ITEM 1

Report and Specifications

For

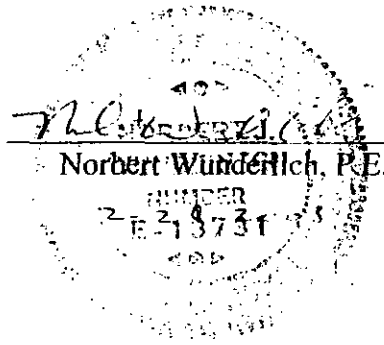
"Village Greens"

Date
January 20, 2003

Owner
Jay Rice Contracting
960 A Plaza Drive
St. Clair, Missouri 63077

Prepared By

Wunderlich Surveying & Engineering, Inc
20 South Church Street
Union, Missouri 63084



Norbert Wunderlich, P.E.

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INTROCTION:

Village Greens is a proposed 73- lot subdivision located in the Village of Parkway, Franklin County, Missouri. (SE ¼ , Sec. 36, T42N, R1W, of the 5[th] P.M.) Jay Rice Contracting is the developer for this subdivision. The sanitary sewage from Village Greens will be collected by a gravity system and treated by the City of St, Clair.

The Village of Parkway has no central water distribution system. Because the City of St. Clair is providing sewage service to the proposed subdivision, Mr. Rice, owner of Jay Rice Contracting, contacted the City of St. Clair about providing his subdivision with water service. The City of St. Clair expressed very little interest in providing Mr. Rice's subdivision with water service, and they even questioned if the City would have the capacity to serve the proposed subdivision.

After exhausting all known measures, Mr. Rice decided to construct a well, and a central water distribution system for his subdivision. During this process, Mt. Zion church, which is located just north of Village Greens subdivision, contacted Mr. Rice about connecting to his system. Mr. Rice is still considering this option at this time.

DESIGN & CALCULATIONS:

Proposed System:

The proposed system will be a ground water well, 12,000 gallon pressure tank, and a 6-inch SDR 21 class 200 PVC distribution system.

Ground Water Well:

A request was made to Missouri Department of Natural Resources, Division of Geology and Land Survey concerning a casing depth letter for a community well. A copy of this letter has been included with this report. DNR~DGLS estimated the casing depth to be 320-feet below the existing ground elevation. It was recommend that a pilot hole be constructed to the total depth of the well. DNR~DGLS requires the well driller to send samples of the cuttings to their office to determine the exact casing depth for the proposed well.

At the total drill depth of 800 to 850-feet, the well should yield 100+ gallons per minute (gpm) of water. The original target yield for the well was 155 gpm , However according to DNR~DGLS this would require the well depth to approach 1,400-feet and the estimated yields at this depth are unpredictable.

After consulting a local well driller, it was decided to use a 8-inch well, with a 20-hp pump set at approximately 550-feet. This was based on the well drillers information from when he constructed the closest community well to our site for The City of St. Clair. Final depth of the well pump will be determined after the well shaft is drilled and a draw down test has been preformed.

The discharge for the pump will be 3-inch in diameter. The discharge piping will have two inline check valves. The first valve will be spaced approximately 40-feet above the pump, and the second will be placed approximately 150-feet above the pump. The well discharge will connect

to the well house piping just above the sanitary split ring seal, and it will terminate with a 3-inch tee connection. The run of the tee shall be plugged. The 1-inch diameter screened vent pipe and the electrical connection for the submersible motor can enter through the side of the well casing or through the top of the sanitary split ring seal. The sanitary split ring seal will require a depth gauge.

Well House:

The well will discharge into a 12,000-gallon pressure tank. This tank was sized assuming 100 homes with 3.5 persons per home and 35 gallons of gross tank volume per person. Village Greens currently has 73 residential building lots. Assuming a total flow of 1-gallon per minute per home, the peak flow for Village Greens would be 73 gallons per minute. The estimated yield for the well pump is 100+ gpm.

The pressure tank will be operated by a Master Level Hydromaster controller. The hydromaster controller will operate through the 40/60 psi pressure range. By operating the pressure tank with a permanent water seal of 1/3 of its gross volume, it is assumed the tank will yield 1/3 the gross volume for usable water storage or approximately 4,000 gallons. The remaining volume of the tank will be compressed air. The compressed air will be absorbed into the water within the tank. To make up the absorbed air, an oil-less air compressor will be connect to the pressure tank, and the master level control will operate an air valve connected to the pressure tank.

The Master Level Controler will determine the water level in the pressure tank with probes. When the water level reaches the high level well pump shut off probe, the master level will sense the pressure in the tank. If the pressure in the tank is to low the air valve will be opened and allow compressed air to be added to the pressure tank until the desired high pressure is reached. Incase the air valve fails, the pressure tank will be equipped with a 70lb pressure release valve.

The well house will be standard wood frame construction. The interior of the well house will be sheeted with 26 gauge metal panels with baked enamel paint to protect the walls. A 4-inch floor drain will be provided incase of a leak in the front of the well house. The back of the well house will be on a granular floor. An interior drain tile will be installed along the footing of the building and discharge to the exterior to drain the rear of the building incase a leak or the draining of the pressure tank. A 4-kw wall mounted heater will be provided for heat during the winter months. Chlorine disinfection is not intended at this time. A room will be constructed to house the chlorine equipment if it becomes necessary to disinfect in the future.

Distribution System:

The distribution system shall consist of 6-inch SDR 35 Class 200 PVC pipe. Because the pressure tank will be operating through the 40-60 psi pressure range, the distribution system should not be below 35 psi at any part of the proposed system. At the lowest point in the proposed distribution system the high pressure will be approximately 93 psi. The homes built in these areas will require a pressure reducing valve located inside the home.

The distribution system was analyzed assuming 1 gallon per minute per home. The EPNET program developed by the EPA was used to perform the calculations. This program employs the

Hardy-Cross Method to determine the flow through the pipes. These calculations have been included.

According to the Design Guide for Community Public Water Supplies, the distribution system cannot have fire hydrants. Flushing hydrants will be attached to the system. No fire flow was intended with this design.

References:

Design Guide for Community Public Water Supplies, January 1988, MO-DNR

Master Level Controls Company

EPNET, by U.S. EPA, Water distribution Analysis Program

Masterspec, by_ Arcom,, specification program

Special Thanks to

Midwest Hydro Drilling & Service, Inc.

Masterspec, by arcom, specification writing program (AIA)

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STATE OF MISSOURI
Bob Holden, Governor • Stephen M. Mahfood, Director
DEPARTMENT OF NATURAL RESOURCES

P.O. Box 250 111 Fairgrounds Rd. Rolla, MO 65402-0250
(573) 368-2100
FAX (573) 368-2111

November 12, 2002

Mr. Jay Rice
Jay Rice Contracting
960A Plaza Dr
St. Clair, MO 63077

Franklin County
NE SE SE Sec. 36, T42N, R1W
Village Greens Subdivision
community well

Dear Mr. Rice:

This letter is regarding a request for information from Wunderlich Surveying and Engineering on your behalf concerning a community (public) well at the above location in Franklin County on the St. Clair quadrangle.

Since this well is to be a public water supply well, construction of the well must conform to the standards of the Department of Natural Resources' Water Protection and Soil Conservation Division, as outlined in their publication Design Guide for Community Public Water Supplies 10 CSR 60-3, 10 CSR 60-10.

One requirement of the Department of Natural Resources' Water Protection and Soil Conservation Division is that the engineer's plans and specifications for water works projects are submitted to them for their review and approval before the start of construction. If the completed project does not conform to the published standards, a Permit of Approval cannot be issued as provided for in Part VI, Book V of the Sanitary Code, a part of the Regulations developed under Section 640.115 - 10 CSR 60 - 10.010, Revised Statutes of Missouri.

Copies of the Regulations and Design Standards are available upon request from Water Protection and Soil Conservation Division, Public Drinking Water Program, Missouri Department of Natural Resources, P.O. Box 176, Jefferson City, MO 65102.

One other requirement for such a water supply is that this office determines the well casing depth. The required casing depth for a well at this location is estimated to be 320 feet and into the Lower Gasconade Dolomite. This is based on a surface elevation of 750 feet above sea level. To help in establishing a final approved casing depth, rock cuttings must be submitted to the total depth of the well. In this instance it could be to your advantage to have a "pilot hole" drilled to total depth before casing is set and grouted. In this way, the casing depth could be approved with good data and you would be assured that no surprises would occur below the final casing depth. The casing (19 pound or equivalent weight per foot for a 6 inch hole, for example) must be placed into a drill hole that is a nominal four (4) inches larger in diameter, and then pressure grouted (Haliburton method or equivalent). Once the grouting is complete, operations must be suspended for a minimum period of seventy-two (72) hours. Pressure grouting of the casing is to be witnessed by the department's Regional Office personnel in St. Louis at 314/ 416-2970 (please give 48 hours notice of intent to grout).

A total drilled depth of 800 to 850 feet should bottom the well in the Derby-Doerun Dolomite, which will fully penetrate the Ozark aquifer. This depth should furnish you with approximately 100+ gallons of water per minute (gpm). In order to obtain the target yield of 155 gpm, it would be necessary to drill to approximately 1,360 to 1,400 feet to the Lamotte Sandstone. However, yields are unpredictable in this area and sometimes water quality becomes a problem at the greater depth.

Persons in Missouri with a well or wells capable of producing at least 100,000 gallons per day (70 gallons per minute) are required to register as major water users. Should the proposed well be capable of producing that amount, it will be necessary for the well owner to file a form each year showing water use for the preceding year. Should you have any questions concerning major water use or the purpose of identification of high-yield wells, please feel free to contact Jeanette Barnett at (573) 368-2188 or at this letterhead address.

