank No. 65

Mfg. _____

Type Diesel Engine

Location Corpus Christi, TX

Type Horiz.-Centrifugal

Power _____

Date November 11, 1986

Rating 2000 gpm 150 psi

Engine Hours _____

By C. V. Frisbie

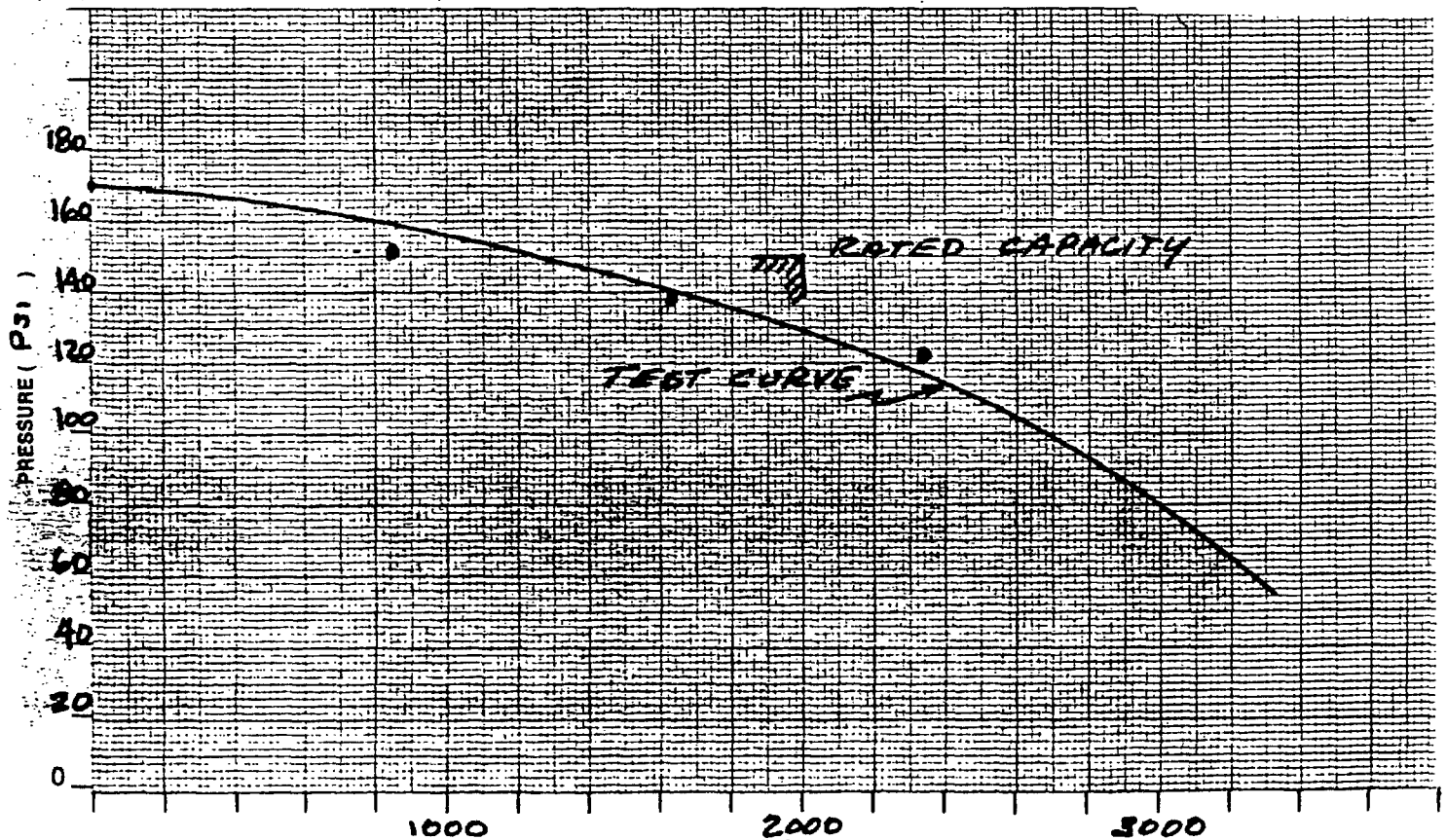
RPM 1900

Gear Ratio Direct Drive

VOLTS/ AMPS	PUMP RPM	PUMP PRESSURE (PSI)			NOZZLE SIZE & NUMBER	PITOT PRESSURES (PSI)	INDIVIDUAL FLOWS (GPM)	TOTAL FLOW (GPM)	CORRECTED TO RATED RPM	
		DISCH.	SUCT.	NET					NET HEAD	FLOW
	*	188	18	170	--	--	--	No Flow		
	*	170	18	152	1-1 3/4"	86	848	848		
	*	156	18	138	2-1 3/4"	80-78	818-807	1625		
	*	140	18	122	3-1 3/4"	78-70-68	818-765-754	2337		
* Tachometer not functioning during test										

CH/W-002531

PUMP CURVE:





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FIRE PUMP TEST REPORT

Client Champlin Petroleum Co.

Near Tank No. 65

Location Corpus Christi, TX

Date November 11, 1986

By C. V. Frisbie

PUMP

No. 30

Mfg. _____

Type Horiz.-Centrifugal

Rating 2000 GPM 150 psi

RPM 1900

DRIVER

Mfg. _____

Type Diesel Engine

Power _____

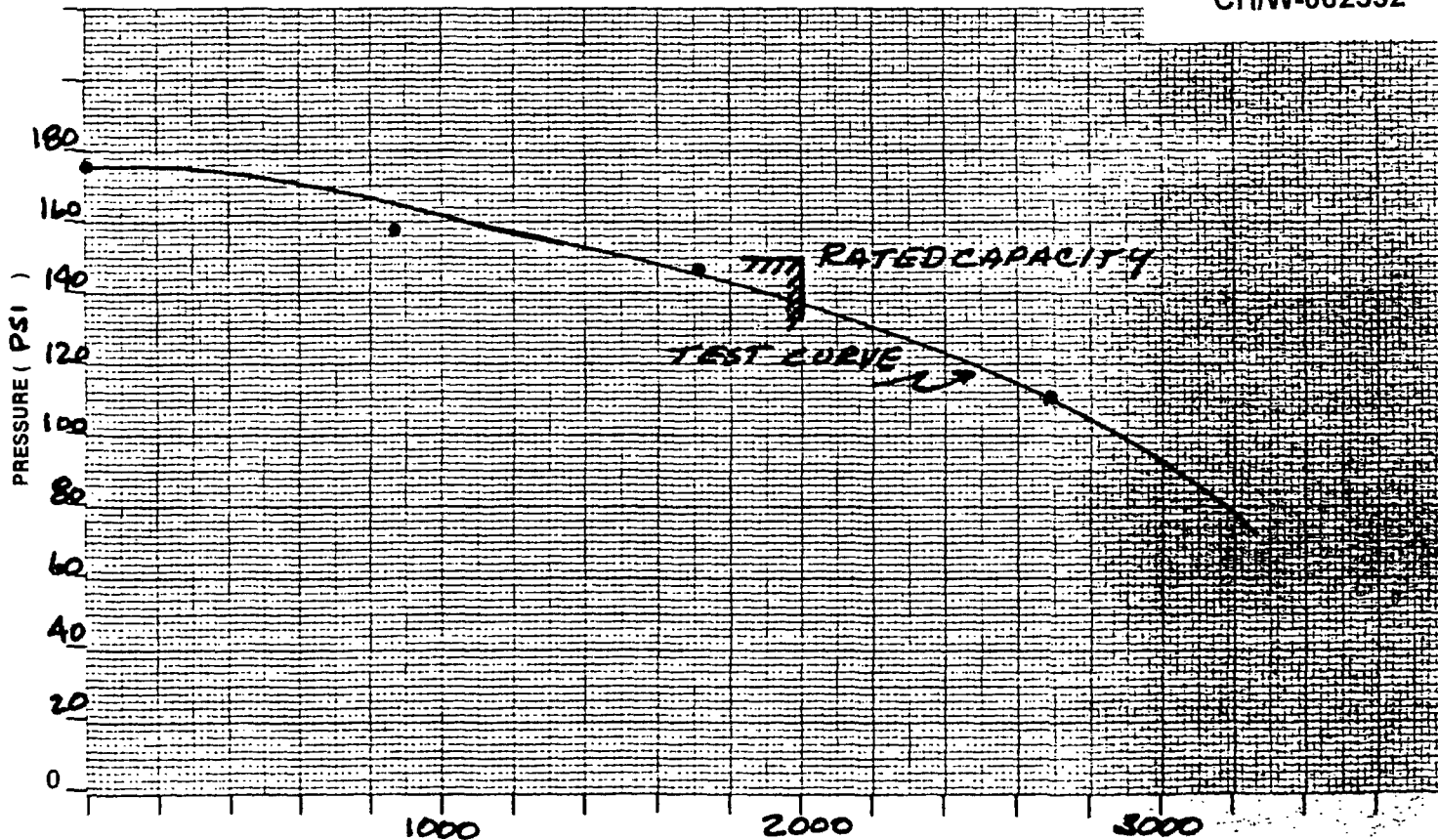
Engine Hours _____

Gear Ratio Direct Drive

VOLTS/ AMPS	PUMP RPM	PUMP PRESSURE (PSI)			NOZZLE SIZE & NUMBER	PITOT PRESSURES (PSI)	INDIVIDUAL FLOWS (GPM)	TOTAL FLOW (GPM)	CORRECTED TO RATED RPM	
		DISCH.	SUCT.	NET					NET HEAD	FLOW
	1800	176	18	158	---	---	---	No Flow	176	---
	1800	160	18	142	1-1 3/4"	82	828	828	158	874
	1750	150	18	132	2-1 3/4"	74-74	786-786	1572	147	1707
	1525	118	18	100	3-1 3/4"	56-60-70	684-708-765	2157	111	2687

PUMP CURVE:

CH/W-002532





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FIRE PUMP TEST REPORT

Client Champlin Petroleum Co.

PUMP

DRIVER

No. 31

Mfg. _____

Near Cooling Tower

Mfg. _____

Type Diesel Engine

Location Corpus Christi, TX

Type Horiz.-Centrifugal

Power _____

Date November 11, 1986

Rating 1500 GPM 150 psi

Engine Hours _____

By C. V. Frisbie

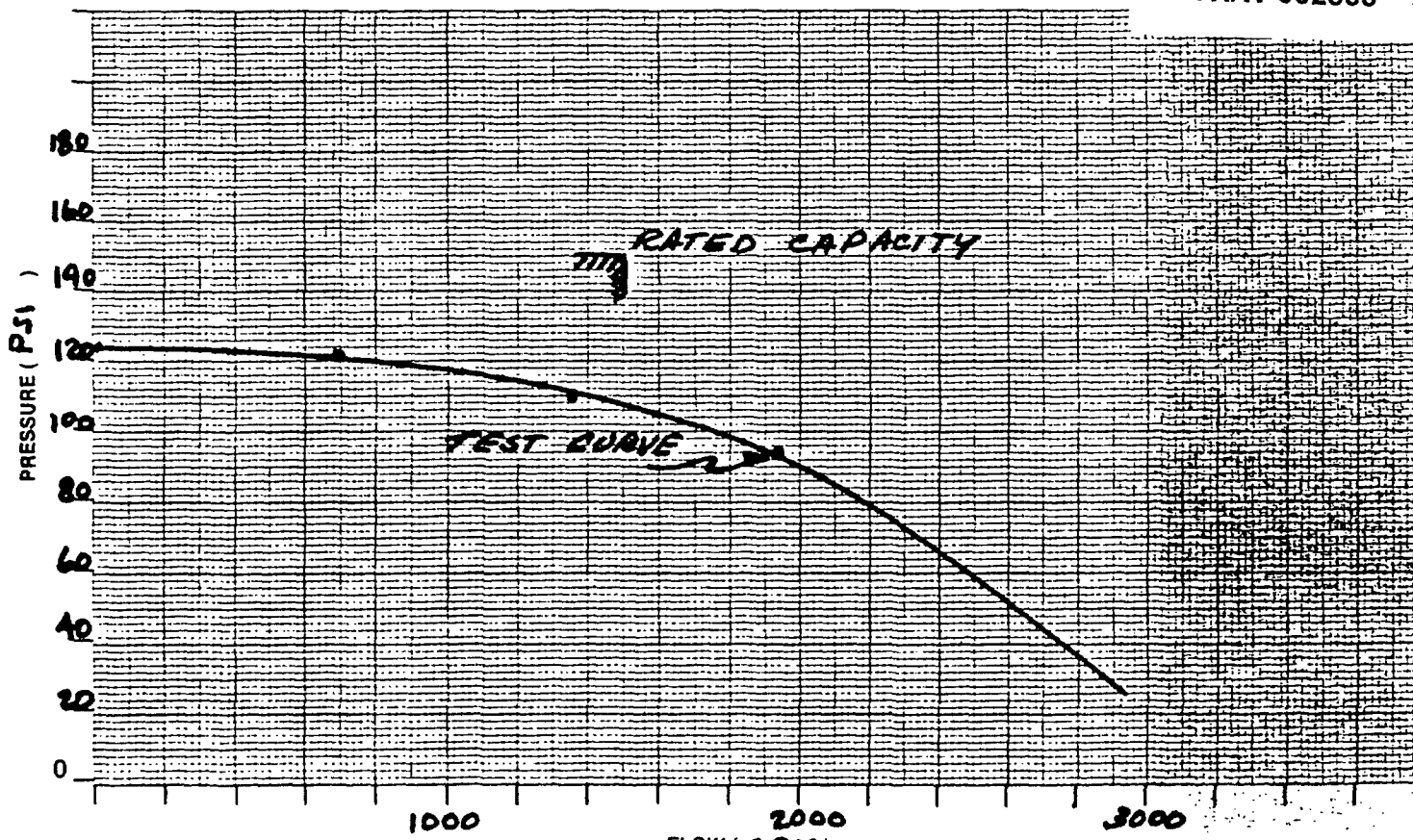
RPM 1760

Gear Ratio Direct With Clutch

VOLTS/ AMPS	PUMP RPM	PUMP PRESSURE (PSI)			NOZZLE SIZE & NUMBER	PITOT PRESSURES (PSI)	INDIVIDUAL FLOWS (GPM)	TOTAL FLOW (GPM)	CORRECTED TO RATED RPM	
		DISCH.	SUCT.	NET					NET HEAD	FLOW
	*	142	18	124	--	--	--	No Flow		
	*	136	14	122	1-1 3/4'	58	696	696		
	*	122	12	110	2-1 3/4'	60-50	708-646	1354		
	*	104	10	94	3-1 3/4'	42-52-56	592-659-684	1935		
* Tachometer Not Functioning During Test										

PUMP CURVE:

CH/W-002533





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FIRE PUMP TEST REPORT

Client Champlin Petroleum Co.