Since passage of the Water Well Drillers Act (RSMo 256.600, effective October 1, 1986) it is a legal requirement that all water wells be drilled and pumps installed by persons permitted by the Department of Natural Resources' Geological Survey and Resource Assessment Division. It is in your best interests to contract with a permitted water well driller/pump installer to complete your well installation. The law also requires that all new wells (or old wells that need major reconstruction) must be registered and a Water Well Record completed on each well. A $35.00 fee, which is to be paid by the well owner, must accompany the completed form. The well driller and well owner must sign the form, and a copy returned to this office by the well driller. You will receive a tag and a card with a registration number upon our receipt of the form and fee.

When I may be of further assistance, please do not hesitate to contact me.

Sincerely,

GEOLOGICAL SURVEY AND RESOURCE ASSESSMENT DIVISION

Jeffrey C. Jaquess
Hydrologist
Water Resources Program
Groundwater Geology Section
(573) 368-2190

November 12, 2002

JCJ/sh

c: Jerry Lane, WPSCD/PDWP
Department of Natural Resources/St. Louis Regional Office
Kirby Scheer, Wunderlich Surveying and Engineering, PO Box 536, Union, MO 63084

Project: Village Greens
Project No:

Design Water Demand

1.) Population to be served.

Homes to be served home := 100

Persons per home capita := 3.5

Total estimated population to be served. dd := capita·home dd = 350 People

2.) Average Daily Demand per person ADD := 100·$\frac{gal}{day}$

Design flow Df := ADD·dd Df = 35000·$\frac{gal}{day}$ or Df = 24.306·$\frac{gal}{min}$

3.) Maximum hourly demand Mh := 6·Df Mh = 145.833·$\frac{gal}{min}$

proposed pump yields 100 gpm

4.) Gross Capacity of the Pressure Tank

Tank Gross Size TGS := dd·35·gal TGS = 12250·gal

Use a 12,000 Gallons Pressure Vessel.

5.) Flow Demand in Distribution Pipes was estimated as 1 gallon per minute per household throughout the distribution system. The demand on each line was analyzed using EPNET a computer program produced by the US EPA. This program uses the Hardy-Cross Method to determine the flow throughout the individual legs of the distribution system. Copies of the results for the water system high and low pressure have been included.

Village Greens High Pressure

Network Table - Links

Link ID	Velocity fps	Unit Headloss ft/Kft	Friction Factor
Pipe 1	0.63	0.27	0.022
Pipe 2	0.60	0.24	0.022
Pipe 3	0.39	0.11	0.023
Pipe 4	0.32	2.57	0.801
Pipe 5	0.08	0.01	0.029
Pipe 6	0.22	0.04	0.025
Pipe 7	0.23	0.04	0.025
Pipe 8	0.17	0.02	0.026
Pipe 9	0.05	0.00	0.031
Pipe 10	0.09	0.01	0.029
Pipe 11	0.11	0.01	0.029
Pipe 12	0.95	0.58	0.021

Village Greens High Pressure

Network Table - Links

Link ID	Length ft	Diameter in	Roughness	Flow GPM
Pipe 1	175	6	150	55.68
Pipe 2	750	6	150	52.68
Pipe 3	280	6	150	34.68
Pipe 4	100	6	100	28.32
Pipe 5	770	6	150	7.48
Pipe 6	320	6	150	19.16
Pipe 7	320	6	150	19.84
Pipe 8	100	6	150	14.84
Pipe 9	650	6	150	4.84
Pipe 10	560	6	150	8.00
Pipe 11	230	6	150	10.00
Pipe 12	200	6	150	84.00

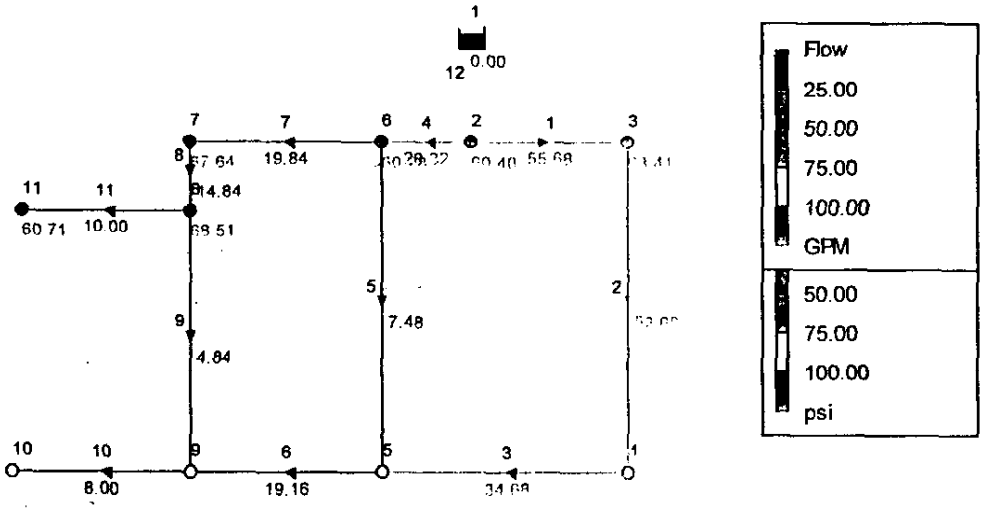
Village Greens High Pressure

Network Table - Nodes

Node ID	Elevation ft	Base Demand GPM	Head ft	Pressure psi
Junc 2	747	0	886.38	60.40
Junc 3	740	3	886.34	63.41
Junc 4	670	18	886.15	93.66
Junc 5	676	23	886.12	91.05
Junc 6	747	1	886.13	60.28
Junc 7	730	5	886.11	67.64
Junc 8	728	0	886.11	68.51
Junc 9	688	16	886.11	85.84
Junc 10	698	8	886.11	81.51
Junc 11	746	10	886.11	60.71
Resvr 1	886.5	#N/A	886.50	0.00

Village Greens

Day 1, 12



Village Greens Low Pressure

Network Table - Nodes

Node ID	Elevation ft	Base Demand GPM	Head ft	Pressure psi
Junc 2	747	0	840.28	40.42
Junc 3	740	3	840.24	43.43
Junc 4	670	18	840.05	73.68
Junc 5	676	23	840.02	71.07
Junc 6	747	1	840.03	40.31
Junc 7	730	5	840.01	47.67
Junc 8	728	0	840.01	48.53
Junc 9	688	16	840.01	65.87
Junc 10	698	8	840.01	61.53
Junc 11	746	10	840.01	40.73
Resvr 1	840.4	#N/A	840.40	0.00

Village Greens Low Pressure

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Pipe 1	175	6	150	55.68
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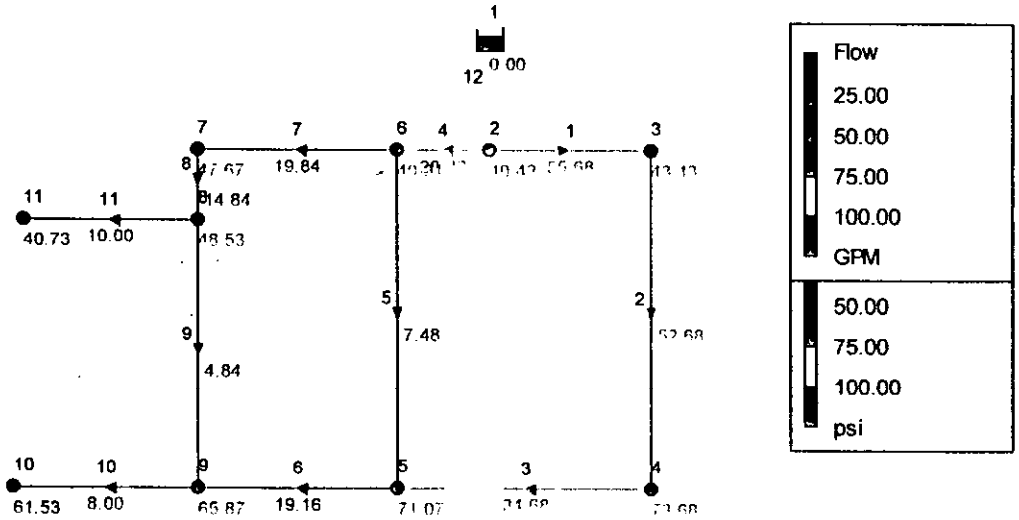
Pipe 2	0.60	0.24	0.022
Pipe 3	0.39	0.11	0.023
Pipe 4	0.32	2.57	0.801
Pipe 5	0.08	0.01	0.029
Pipe 6	0.22	0.04	0.025
Pipe 7	0.23	0.04	0.025
Pipe 8	0.17	0.02	0.026
Pipe 9	0.05	0.00	0.031
Pipe 10	0.09	0.01	0.029
Pipe 11	0.11	0.01	0.029
Pipe 12	0.95	0.58	0.021

Village Greens Low Pressure

Day 1, 12



SECTION 2511 - MUNICIPAL WATER DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Water Service Mains
   2. Water Main Appurtenances
   3. Fire and Flush hydrants

B. Related Sections include the following:
   1. Division 1 Specifications

C. Alternates: Refer to Division 1 Section "Alternates" for description of Work in this Section affected by alternates.

1.3 UNIT PRICES

A. Bid Unit Prices shall be used for final payment based on installed field measurements.

1.4 DEFINITIONS

A. AWWA; American Water Works Association
B. Continuing Authority; City, Municipality, or Home Owners Association where the work is being performed. Are responsible to Mo~DNR for the Ownership of the System.
C. Mo~DNR; Missouri Department of Natural Resources

1.5 DELIVERY, STORAGE, AND HANDLING

A. Contractor is responsible for the delivery, storage, and handling of all materials. Any expense incurred due to materials being damaged, lost, or stolen shall be the responsibility of the contractor.