PUMP

No. 32

DRIVER

Mfg. _____

Near Cooling Tower

Mfg. _____

Type Diesel Engine

Location Corpus Christi, TX

Type Horiz.-Centrifugal

Power _____

Date November 11, 1986

Rating 1500 GPM 150 psi

Engine Hours _____

By C. V. Frisbie

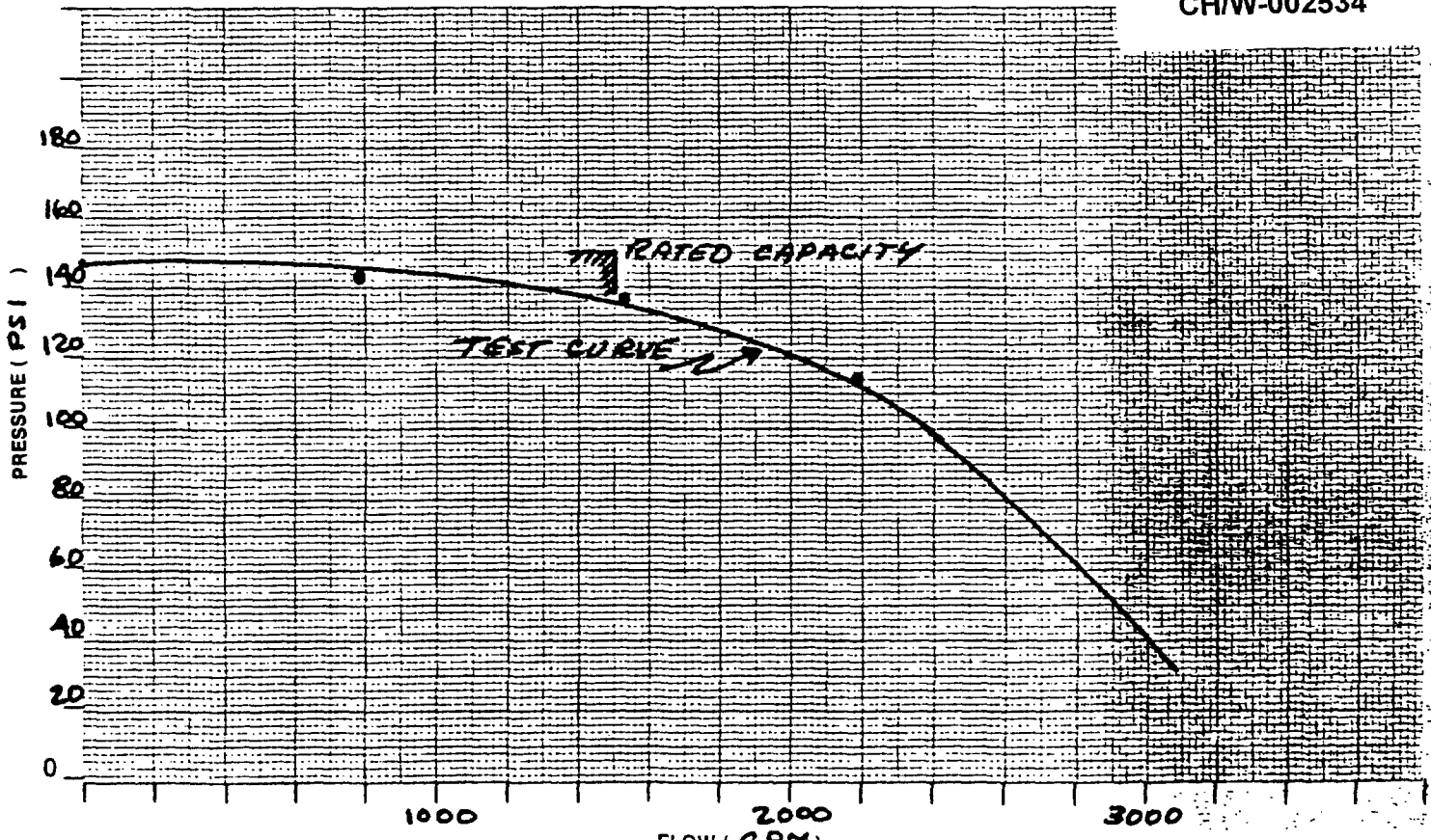
RPM 1760

Gear Ratio Direct With Clutch

VOLTS/ AMPS	PUMP RPM	PUMP PRESSURE (PSI)			NOZZLE SIZE & NUMBER	PITOT PRESSURES (PSI)	INDIVIDUAL FLOWS (GPM)	TOTAL FLOW (GPM)	CORRECTED TO RATED RPM	
		DISCH.	SUCT.	NET					NET HEAD	FLOW
	1600	138	18	120	--	--	--	No Flow	145	--
	1600	132	14	118	1-1 3/4"	60	708	708	143	779
	1550	118	12	106	2-1 3/4"	58-50	696-646	1342	137	1524
	1550	100	10	90	3-1 3/4"	58-50-40	696-646-578	1920	116	2180

PUMP CURVE:

CH/W-002534





M&M Protection Consultants
A Resource of Marsh & McLennan

FIRE PUMP TEST REPORT

Client Champlin Petroleum Co.

PUMP

No. 33

DRIVER

Mfg. _____

Near East Gate

Mfg. _____

Type Diesel Engine

Location Corpus Christi, TX

Type Horiz.-Centrifugal

Power _____

Date November 11, 1986

Rating 1500 gpm 150 psi

Engine Hours _____

By C. V. Frishie

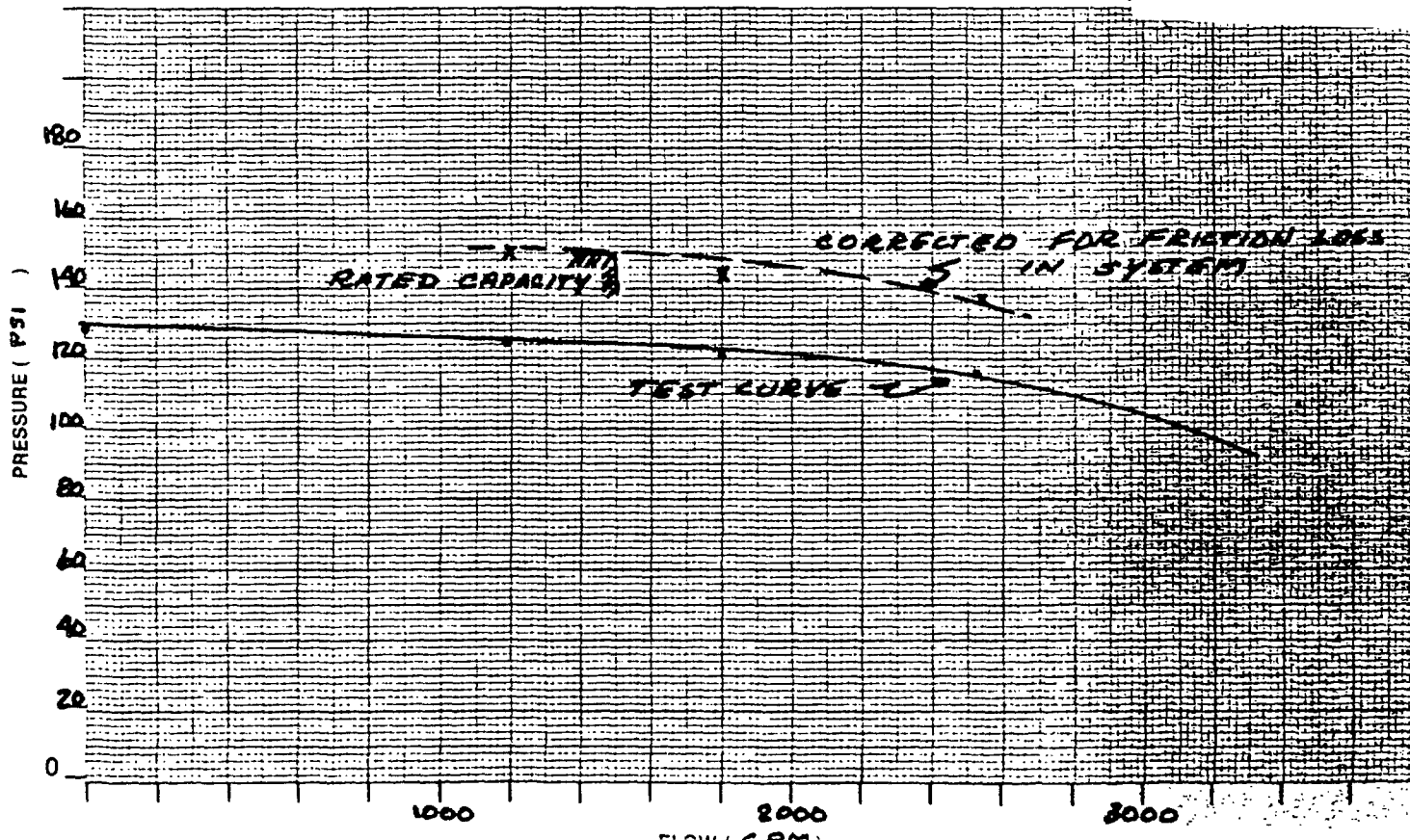
RPM 1760

Gear Ratio Direct With Clutch

VOLTS/ AMPS	PUMP RPM	PUMP PRESSURE (PSI)			NOZZLE SIZE & NUMBER	PITOT PRESSURES (PSI)	INDIVIDUAL FLOWS (GPM)	TOTAL FLOW (GPM)	CORRECTED TO - RATED RPM	
		DISCH.	SUCT.	NET					NET HEAD	FLOW
	1750	177	50	127	--	--	--	No Flow	128	--
	1700	165	48	117	1-1 3/4"	134	1058	1058	125	1095
	1650	150	44	106	2-1 3/4"	90-100	867-914	1781	121	1900
	1600	130	34	96	3-1 3/4"	74-65-70	786-736-765	2287	116	2516

PUMP CURVE:

CH/W-002535





M&M Protection Consultants
A Resource of Marsh & McLennan

FIRE PUMP TEST REPORT

Client Champlin Petroleum Co. PUMP

Near East Gate

Location Corpus Christi, TX

Date November 11, 1986

By C. V. Frisbie

No. 34

Mfg. _____

Type Horiz. - Centrifugal

Rating 1500 gpm 150 psi

RPM 1760 RPM

DRIVER

Mfg. _____

Type Diesel Engine

Power _____

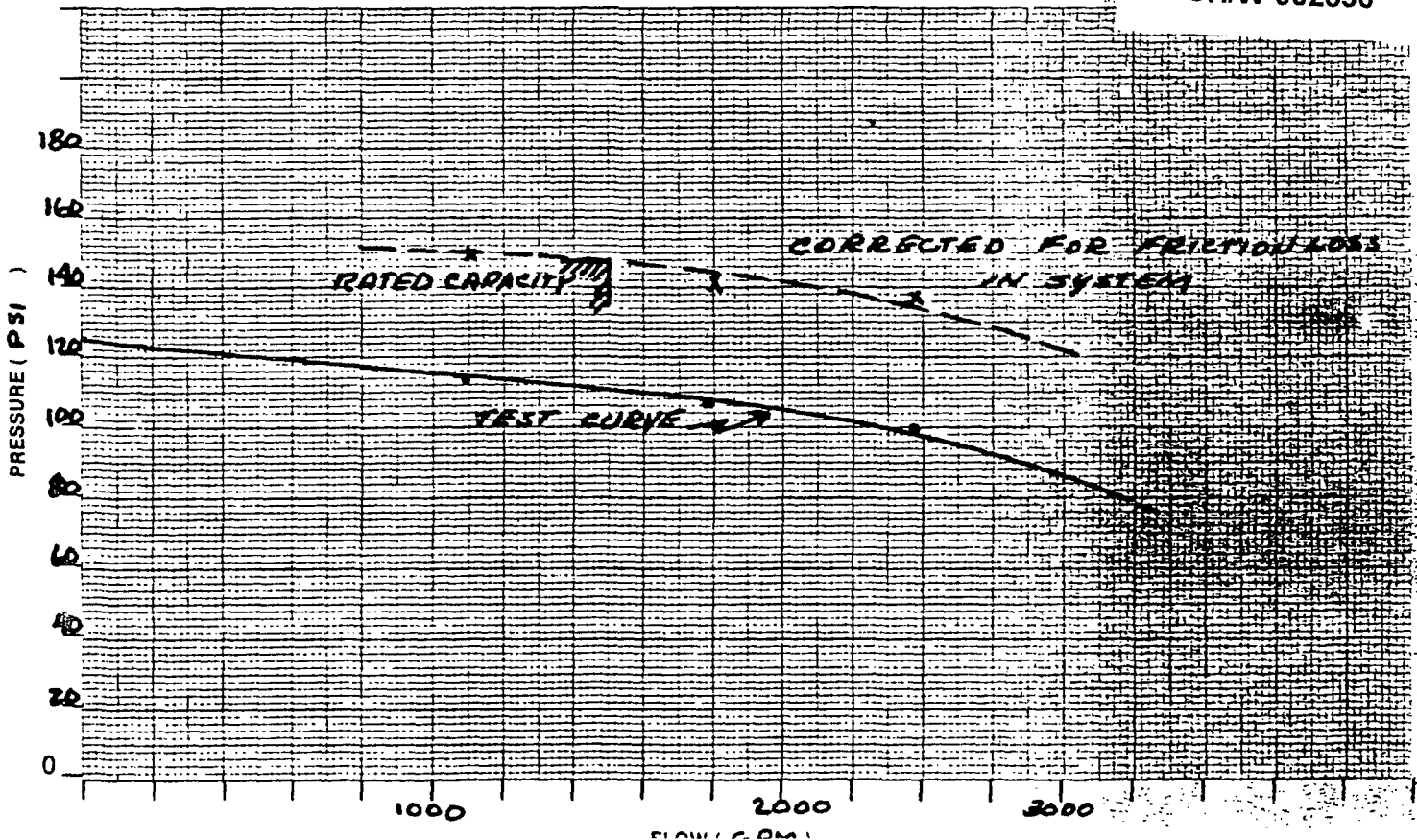
Engine Hours _____

Gear Ratio Direct With Clutch

VOLTS/ AMPS	PUMP RPM	PUMP PRESSURE (PSI)			NOZZLE SIZE & NUMBER	PITOT PRESSURES (PSI)	INDIVIDUAL FLOWS (GPM)	TOTAL FLOW (GPM)	CORRECTED TO RATED RPM	
		DISCH.	SUCT.	NET					NET HEAD	FLOW
	1700	150	44	106	1-1 3/4"	134	1058	1058	114	1095
	1700	135	35	100	2-1 3/4"	84-95	838-890	1728	107	1789
	1650	122	34	88	3-1 3/4"	74-60-65	786-708-736	2230	100	2379

PUMP CURVE:

CH/W-002536





M&M Protection Consultants
A Resource of Marsh & McLennan

FIRE PUMP TEST REPORT

Client Champlin Petroleum Co.

PUMP

DRIVER

Area 90

No. A

Mfg. _____

Location Corpus Christi, TX

Mfg. _____

Type Diesel Engine

Date November 11, 1986

Type Vertical Turbine

Power _____

By C. V. Frisbie

Rating 3000 gpm 150 psi

Engine Hours _____

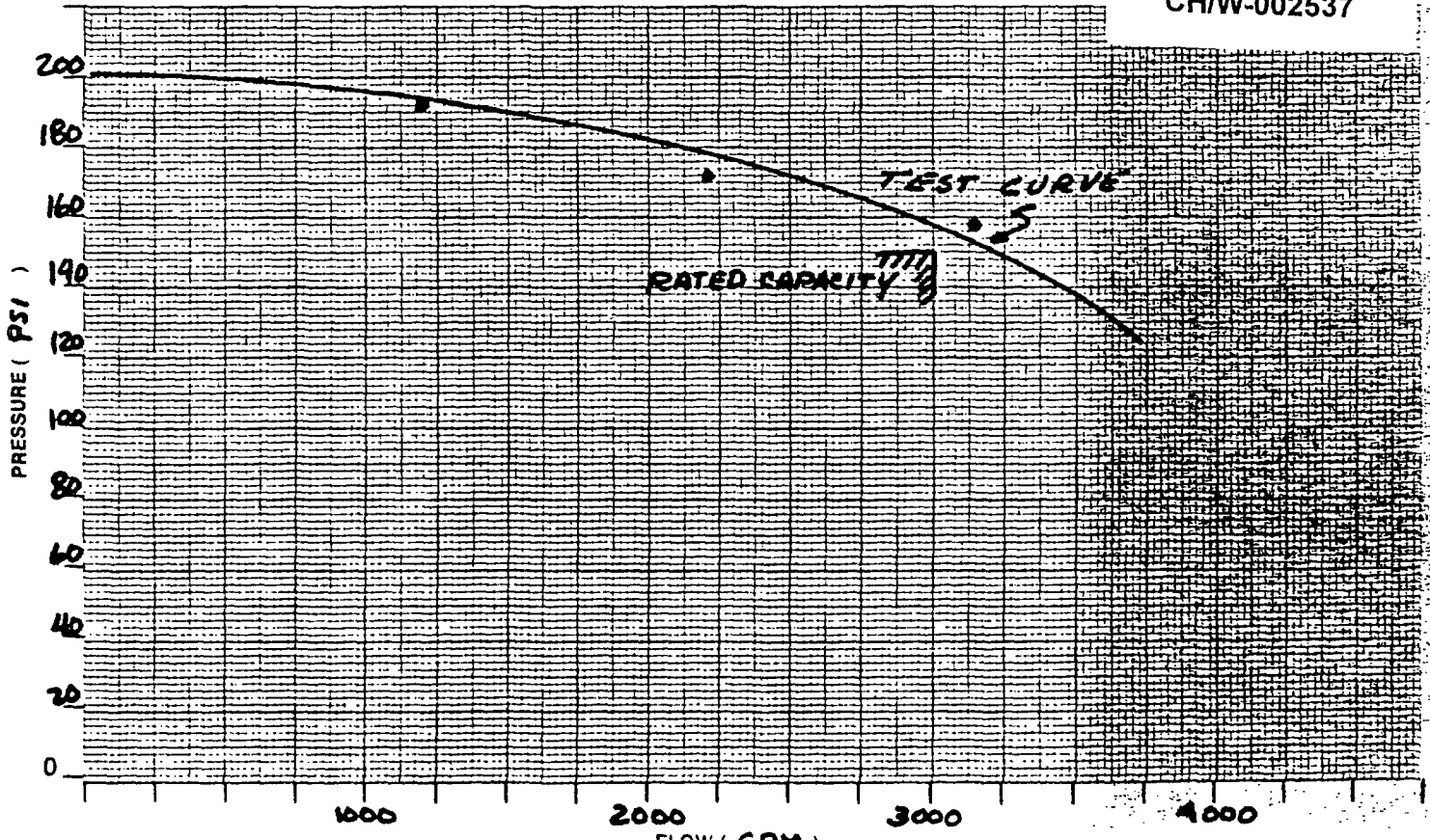
RPM 1770

Gear Ratio 1:1

VOLTS/ AMPS	PUMP RPM	PUMP PRESSURE (PSI)			NOZZLE SIZE & NUMBER	PITOT PRESSURES (PSI)	INDIVIDUAL FLOWS (GPM)	TOTAL FLOW (GPM)	CORRECTED TO RATED RPM	
		DISCH.	SUCT.	NET					NET HEAD	FLOW
	1550	146	-2	148	1-1 3/4"	130	1042	1042	193	1190
	1525	126	-2	128	2-1 3/4"	108-108	950-950	1900	172	2205
	1675	140	-2	142	2-1 3/4"	120-116-114	1001-984-976	2961	158	3129
		160	-2	162		Relief Valve Setting				

PUMP CURVE:

CH/W-002537





M&M Protection Consultants

A Resource of Marsh & McLennan

FIRE PUMP TEST REPORT

Client Champlin Petroleum Co.