1.6 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing weather conditions permit trench excavation to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Indicate measurements on Shop Drawings. When required by the Continuing Authority AS-Built drawings shall be provided at the expense of the owner.

1.7 COORDINATION

A. Contractor shall coordinate his/her work with the schedule prepared by the owner. The Contractor shall not perform work prior to its scheduled start date.

1.8 WARRANTY

A. Special Warranty: The contractor agrees to repair or replace components of the water distribution system that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failed hydrostatic pressure testing.
      b. Burst pipe
      c. Faulty appurtenances

B. Warranty Period: 1 year from date of Substantial Completion.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below.
   1. All equipment necessary to perform the required hydrostatic pressure test according to AWWA & Mo~DNR guidelines.
   2. All equipment necessary to disinfect the water line according to AWWA & Mo~DNR guidlines.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Pipe
   1. PVC
      a. Class 200 PVC water mains shall conform to ASTM D2241 and shall be pressure rated at 200 psi at 73° F with a standard dimension ratio of SDR 21. PVC pipe must be certified by the National Sanitation Foundation. Joints shall be integral bell push on joints with a single rubber gasket, making a pressure tight seal
      b. C900 PVC water mains shall conform to ANSI/AWWA C-900 DR-18 Class 150 requirements. PVC pipe must be certified by the National Sanitation Foundation. Joints shall be integral bell push n joints with a single rubber gasket, makng a pressure tight seal.

c. Fittings for PVC Mains , flanged and/or mechanical joint , shall be cast iron fittings for PVC pipe and shall meet the latest revisions of ANSIA21.11/AWWA C111. Fittings shall include all appropriate transition gaskets .All mechanical joints shall be restrained with "Mega Lug" restraining glands as manufactured by EBBA Iron Company or approved substitute.

2. Ductile Iron
   a. Ductile Iron Pipe used for water mains shall be cement lined super bell-tite push on joint. The pipe shall meet the requirements of the latest revision of ANSI A21.51/AWWA C151 for Class 50 ductile iron pipe. The pipe shall have a working pressure of 350 psi.
3. Valves
   a. Valves for PVC water lines shall be Mueller Model A-2360-20 gate valve, non-rising stem, resilient wedge, gate valve or approved substitute. Each valve shll include all appropriate transition gaskets. All mechanical joints shall be restrained with "Mega Lug" restraining glands as manufactured by EBBA Iron or approved substitute. All valves shall be sized according to approved drawings and shall meet AWWA C-509.
   b. Valves for Ductile Iron water lines shall be Mueller Model A-2360-20 gate valves, non-rising stem, resilient wedge gate valve. All valves shall have the required joint accessories. All valves shall be sized according to approved drawings and shall meet AWWA C509
4. Gate Boxes
   a. Valve boxes shall be Mueller Model H-10360 with lid as manufactured by Mueller Company or approved substitute.
5. Tees & Bends
   a. All tees and bends shall meet AWWA C153/A21.53 and ANSI/AWWA C111/A21.11 requirements. All tees and bends shall be cement lined according to ANSI/AWWA C104/A21.4. Fitting size and joint type to match drawings. If joint type is not noted contact the Continuing Authority for preferred type of joint. If mechanical joints are used, all joints shall be restrained with a restraining gland. Mega Lug as manufactured by EBBA Iron or approved substitute.
6. Tapping Sleeve
   a. Tapping Sleeves for PVC water lines shall be Mueller Model H304, stainless steel with flanged outlet as manufactured by Mueller Company or approved substitute.
   b. Tapping valve shall be Mueller Model T-2360-16, gate valve non-rising stem, resilient wedge seat meeting AWWA C-509. All tapping valves shall include the required transition glands and shall be sized as shown on the drawings. All mechanical joints shall be restrained with "Mega Lug" restraining glands as manufactured by EBBA Iron or approved substitute.
7. Detectable Locator Tape
   a. Detectable locator tape shall be 3-inches wide, bonded layer plastic with magnetic foil core. Tape shall be labeled as follows " Caution: Water Main Buried Below"
8. Water Main Locator Wire
   a. Water main locator wire shall be # 12 copper wire, solid or stranded, insulated for 600 volts with splice points in valve boxes only

C. Fire & Flush Hydrants
   1. Three-way Fire Hydrants
      a. Three-way Fire hydrants shall comply with American Water Works Association specifications C502. Hydrants shall have: post type dry barrel design, two-piece standpipe; compression type main valve; five and one-forth (5 ¼) inch valve

opening; two (2) two and one-half (2 ½) inch hose nozzles; one (1) four and one-half (4 ½) inch pumper nozzle; mechanical joint inlet with cast iron retainer glands; 7/8 inch square operating nut to open counter clockwise. Cast iron fitting shall be cement mortar lines with bituminous seal coat inside and out. Inlet connection shall be 6-inch mechanical joint. Fire hydrants shall be Model 423 as manufactured by the Mueller Company, or approved equal. Said hydrants shall be equipped with auxiliary gate valve and valve box and Mueller transition gland. Hydrants shall be properly restrained with tie rods or duc-lugs, size and quantity per manufactures recommendations for the hydrants pressure.

2. Two-way Fire Hydrant
   a. Two-way Fire hydrants shall comply with American Water Works Association specifications C502. Hydrants shall have: post type dry barrel design, two-piece standpipe; compression type main valve; five and one-forth (5 ¼) inch valve opening; two (2) two and one-half (2 ½) inch hose nozzles; mechanical joint inlet with cast iron retainer glands; 7/8 inch square operating nut to open counter clockwise. Cast iron fitting shall be cement mortar lines with bituminous seal coat inside and out. Inlet connection shall be 6-inch mechanical joint. Fire hydrants shall be Model 423 as manufactured by the Mueller Company, or approved equal. Said hydrants shall be equipped with auxiliary gate valve and valve box and Mueller transition gland. Hydrants shall be properly restrained with tie rods or duc-lugs, size and quantity per manufactures recommendations for the hydrants pressure.
3. Flush Hydrant
   a. One-way Flush hydrants shall comply with American Water Works Association specifications C502. Hydrants shall have: post type dry barrel design, two-piece standpipe; compression type main valve; 2 1/8-inch valve opening; one 2 ½ inch hose nozzles; mechanical joint inlet with cast iron retainer glands; 7/8 inch square operating nut to open counter clockwise. Cast iron fitting shall be cement mortar lines with bituminous seal coat inside and out. Inlet connection shall be 6-inch mechanical joint. Fire hydrants shall be Model 85 as manufactured by the Kupferle Foundry or approved substitute. Said hydrants shall be equipped with auxiliary gate valve and valve box and Mueller transition gland. Hydrants shall be properly restrained with tie rods or duc-lugs, size and quantity per manufactures recommendations for the hydrants pressure.

D. Water Service Connections
   1. Service Saddles
      a. Service saddles for water lines shall be Mueller Bronxe H-1300 Series or approved Substitute by the Continuing Authority. Saddles shall have a tapped outlet and shall be sized as specified by the Continuing Authority
   2. Corporation Stops
      a. Corporation stops shall be Mueller B-25008 or approved substitute by the Continuing Authority. Corporation stops shall be sized by the Continuing Authority.
   3. Curb Valves and Valve Boxes
      a. Curb Valves for service connections shall be Mueller H-15209 or approved substitute by the Continuing Authority. Curb Valves shall be sized by the Continuing Authority.
      b. Curb Boxes shall be Mueller H-15209 with compression connections on both ends. Curb boxes shall be extended to grade and clearly marked. Curb boxes shall be sized by the Continuing Authority.

4. Service Piping
   a. Type K copper tubing sized by the Continuing authority shall be buried with a minimum of 36-inches of cover. Service lines must be inspected by the Continuing Authority prior to backfilling.
   b. PVC service lines are permitted **only on approval** of the Continuing Authority.
5. Water Meters
   a. Water meters shall be sized by the Continuing Authority. All meters must be proceeded immediately by a ball valve. Meters shall be equipped with an approved dual check valve. Meters are to be installed according to the manufactures recomendations.
   b. Outdoor installation of water meters shall be inspected by the Continuing Authority prior to use. Contact the Continuing Authority of approved materials for outdoor installation.

PART 3 - EXECUTION

3.1 EXCAVATION CLASSIFICATIONS

A. Class A Excavation
   1. Class A excavation shall consist of all other materials not mentioned in Class B excavation. The decision of the Continuing Authority shall be final on the determination of the proper classification.

B. Class B Excavation
   1. Any material which cannot be excavated by any other process other than drilling and blasting or drilling and wedging shall be determined to be Class B excavation. Class B excavation shall be defined as solid rock. All Class B excavation shall be stripped clear to allow for measurement prior to payment.

   2. Explosives shall only be used when permitted by the Continuing Authority. Only a insured State licensed blaster shall be permitted to perform the work. The blaster shall use all OSHA Safety Guidelines when working. Any and all damages incurred as a result of the blasting shall be the responsibility of the contractor and the blaster.

   3. Measurement of the Class B excavated material shall be determined as in-place cubic yardage. Pay limits are established as the required trench width as defined below. Any over-excavation required to install the water line will be at the contractors expense.

3.2 TRENCH LOCATION

A. Horizontal & Vertical Separation with Sewers
   1. Horizontal Separation: Water mains shall maintain a minimum of 10 feet horizontal separation form sanitary sewer lines, storm sewer lines, and/or manholes. The horizontal separation shall be measured from the nearest edge of the water main to the closet edge of the sewer main.
   2. Vertical Separation: Water mains shall maintain a minimum of 18-inches cover over the sewer main. The separation distance shall be measured from the bottom of the water main to the top of the sewer main.

3. Unusual Conditions: When minimum separations distances cannot be met and the water or sewer line cannot be relocated, minimum separation distances may be reduced by the following methods
   a. Approval of the Continuing Authority must be obtained.
   b. The water main shall be laid with a full-length cast iron pipe. The pipe shall be located such that the pipe joints will be located as far as possible for the crossing. (ie. center of pipe at center or crossing) concrete encasement shall be placed 10-feet from the crossing point in both directions. The sewer line and the water line must be encased. Contact the Division of Health for alternate methods.

B. Location in Easements
1. The water line shall be constructed in the plated easements as shown on the drawing. The contractor is responsible any and all work performed outside of the established easements. The contractor is responsible for any and all damages incurred due to work outside the easements.

3.3 EXCAVATION OF TRENCHES

C. Trenches
1. Trench Depth
   a. Trenches shall have a minimum of 42" of cover over the top of the water line. Holes for the pipe bells shall be excavated to allow full and continuous support along the length of the pipe. The bottom of the trench shall be free of rocks, roots, or any other material that may damage the pipe. When trench bottom is unsuitable for laying the pipe directly on the bottom of the trench, 6-inchs of 1-inch minus material shall be used for bedding.
2. Trench Width & Pay Line
   a. No excavation shall be wider than one and four tenths (1.4) times the pipe diameter in inches plus 12-inches (W=1.4(D")+12). Two feet shall be the minimum trench width. Pay limits will be established using the following equation. Contractor is responsible for all excavation beyond the pay limits.
3. Trench Excavation
   a. The Contractor shall control the grading to prevent surface ground water from running into the excavated areas. Any water or other liquid wastes, which accumulated in the excavations, shall be removed promptly.

   b. The Contractor shall perform all excavation work necessary for and incidental to the proper construction of the water lines as shown on the approved plans or directed by the Continuing Authority. Excavation shall include the removal of trees, shrubs, and undesirable material. Excavation shall be done along the lines indicated on the approved plans and shall be continuous and straight. During excavation, material suitable for backfilling shall be stockpiled in an orderly manner a sufficient distance from the banks of the trenches to avoid overloading. All excavated material not suitable for backfill shall be removed by the Contractor and disposed of in a manner approved by the owner. The Contractor shall provide all barricades, lights, temporary crossings, warning signs, etc. that may be necessary to properly protect the public and the work from injury or damage

3.4 PIPE LAYING

D. Installation

1. Laying Pipe
   a. Laying of the pipe shall be commenced immediately after the excavation is started. The Contractor shall keep laying pipe closely behind the trenching operation. The Continuing Authority may stop the trenching when, in its opinion, the trench is opened too far in advance of the pipe laying operation. The Contractor shall lay the pipe in accordance with the manufacturer's instructions and recommendations, and in a manner that will not damage the pipe.
2. Thrust Blocking
   a. Lines shall be thrust blocked at bends, tees, and hydrants to prevent movement of lines under pressure. The concrete blocking shall be placed between solid ground and the fitting to be anchored in such a manner that the pipe and fitting joints will be accessible for repairs. Thrust blocks shall be constructed in accordance with the table shown on the detail drawing
   b. Restraining Glands shall be used on all mechanical joint connections. Mega Lug manufactured by EBBA Iron or approved substitute shall be used
   c. Duc Lugs or Tie Rods shall be used. Contractor shall consult manufactures specifications for size and quantity of rods required for the rated pressure
3. Damaged pipe will not be allowed. All damaged pipe shall be replaced at the contractors expense, and shall under no circumstances shall damaged pipe be installed.

3.5 TRENCH BACFILL

E. Backfill
1. Backfill
   a. When the pipe is laid, the Contractor shall backfill under and around the pipe until the pipe is covered with sufficient material to hold the pipe in position when firmly tamped. The remainder of the trench shall then be carefully backfilled simultaneously on both sides of the pipe. Broken concrete or pavement, blasted rock and large boulders shall not be used as backfill materials. Any trenches improperly backfilled, or where settlement occurs shall be repaired as directed by the Continuing Authority. The ground shall be graded to a reasonable uniformity and the required amount of mounding over the trenches left in a uniform and neat condition. Before final acceptance is made, the Contractor shall travel the line with the Continuing Authority to locate any places requiring repair. It is the intent of these Specifications to secure a condition where no further settlement of trenches will occur after backfilling is completed
2. Backfill Under Paved Areas
   a. In areas of existing or proposed pavement or rock surfaces, the entire backfill shall consist of well-graded one (1) inch minus crushed limestone. The backfill material shall be compacted by an acceptable method to insure that no settlement of the completed backfill will occur. All areas of existing pavement damaged during construction shall be repaved to the specifications of the Appropriate Governing Authority. Edges of the existing pavement shall be neatly cut in a straight line, removing all damaged pavement, prior to repaving.
3. Backfill Settlement
   a. The Contractor shall be responsible for the satisfactory compaction of backfill material described. If any trenches or other excavation are found to have settled, they shall be immediately reworked by the Contractor and restored to the specified grades. In addition, the Contractor shall be responsible for all damage or damages which might result from settlement of backfill made by him of the fulfillment of his

contract within and during the period of one (1) year from and after the date of final acceptance

3.6 WATER LINE TESTING

F. Hydrostatic Testing

1. All newly laid lines shall be tested before being placed in service. Trenches may be backfilled as the pipe is laid; or where practicable, trenches or bell holes may be left open for visual inspection during tests. Prior to making tests, all air shall be expelled from the pip. If hydrants or blow-offs are not available at high points of the lines, suitable taps shall be provided at such points
2. A one-hour hydrostatic test shall be made on the pipeline between valves or temporary plugs at a test pressure of at least fifty (50) percent in excess or normal operating pressure. Any open trench or bell holes may over dry joints and may be backfilled following this test. Where trenches have been backfilled prior to making the test, any leaks evident at the surface shall be remade and retested. All pipes, fittings, valves, hydrants, and other materials found defective under this test should be removed and replaced.
3. After hydrostatic tests have been satisfactorily completed, a two (2) hour leakage test shall be made on the pipeline valves or temporary plugs at a constant test pressure of seventy-five (75) pounds per square inch. Leakage in the test system shall be measured through a meter or approved measuring device. The allowable leakage shall not be greater than seventy (70) gallons per 24-hour day per mile of pipe per inch nominal diameter of pipe. Should tests disclose leakage greater than the allowable amount, locate and repair defective joint(s) until the leakage is within the specified allowance.

3.7 WATER LINE DISINFECTION

G. Preparation

1. The interior of all pipe, fittings, and other accessories shall be kept free as possible from dirt and foreign matter at all times. Every precaution shall be used to protect the pipe against the entrance of foreign material before the pipe is placed in the new line. At the close of the day's work or whenever the workmen are absent from the job, the end of the last laid section of pipe shall be plugged, capped or otherwise tightly closed to prevent the entry of foreign material of any nature. If the pipe laying crew cannot put the pipe into the trench and in place without getting earth into it, the City of Washington may require that before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size shall be placed over each end, and left there until the connection is to be made to the adjacent pipe.
2. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug. Joints of pipe in the trench shall be made before the work is stopped. The provision shall apply during the noon hour as well as overnight.

H. Flushing & Sterlizing

1. Sterilizing of the completed line shall be done in a manner approved and recommended by the Missouri Division of Health. Prior to chlorination, the main shall be flushed as thoroughly as possible with the water pressure and outlets available. Flushing shall be done after the pressure tests are made. It must be understood that such flushing removes only the lighter solids and cannot be relied upon to remove heavy material allowed to get into the main during laying, Unless extreme care and thorough inspection is practiced during the laying of water mains, small stones, pieces of concrete, particles of metal, or

other foreign material may gain access to mains newly laid. If it is believed that such foreign material may be in the main, it shall be thoroughly flushed and valves carefully inspected after flushing to see that the entire valve operating mechanism is in good condition.

2. Subsequent to flushing, the following procedure shall be followed in disinfecting the water mains.

   a. Close off section of distribution system that is to be disinfected.
   b. Prepare one (1) percent chlorine solution as shown in the following table:

Product	Amount of Compound	Quantity of Water to Add to make 1% Solution
High Test Calcium Hypo-Chlorite (65-70% Chlorine, HTH Parachloron, etc.)	1 lb.	7.5 gal.
Chlorinated Lime (32-35% Chlorine)	2 lbs.	7.5 gal.
Liquid Laundry Bleach (Purex or Chlorox	1 gal.	4.25 gal.

   c. The amount of chlorine required per one hundred (100) feet length of various pipe sizes is as shown in the following table:

Pipe Size		Volumeof 100 ft. Length	Amount Required to Give 25 *ppm* Chlorine
(in)	(gal)	100% Chlorine (lb.)	1% Chlorine/Water (gal.)
2	16.4	0.0034	1/24
4	65.3	0.0135	1/6
6	146.5	0.0305	3/8
8	261.0	0.054	2/3
10	408.0	0.085	1
12	588.7	0.123	1 ½

   d. Introduce the chlorine solution with a positive displacement type pump at the same point where the water will be introduced into the section to be disinfected.
   e. Fill the pipe slowly and be sure not to trap any air in the pipe. Close the section off that is to be disinfected when the pipe is full and under slight pressure. The solution should be allowed to remain in the pipe for twenty-four (24) hours.