PUMP

DRIVER

Area 90

No. B

Mfg. _____

Location Corpus Christi, TX

Mfg. _____

Type Diesel Engine

Date November 11, 1986

Type Vertical Turbine

Power _____

By C. V. Frisbie

Rating 3000 gpm 150 psi

Engine Hours _____

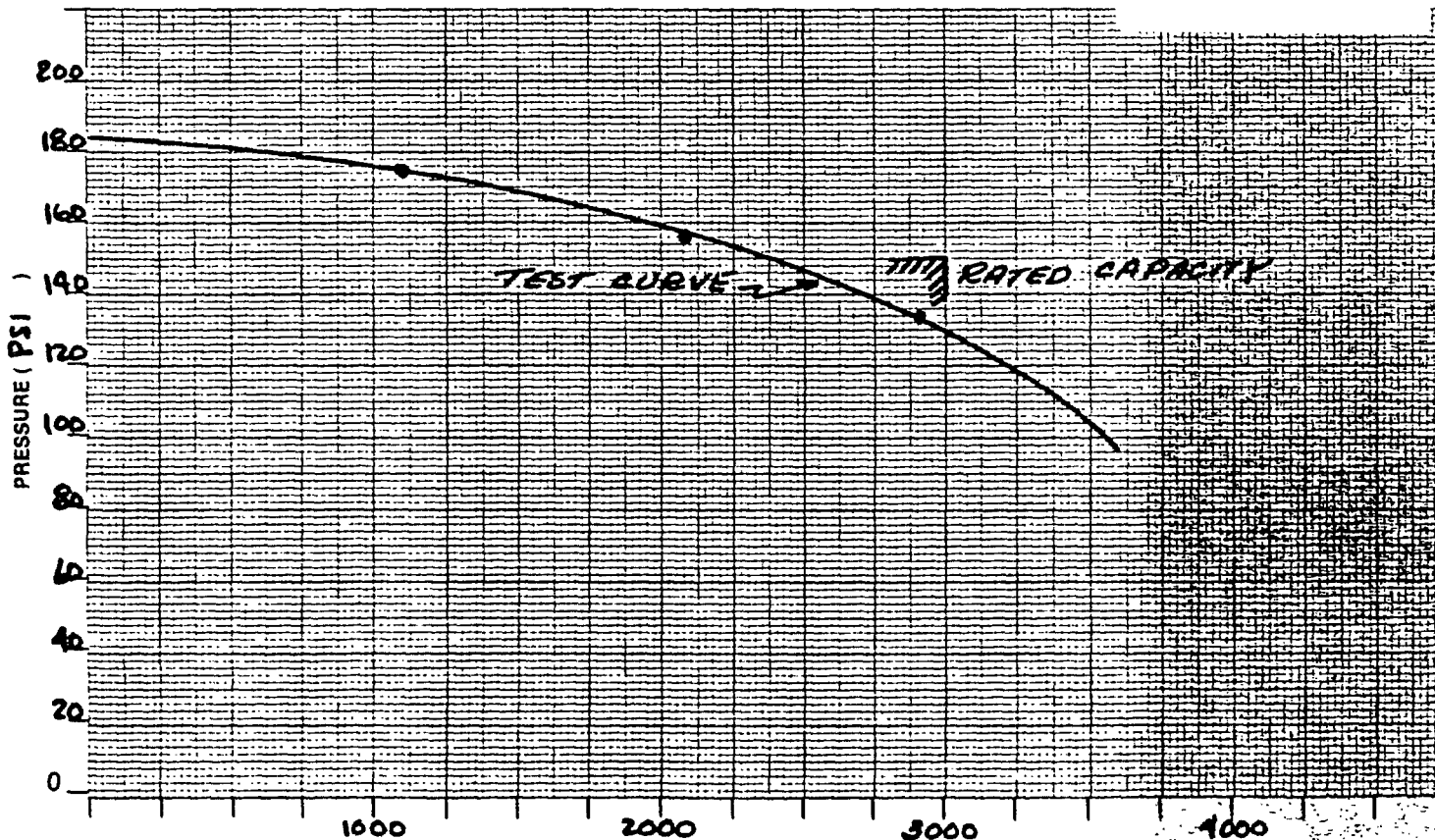
RPM 1770

Gear Ratio 1:1

VOLTS/ AMPS	PUMP RPM	PUMP PRESSURE (PSI)			NOZZLE SIZE & NUMBER	PITOT PRESSURES (PSI)	INDIVIDUAL FLOWS (GPM)	TOTAL FLOW (GPM)	CORRECTED TO RATED RPM	
		DISCH.	SUCT.	NET					NET HEAD	FLOW
	1525	128	-2	130	1-1 3/4"	110	959	959	175	1113
	1775	156	-2	158	2-1 3/4"	130-130	1042-1042	2084	157	2078
	1750	130	-2	132	3-1 3/4"	110-110-110	959-959-959	2877	135	2910
		160	-2	162		Relief Valve Setting				

PUMP CURVE:

CH/W-002538



M&M PC

M&M Protection Consultants

A Resource of Marsh & McLennan

FIRE PUMP TEST REPORT

Client Champlin Petroleum Co.