   NOTE: The detention time may be cut to three (3) hours, provided a one-hundred (100) ppm chlorine solution is used in place of the 25 ppm chlorine solution.

   f. All valves or other appurtenances in the line being disinfected should be operated while the system is being filled with the chlorine solution.

3. Following sterilizing, all treated water shall be thoroughly flushed from the newly laid pipeline at its extremities until the replacement water throughout its length shall, upon test, be proved comparable to the quality of water approved by the Public Health Authority having jurisdiction. The Contractor or his Representative shall arrange for any bacteriological testing of water samples that may be required. This quality of water delivered by the new main should continue for a period of at least two (2) full days, as demonstrated by laboratory examination of samples taken from a tap located and installed in such a way as to prevent outside contamination. Samples should never be taken from an unsterilized hose or from a hydrant, because such samples seldom meet current bacteriological standards.
4. Should the initial treatment fail to result in the condition specified in the preceding paragraph, the sterilization procedure shall be repeated until such results are obtained.

3.8 FINISH GRADDING

I. Finish Gradding
   1. During the progress of the work, the Contractor shall remove and properly dispose of all debris and waste material. Upon completion and acceptance of the work, remove from the property of the Owner all equipment and facilities and unused materials provided by the contractor in connection with the work and leave the grounds in a clean and orderly condition. Any and all areas that are disturbed as a result of construction shall be restored to an "as good or better" condition as existed prior to being disturbed.

3.9 SAFTEY

J. The contractor shall follow all current OSHA guidelines at all times during construction.

END OF SECTION 2511

SECTION 02525 - WATER SUPPLY WELLS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Submersible-type pumps for water supply wells.
   2. Associated specialties.

B. See Division 2 Section "Water Distribution" for water-service, fire-service-main, and combined water-service and fire-service-main piping.

1.2 PERFORMANCE REQUIREMENTS

A. Minimum Tested Water Supply Well Performance Capacity: 100 gpm. Final capacity will be determined by the required pump test.

B. Well driller must be certified by The State of Missouri to drill this type of well.

C. The well driller is required to contact Missouri Department of Natural Resources, State Geologist prior to drilling the well. The driller shall perform the required samples as described by state requirements. These samples will determine the final properties of the well.

1.3 UNIT PRICES

A. Unit-Price Amounts: As stipulated in the Form of Agreement.

B. Measurement and Payment Procedures:
   1. Measurement of the well shall be made from the existing ground surface to the bottom of the well. Measurement of the well casing shall be measured from the top of the casing to the bottom of the casing. Measurement of the surface casing shall be measured from the top of the casing to the bottom of the casing.
   2. Unit Prices as determined by the agreement shall be used for final payment based on final measurments.

C. Measurement Units for Water Supply Wells, Casings, and Grout: Per linear foot of well depth.

1.4 SUBMITTALS

A. Product Data: Submit certified performance curves and rated capacities of selected well pumps and furnished specialties for each type and size of well pump indicated.

B. Shop Drawings: Show layout and connections for well pumps.

   1. Wiring Diagrams: Power, signal, and control wiring.

C. Field quality-control reports.

D. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. AWWA Compliance: Comply with AWWA A100 for water supply wells.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 WELL CASINGS

A. Surface Casing
1. Well Casing shall be sized in according to MO-DNR 10 CSR 23-3 Steel Casing Table and shall be sized as shown on the drawings

B. Well Casing
1. Well Casing shall be sized in according to MO-DNR 10 CSR 23-3 Steel Casing Table and shall be sized as shown on the drawings."

C. Discharge Piping
1. Steel Pipe shall meet AWWA C200, single ply, steel pipe with threaded ends and threaded couplings for threaded joints
2. Two inline check valves shall be installed in the discharge piping. The first inline check valve shall be placed approximately 40-feet above the well pump. The second valve shall be placed approximately 150-feet above the pump. Inline check valves shall be Flowmatic or Technocheck sized for the discharge column as shown on the drawings

D. Well Sanitary Seals: Casing cap, with holes for piping and cables, that fits into the casing and is removable, waterproof, and vermin proof.

2.3 WATER WELL SCREENS

A. Screen Material: Fabricated of ASTM A 666, Type 304 stainless-steel tube; with slotted or perforated surface and designed for well-screen applications.

1. Screen Couplings: Butt-type, stainless-steel, coupling rings.
2. Screen Fittings: Screen, with necessary fittings, closes bottom and makes tight seal between top of screen and well casing.
3. Maximum Entering Velocity: 0.1 fps.

2.4 SUBMERSIBLE-TYPE WELL PUMPS

A. Manufacturers:
1. Grundfos.
2. Jacuzzi, Inc.; Jacuzzi Brothers.
3. Pentair Pump Group; F. E. Myers.

B. Description: Submersible-type, vertical-turbine well pump complying with HI 2.1-2.5 or AWWA E101, with the following features:

1. Impeller Material: Stainless steel.
2. Motor: Capable of continuous operation under water, with protected submersible power cable.
3. Column Pipe: ASTM A 53, Schedule 40, galvanized steel pipe with threaded ends and cast-iron or steel threaded couplings.

PART 3 - EXECUTION

3.1 PREPARATION

A. Pilot-Hole Data: Pilot hole is not required but is recommended. Boring samples from the pilot hole shall be taken in accordance with Mo~DNR guidelines and they shall be submitted to the State Geologist for review. The State Geologist will use these samples to determine the final casing depth and total depth of the well. A copy of this report shall be furnished to Owner.

3.2 INSTALLATION

A. Construct well using air driven rotary or rotary percussion method.

B. Enlarge pilot hole and install permanent casing, screen, and grout. Install first section of casing with hardened steel driving shoe of an OD slightly larger than casing couplings if threaded couplings are used.

C. Set casing and liners round, plumb, and true to line.

D. Join casing pipe as follows:

1. *Ream ends of pipe and remove burrs.*

2. Remove scale, slag, dirt, and debris from inside and outside casing before installation.
3. Cut bevel in ends of casing pipe and make threaded joints.
4. Clean and make solvent-cement joints.

E. Provide permanent casing with temporary well cap. Install with top of casing 24 inches above finished grade.

F. Develop wells to maximum yield per foot of drawdown.

1. Extract maximum practical quantity of sand, drill fluid, and other fine materials from water-bearing formation.
2. Avoid settlement and disturbance of strata above water-bearing formation.
3. Do not disturb sealing around well casings.
4. Continue developing wells until water contains no more than 2 ppm of sand by weight when pumped at maximum testing rate.

G. Install submersible-type well pumps according to HI 2.1-2.5 and provide access for periodic maintenance.

1. Before lowering permanent pump into well, lower a dummy pump that is slightly longer and wider than permanent pump to determine that permanent pump can be installed. Correct alignment problems.
2. Before lowering permanent pump into well, start pump to verify correct motor rotation.
3. Securely tighten discharge piping joints.
4. Connect motor to submersible pump and locate as determined by Mo~DNR near well bottom.

a. Connect power cable while connection points are dry and undamaged.
b. Do not damage power cable during installation; use cable clamps that do not have sharp edges.
c. Install water-sealed surface plate that will support pump and piping.

H. See Division 2 Section "Utility Materials" for basic piping joint construction.

3.3 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

1. Connect piping between well pump and water piping.
2. Connect building water distribution to well pipe inside well house.

B. Electrical wiring, connections, and pump controllers are specified..

C. Ground equipment according to NEC Electrical Codes.

3.4 WELL ABANDONMENT

A. Follow well-abandonment procedures of Missouri Department of Natural Resources. Restore ground surface to finished grade.

3.5 FIELD QUALITY CONTROL

A. Plumbness and Alignment Testing: Comply with AWWA A100, Section 8.

B. Water Samples, Records, and Reports: Take samples of substrata formation at Mo~DNR pre determined intervals and at changes in formation throughout entire depth of each water supply well. Carefully preserve samples on-site in glass jars properly labeled for identification.

1. Furnish samples of water-bearing formation to testing laboratory and well-screen manufacturer for mechanical sieve analysis.
2. Prepare reports on static level of ground water, level of water for various pumping rates, and depth to water-bearing strata.

C. Performance Testing: Conduct final pumping tests after wells have been constructed, cleaned, and tested for plumbness and alignment.

1. Provide discharge piping to conduct water to locations where disposal will not create a nuisance or endanger adjacent property. Comply with requirements of Mo~DNR.
2. Measure elevation to water level in wells.
3. Perform two bailer or air-ejection tests to determine expected yield. Test at depths with sufficient quantity of water to satisfy desired yields.
4. Test Pump: Variable capacity test pump with capacity equal to maximum expected yields at pressure equal to drawdown in wells, plus losses in pump columns and discharge pipes.
5. Start and adjust test pumps and equipment to required pumping rates.
6. Record readings of water levels in wells and pumping rates at Mo~DNR or AWWA required required rates.
7. Record maximum yields when drawdown..
8. Operate pumping units continuously as required after maximum drawdown is reached.
9. Record returning water levels in wells and plot curves of well recovery rates.
10. Remove sand, stones, and other foreign materials that may become deposited in wells after completing final tests.

D. Water Analysis Testing: Make bacteriological, physical, and chemical analyses of water from each finished well and report the results. Make analyses according to requirements of authorities having jurisdiction.

E. Start well pump and adjust controls and pressure setting. Replace damaged and malfunctioning controls and equipment.

3.6 CLEANING

A. Disinfect water supply wells according to AWWA A100 and AWWA C654 before testing well pumps.

B. Follow water supply well disinfection procedures required by Mo~DNR.

3.7 PROTECTION

A. Water Quality Protection: Prevent well contamination, including undesirable physical and chemical characteristics.

B. Ensure that mud pit will not leak or overflow into streams or wetlands. When well is accepted, remove mud and solids in mud pit from Project site and restore site to finished grade.

C. Provide casings, seals, sterilizing agents, and other materials to eliminate contamination; shut off contaminated water.

D. Exercise care to prevent breakdown or collapse of strata overlaying that from which water is to be drawn.

E. Protect water supply wells to prevent tampering and introducing foreign matter. Retain temporary well cap until installation is complete.

END OF SECTION 02525

GRUNDFOS STAINLESS STEEL PUMPS

STAINLESS STEEL CONSTRUCTION

Grundfos submersibles feature rugged and durable stainless steel construction for all vital pump components. Impellers, diffusers, shafts, vanes, cable guards, couplings...even the nuts and bolts are stainless steel. Grundfos' 4-inch pump systems include the stainless steel pump, motor, and control box and are delivered ready to install.

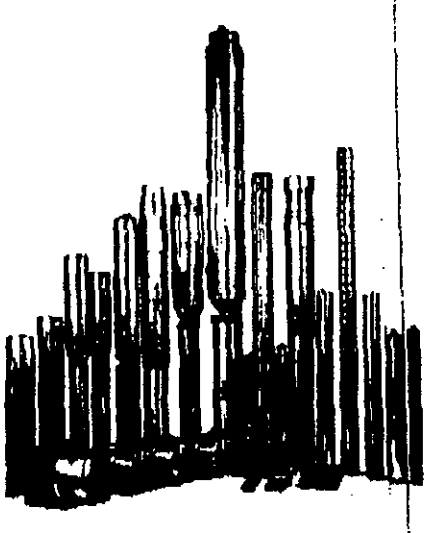
Computer-aided design and manufacturing techniques ensure that each *pump* is built to exacting tolerance and performs to industry-leading standards. Grundfos state-of-the-art production equipment includes extensive use of robotics and advanced quality assurance procedures. You can rely on quality Grundfos' groundwater products for outstanding pump performance and best value.

SUBMERSIBLES

4-INCH and LARGER WELLS
The 4-inch submersibles line covers all flow requirements from 1.2 to 95 gpm and heads to 2000 feet. This broad range ensures proper pump selection for all domestic groundwater system applications.

6, 8, & 10-INCH and LARGER WELLS
For high flow requirements, this submersible line includes 6, 8, and 10-inch models for flows up to 1,400 gpm and heads to 2100 feet.

Grundfos offers 18 models of submersible pumps designed for domestic and industrial applications with flow rates from five to 1,400 gpm. Horsepower range extends from 1/3 hp to 250 hp. These pumps are marketed through more than 300 distributors and nearly 2,000 dealers nationwide.



THE STAINLESS STEEL ADVANTAGE

TOP PUMP PERFORMANCE
Grundfos pumps are built to work hard with every component designed for maximum hydraulic efficiency. With the inherently smooth surfaces of fabricated stainless steel, peak performance is maintained over many years of service.

RELIABLE OPERATION
Highly advanced design and manufacturing techniques minimize the number of moving parts. This, plus Grundfos' use of rugged stainless steel construction, make GRUNDFOS groundwater pumps the toughest, most reliable pumps on the market. With Grundfos you can rely on getting the water you need, when you need it.

LONG PUMP LIFE
Stainless steel is the best available material to resist wear and corrosion in water system applications. Compare Grundfos' stainless steel construction to the best the other manufactures have to offer. Grundfos stainless steel pumps are designed to operate efficiently and effectively for a long, long time.

TECHNICAL DATA 85 GPM MODEL 85S

DIMENSIONS AND WEIGHTS

MODEL NO.	FIG.	HP	MOTOR SIZE	DISCH. SIZE	DIMENSIONS IN INCHES					APPROX. SHIP WT.
					A	B	C	D	E	
85S15-1	A	1 1/2	4"	3" NPT	25.9	13.6	12.3	3.75	5.2	37
85S30-2	A	3	4"	3" NPT	35.3	20.6	14.7	3.75	5.2	61
85S50-3	A	5	4"	3" NPT	40.7	23.6	17.1	3.75	5.2	75
85S50-4	A	5	4"	3" NPT	43.1	23.6	19.5	3.75	5.2	77
85S75-5	A	7 1/2	4"	3" NPT	51.5	29.6	21.9	3.75	5.2	95
85S75-6	A	7 1/2	4"	3" NPT	53.9	29.6	24.3	3.75	5.2	97
85S100-7	A	10	4"	3" NPT	70.5	43.9	26.6	3.75	5.2	151
85S100-8	A	10	4"	3" NPT	72.9	43.9	29.0	3.75	5.2	154
85S100-9	A	10	4"	3" NPT	75.3	43.9	31.4	3.75	5.2	156
85S75-5	A	7 1/2	6"	3" NPT	46.7	24.2	22.5	5.38	5.6	135
85S75-6	A	7 1/2	6"	3" NPT	49.1	24.2	24.9	5.38	5.6	137
85S100-7	A	10	6"	3" NPT	52.7	25.4	27.3	5.38	5.6	148
85S100-8	A	10	6"	3" NPT	55.0	25.4	29.6	5.38	5.6	151
85S100-9	A	10	6"	3" NPT	57.4	25.4	32.0	5.38	5.6	153
85S150-10	A	15	6"	3" NPT	62.4	28.0	34.4	5.38	5.6	170
85S150-11	A	15	6"	3" NPT	64.8	28.0	36.8	5.38	5.6	174
85S150-12	A	15	6"	3" NPT	67.2	28.0	39.2	5.38	5.6	176
85S150-13	A	15	6"	3" NPT	69.6	28.0	41.6	5.38	5.6	178
85S200-14	A	20	6"	3" NPT	74.5	30.6	43.9	5.38	5.6	193
85S200-15	A	20	6"	3" NPT	76.9	30.6	46.3	5.38	5.6	198
85S200-16	A	20	6"	3" NPT	79.3	30.6	48.7	5.38	5.6	200
85S200-17	A	20	6"	3" NPT	81.7	30.6	51.1	5.38	5.6	202
[illegible]	A	20	6"	3" NPT	84.1	30.6	53.5	5.38	5.6	204
85S250-19	A	25	6"	3" NPT	88.9	33.1	55.8	5.38	5.6	240
85S250-20	A	25	6"	3" NPT	91.9	33.1	58.8	5.38	5.6	244
85S250-21	A	25	6"	3" NPT	94.3	33.1	61.2	5.38	5.6	246
85S250-22	A	25	6"	3" NPT	96.7	33.1	63.6	5.38	5.6	249
85S300-23	A	30	6"	3" NPT	101.9	35.7	66.2	5.38	5.6	264
85S300-24	A	30	6"	3" NPT	104.1	35.7	68.4	5.38	5.6	266
85S300-25	A	30	6"	3" NPT	106.4	35.7	70.7	5.38	5.6	271
85S300-26	A	30	6"	3" NPT	108.8	35.7	73.1	5.38	5.6	273
85S300-27	A	30	6"	3" NPT	116.3	40.8	75.5	5.38	5.6	278
85S400-28	A	40	6"	3" NPT	118.7	40.8	77.9	5.38	5.6	281
85S400-29	A	40	6"	3" NPT	121.1	40.8	80.3	5.38	5.6	283
85S400-30	A	40	6"	3" NPT	123.4	40.8	82.6	5.38	5.6	287
85S400-33*	B	40	6"	3" NPT	139.7	40.8	93.9	5.38	6.9	343
85S400-36*	B	40	6"	3" NPT	146.9	40.8	106.1	5.38	6.9	354
85S500-39*	B	50	6"	3" NPT	171.0	57.8	113.2	5.38	6.9	448
85S400-33*	B	40	8"	3" NPT	134.7	35.8	98.9	7.5	6.9	377
85S400-36*	B	40	8"	3" NPT	141.9	35.8	106.1	7.5	6.9	390
85S500-39*	B	50	8"	3" NPT	152.0	38.6	113.2	7.5	6.9	498

NOTES: All models suitable for use in 6" wells, unless otherwise noted.
Weights include pump end with motor in lbs.
* Built into sleeve 3" NPT discharge, 8" min. well dia.