PUMP

DRIVER

Area 90

No. C

Mfg. _____

Location Corpus Christi, TX

Mfg. _____

Type Diesel Engine

Date November 11, 1986

Type Vertical Turbine

Power _____

By C. V. Frisbie

Rating 3000 gpm 150 psi

Engine Hours _____

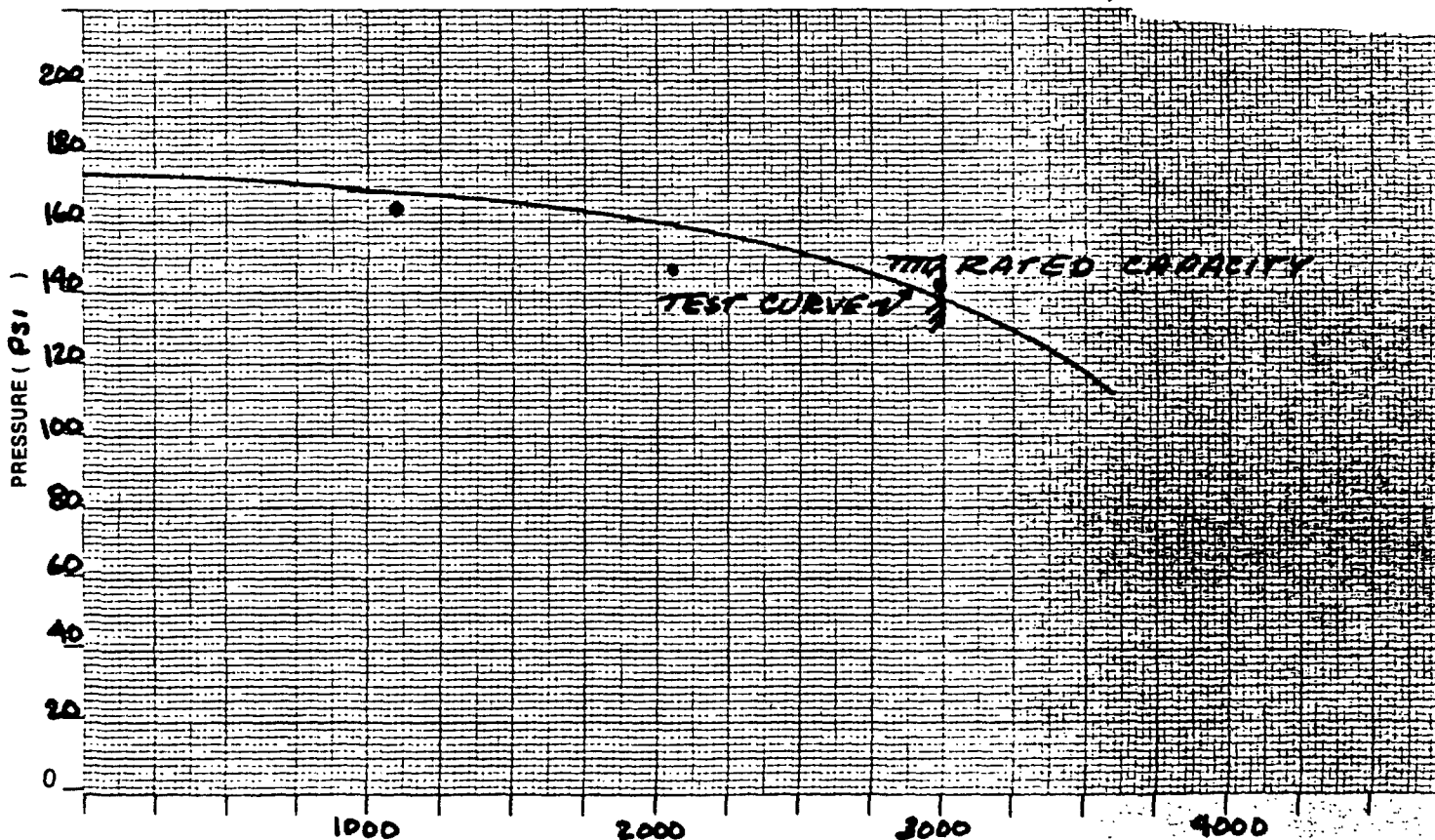
RPM 1770

Gear Ratio 1:1

VOLTS/ AMPS	PUMP RPM	PUMP PRESSURE (PSI)			NOZZLE SIZE & NUMBER	PITOT PRESSURES (PSI)	INDIVIDUAL FLOWS (GPM)	TOTAL FLOW (GPM)	CORRECTED TO RATED RPM	
		DISCH.	SUCT.	NET					NET HEAD	FLOW
	1525	120	-2	122	1-1 3/4"	106	941	941	164	1092
	1675	130	-2	132	2-1 3/4"	112-112	967-67	1934	147	2044
	1775	142	-2	144	3-1 3/4"	120-120-120	1001-1001-1001	3003	143	2995
		158	-2	160		Relief Valve	Setting			

PUMP CURVE:

CH/W-002539





M&M Protection Consultants

A Resource of Marsh & McLennan

FIRE PUMP TEST REPORT

Client Champlin Petroleum Co.

PUMP

DRIVER

No. 100

Mfg. _____

Area 91

Mfg. _____

Type Diesel Engine

Location Corpus Christi, TX

Type Vertical Turbine

Power _____

Date November 11, 1986

Rating 3000 gpm 150 psi

Engine Hours _____

By C. V. Frishie

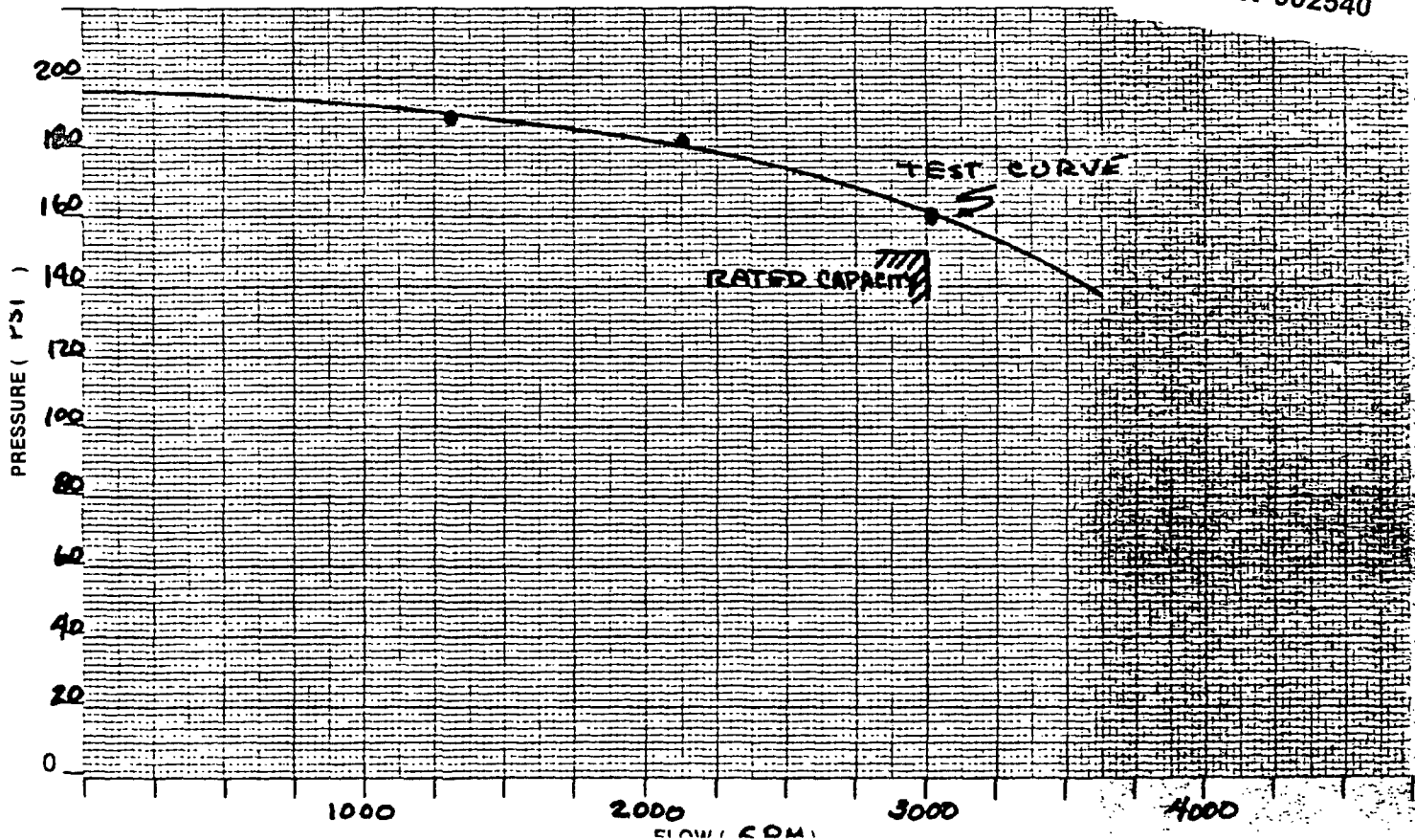
RPM 1770

Gear Ratio 1:1

VOLTS/ AMPS	PUMP RPM	PUMP PRESSURE (PSI)			NOZZLE SIZE & NUMBER	PITOT PRESSURES (PSI)	INDIVIDUAL FLOWS (GPM)	TOTAL FLOW (GPM)	CORRECTED TO RATED RPM	
		DISCH.	SUCT.	NET					NET HEAD	FLOW
	1200	85	-2	87	1-1 3/4"	60	708	708	189	1044
	1400	112	-2	114	2-1 3/4"	82-86	828-848	1676	182	2119
	1700	146	-2	148	3-1 3/4"	112-106-116	967-941-984	2892	160	3011