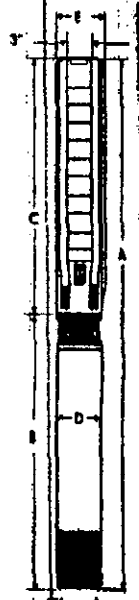


Fig. A

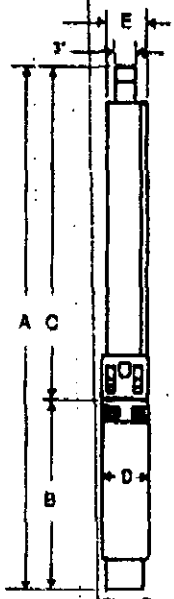
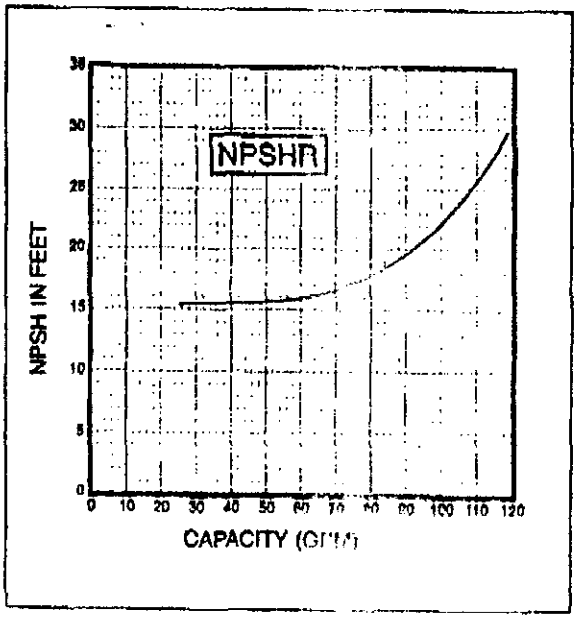


Fig. B

MATERIALS OF CONSTRUCTION

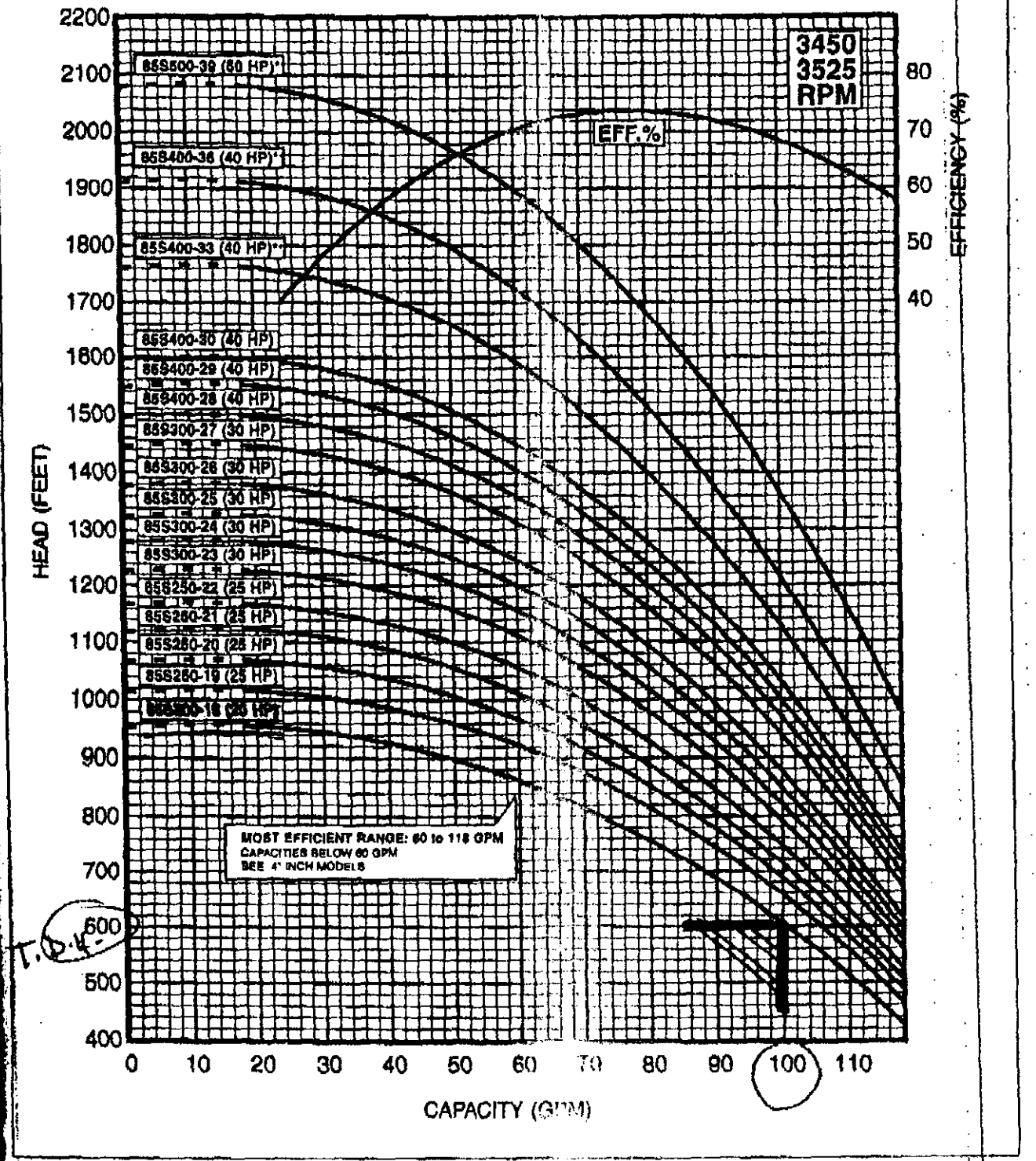
COMPONENT	CYLINDRICAL SHAFT (1- 39 Stgs.)
Check Valve Housing	304 Stainless Steel
Check Valve	304 Stainless Steel
Diffuser Chamber	304 Stainless Steel
Split Cone Nut	304 Stainless Steel
Split Cone	304 Stainless Steel
Impeller	304 Stainless Steel
Suction Interconnector	304 Stainless Steel
Seal Ring Support	304 Stainless Steel
Inlet Screen	304 Stainless Steel
Straps	304 Stainless Steel
Cable Guard	304 Stainless Steel
Priming Inducer	304 Stainless Steel
Coupling	316/329 Stainless Steel**
Pump Shaft	431 Stainless Steel
Intermediate Bearings	NBR
Impeller Seal Ring	NBR/PPS
Check Valve Seat	NBR/316 Stainless Steel
Upthrust Disc	Carbon/Graphite
Upthrust Stop Washer	304 Stainless Steel
6" Motor Adaptor Plate	304 Stainless Steel
Sleeve *	316 Stainless Steel
Sleeve Flange *	316 Stainless Steel

NOTES: Specifications are subject to change without notice.
* Required for 33-39 stages.
** 4" Coupling made of 316 Stainless Steel



MODEL 85S 85 GPM PERFORMANCE CURVES

FLOW RANGE: 18 -118 GPM **OUTLET SIZE: 3" NPT** **NOMINAL DIA. 6"**



T.D.H.

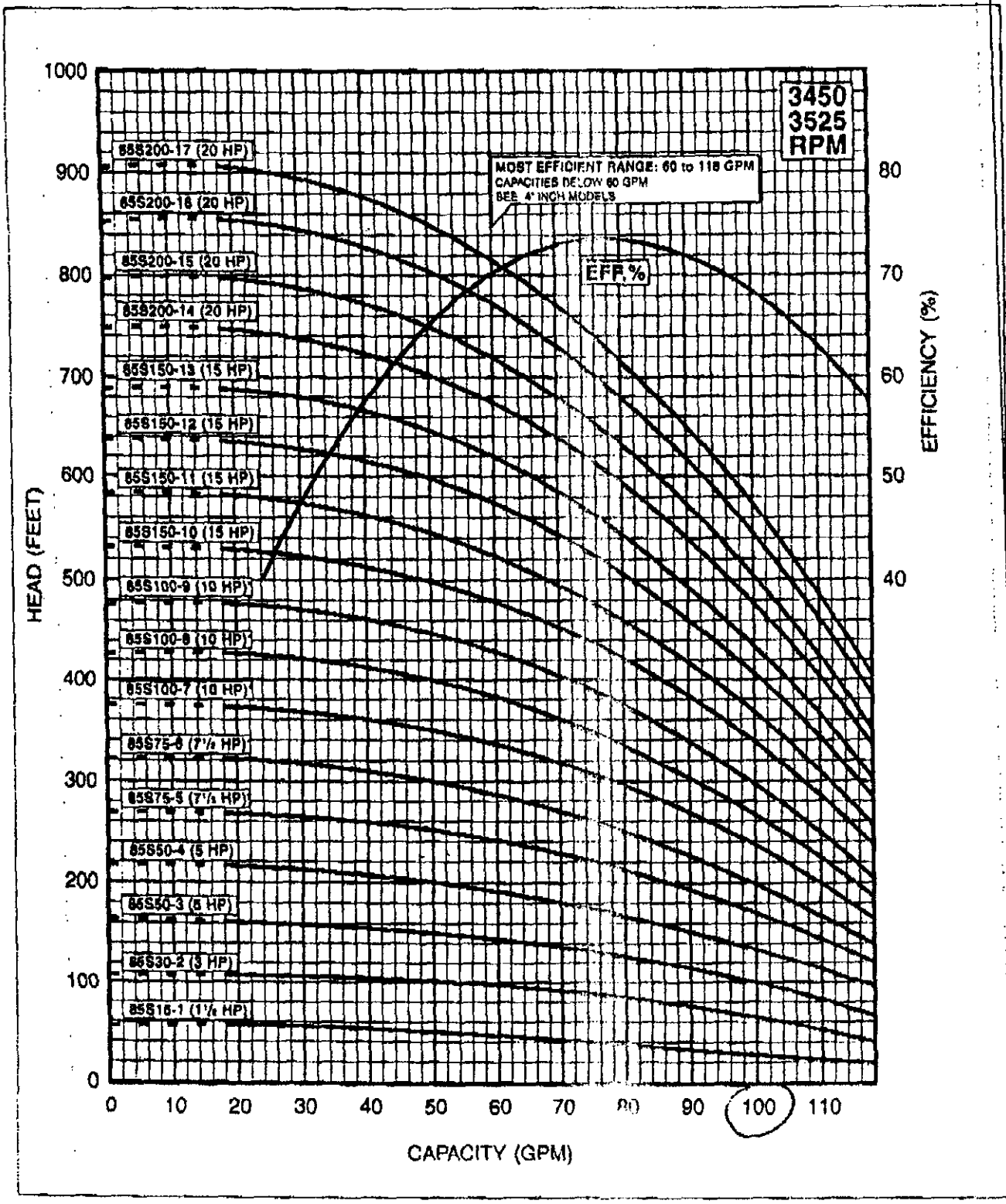
SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.
Built into sleeve 3" male NPT discharge/ 6" min. well diameter.
* MOTOR STANDARD, 7.5-50 HP/3450 RPM.
Alternate motor sizes available.