PUMP CURVE:

CH/W-002540





M&M Protection Consultants
A Resource of Marsh & McLennan

FIRE PUMP TEST REPORT

Client Champlin Petroleum Co.

PUMP

DRIVER

Area 91

No. 101

Mfg. _____

Location Corpus Christi, TX

Mfg. _____

Type Diesel Engine

Date November 11, 1986

Type Vertical Turbine

Power _____

By C. V. Frisbie

Rating 3000 gpm 150 psi

Engine Hours _____

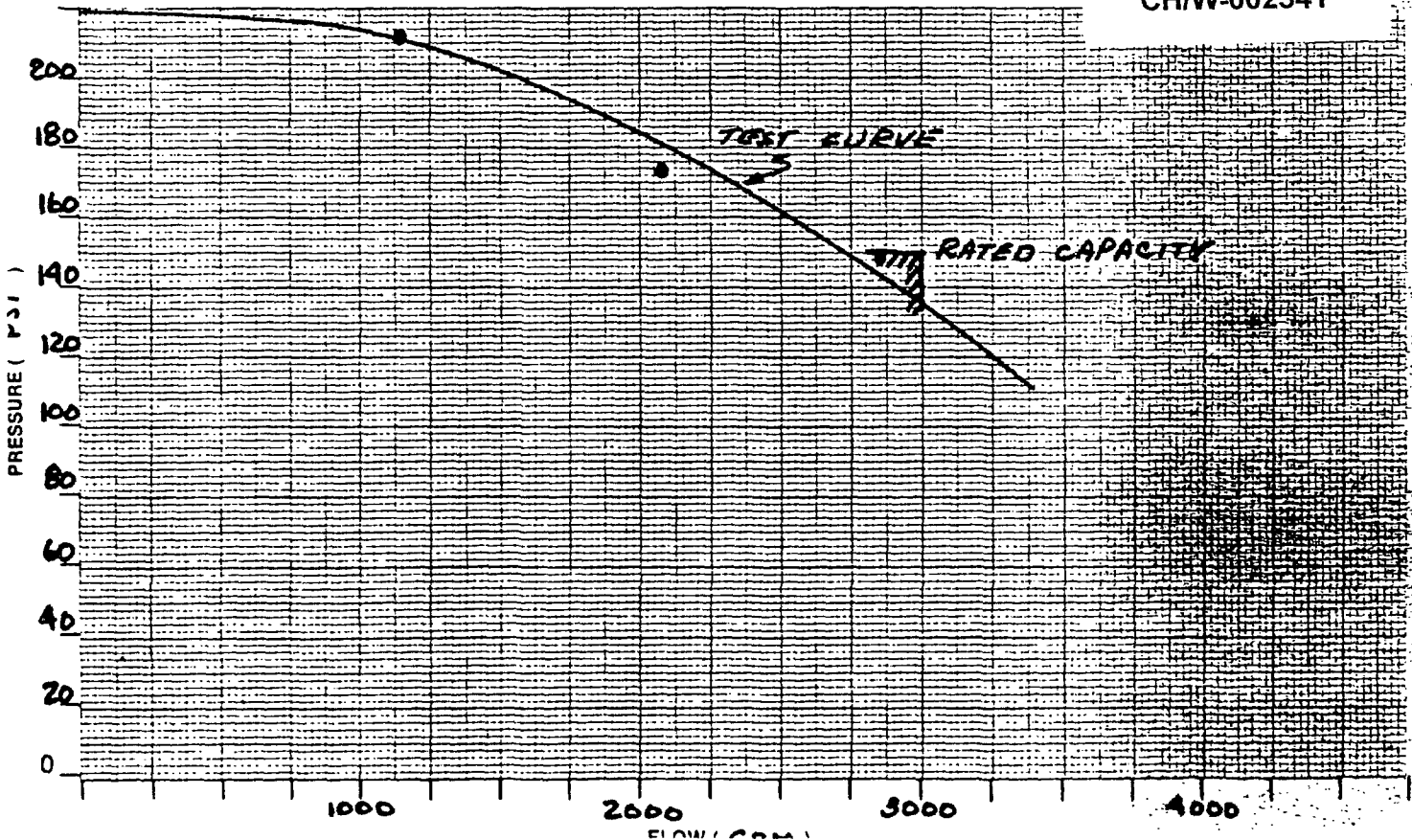
RPM 1770

Gear Ratio 1:1

VOLTS/ AMPS	PUMP RPM	PUMP PRESSURE (PSI)			NOZZLE SIZE & NUMBER	PITOT PRESSURES (PSI)	INDIVIDUAL FLOWS (GPM)	TOTAL FLOW (GPM)	CORRECTED TO RATED RPM	
		DISCH.	SUCT.	NET					NET HEAD	FLOW
	1100	80	-2	82	1-1 3/4"	60	708	708	212	1139
	1600	140	-2	142	2-1 3/4"	100-110	914-959	1873	174	2072
	1600	120	-2	122	3-1 3/4"	92-84-90	877-838-867	2582	149	2856

PUMP CURVE:

CH/W-002541



FIRE PUMP TEST REPORT

Client Champlin Petroleum Co. PUMP

No. 3 Dock

Location Corpus Christi, TX

Date November 11, 1986

By C. V. Frisbie

No. _____

Mfg. _____

Type Vertical Turbine

Rating 3000 GPM 150 psi

RPM 1770

DRIVER

Mfg. _____

Type Diesel Engine

Power _____

Engine Hours _____

Gear Ratio 1:1

VOLTS/ AMPS	PUMP RPM	PUMP PRESSURE (PSI)			NOZZLE SIZE & NUMBER	PITOT PRESSURES (PSI)	INDIVIDUAL FLOWS (GPM)	TOTAL FLOW (GPM)	CORRECTED TO RATED RPM	
		DISCH.	SUCT.	NET					NET HEAD	FLOW
	1800	188	-3	191	1-1 3/4"	138	1073	1073	185	1055
	1800	160	-3	163	2-1 3/4"	114-116	976-984	1960	158	1927
	1770	136	-3	139	3-1 3/4"	100-100-90	914-914-867	2695	139	2695
		196	-3	199		Relief Valve Setting				

PUMP CURVE:

CH/W-002542