Performance conforms to ISO 9906 Annex A
@ 5 ft. min. submergence.

GRUNDFOS

PERFORMANCE CURVES 85 GPM MODEL 85S

FLOW RANGE: 18 -118 GPM **OUTLET SIZE: 3" NPT** **NOMINAL DIA. 6"**



SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.
4" MOTOR STANDARD, 1.5-5 HP/3450 RPM
6" MOTOR STANDARD, 7.5-50 HP/3450 RPM.
* Alternate motor sizes available.

Performance conforms to ISO 9906 Annex A
@ 5 ft. min. submergence.

Table 13 Three Phase Motor Specifications (60 Hertz)

Motor Model	HP	Volts	HZ	S.F.	Rated Input Amps	Rated Input Watts	Maximum (S.F. Load) Amps	Maximum (S.F. Load) Watts	Line to Line Res.	Efficiency % F.L.	Efficiency % 3/4	Power Factor % S.F.	Power Factor % F.L.	Power Factor % 3/4	Locked Rotor Amps	KVA Code	Direct Starter Std	Direct Starter Delay
6 Inch Con't - 3450 RPM																		
236653	15	200	60	1.15	47.8	13700	54.5	15800	.22-.27	81.0	81.5	80.2	84.9	82.8	76.5	306	H	150	60
236603	15	230	60	1.15	41.6	13700	47.4	15800	.27-.33	81.0	81.5	80.2	84.9	82.8	76.5	266	H	125	60
236613	15	460	60	1.15	20.8	13700	23.7	15800	1.07-1.32	81.0	81.5	80.2	84.9	82.8	76.5	133	H	60	30
236623	15	575	60	1.15	16.7	13700	19	15800	1.70-2.10	81.0	81.5	80.2	84.9	82.8	76.5	106	H	50	25
236654	20	200	60	1.15	61.9	18100	69.7	20900	.14-.17	82.0	82.3	81.6	86.8	84.8	79.5	416	J	200	80
236604	20	230	60	1.15	53.8	18100	60.6	20900	.20-.25	82.0	82.3	81.6	86.8	84.8	79.5	362	J	175	70
236614	20	460	60	1.15	26.9	18100	30.3	20900	.76-.94	82.0	82.3	81.6	86.8	84.8	79.5	181	J	80	35
236624	20	575	60	1.15	21.5	18100	24.4	20900	1.22-1.52	82.0	82.3	81.6	86.8	84.8	79.5	145	J	70	30
236655	25	200	60	1.15	77.1	22500	86.3	25700	.11-.14	82.8	83.0	82.0	87.0	85.0	79.2	552	J	225	100
236605	25	230	60	1.15	67	22500	75	25700	.15-.19	82.8	83.0	82.0	87.0	85.0	79.2	480	J	200	90
236615	25	460	60	1.15	33.5	22500	37.5	25700	.59-.73	82.8	83.0	82.0	87.0	85.0	79.2	240	J	100	45
236625	25	575	60	1.15	26.8	22500	30	25700	1.01-1.25	82.8	83.0	82.0	87.0	85.0	79.2	192	J	80	35
236656	30	200	60	1.15	90.9	26900	104	31100	.10-.12	82.5	83.0	82.6	87.5	85.4	80.3	653	J	300	125
236606	30	230	60	1.15	79	26900	90.4	31100	.12-.15	82.5	83.0	82.6	87.5	85.4	80.3	568	J	250	110
236616	30	460	60	1.15	39.5	26900	45.2	31100	.48-.60	82.5	83.0	82.6	87.5	85.4	80.3	284	J	125	50
236626	30	575	60	1.15	31.6	26900	36.2	31100	.78-.95	82.5	83.0	82.6	87.5	85.4	80.3	227	J	100	40
236617	40	460	60	1.15	53.5	35600	62	42400	.32-.40	83.2	83.4	82.9	85.8	83.6	77.6	397	J	150	70
236627	40	575	60	1.15	42.8	35600	49.6	42400	.53-.59	83.2	83.4	82.9	85.8	83.6	77.6	318	J	125	60
236618	50	460	60	1.15	67.7	45100	77	52200	.25-.32	82.5	83.0	82.7	85.2	84.0	80.0	414	H	200	90
236628	50	575	60	1.15	54.2	45100	61.6	52200	.39-.48	82.5	83.0	82.7	85.2	84.0	80.0	331	H	150	70
236619	60	460	60	1.15	80.5	53500	91	61700	.22-.27	81.2	84.5	84.0	85.0	83.3	78.0	518	H	250	100
236629	60	575	60	1.15	64.4	53500	72.8	61700	.35-.39	81.2	84.5	84.0	85.0	83.3	78.0	414	H	200	80
8 Inch - 3525 RPM																		
239600	40	460	60	1.15	53	35000	60	40000	.256-.283	86.2	86.1	84.8	86.1	84.2	78.5	407	K	175	70
239610	40	575	60	1.15	42	35000	48	40000	.412-.456	86.0	85.9	84.6	86.0	85.0	81.0	326	K	125	60
239601	50	460	60	1.15	65	43000	73	49000	.188-.207	87.3	87.2	86.2	86.6	85.5	80.5	528	K	200	80
239611	50	575	60	1.15	53	43000	60	49000	.290-.320	86.6	86.5	85.2	87.0	86.0	86.0	422	K	150	70
239602	60	460	60	1.15	79	52000	89	60000	.148-.163	87.6	87.5	87.2	87.6	85.9	81.3	658	K	225	100
239612	60	575	60	1.15	61	52000	69	60000	.235-.260	87.3	87.2	86.1	86.0	85.0	80.0	526	K	175	80
239603	75	460	60	1.15	97	64000	107	73500	.110-.121	89.1	88.0	86.8	88.0	86.8	82.0	833	K	300	125
239613	75	575	60	1.15	78	64000	85	73500	.175-.193	87.5	87.4	86.2	86.0	85.0	81.0	666	K	225	100
239604	100	460	60	1.15	125	85000	144	97500	.076-.084	88.3	88.1	87.5	88.1	86.6	81.7	1212	L	400	175
239614	100	575	60	1.15	104	85000	116	97500	.114-.126	88.0	87.8	86.4	85.8	84.0	79.0	970	L	300	150
239105	125	460	60	1.15	165	109000	189	125000	.057-.063	87.3	86.9	85.3	87.2	86.9	77.9	1318	K	500	225
239115	125	575	60	1.15	136	109000	150	125000	.090-.100	87.2	86.9	85.3	84.3	82.6	77.5	1054	K	400	175
239106	150	460	60	1.15	193	128000	221	146000	.049-.054	87.7	87.4	86.0	86.0	84.4	79.7	1620	K	600	250
239116	150	575	60	1.15	154	128000	177	146000	.067-.074	87.9	87.4	85.7	82.9	80.8	75.0	1296	K	450	200
239107	175	460	60	1.15	218	150000	250	173000	.045-.050	87.3	87.0	86.7	88.8	87.6	84.8	1645	J	700	300
239117	175	575	60	1.15	174	150000	200	173000	.067-.074	88.5	88.0	86.1	86.2	85.0	80.0	1316	J	700	300
239108	200	460	60	1.15	245	169000	286	194000	.038-.042	88.0	87.9	86.8	88.7	88.4	84.5	1875	J	800	350
239118	200	575	60	1.15	196	169000	229	194000	.060-.066	88.0	88.0	87.0	89.5	88.6	85.3	1500	J	600	300

Model numbers are three lead motors. Six lead motors with different model numbers have the same running performance, but when we connected for starting have locked rotor amps 33% of the values shown. Six lead individual phase resistance = table × 1.5.

SECTION 5510 - HYDROPNEUMATIC STORAGE TANK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1.3 ASSEMBLY DESCRIPTION

A. Hydropneumatic Tank shall be constructed as drawn and tested prior to shipping to the site. The tank shall meet all required codes.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide Hydropneumatic Tank capable of withstanding the effects of gravity loads and meeting all requirements of the ASME Boiler Codes, AWWA D100 Standard for "the following loads and stresses within limits and under conditions indicated:

1.5 SUBMITTALS

A. Shop Drawings: Show fabrication and installation details for the Hydropneumatic Tank.

1.6 DELIVERY, STORAGE, AND HANDLING

A. The hydropneumatic tank shall be delivered to the site. Upon delivery the contractor shall store the tank according to the manufactures guidelines and recommendations

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of Hydropneumatic Tank that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Structural failure under normal operating conditions.
   b. Any leaks due to poor workmanship.

B. Special Warranty: Contractor agrees to repair or replace components of Hydropneumatic Tank that fail in within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failure due to improper storage.
b. Structural failure due to improper handling..

C. Warranty Period: 1 year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Qick Tanks Inc.;

2. Continental Tanks

3. Hydropneumatic Tank:

B. The hydropneumatic tank shall meet the following requirements
1) ASME Boiler & Pressure Vessel Code
2) AWWA D100 Standard for Welded Steel Tanks.
3) ANSI/NSF Standard 61

2.2 Hydropneumatic Tank

A. Tank Dimensions and Required Pressure
1. Tank shall have a gross capacity of 12,000 gallons
2. Tank shall be approximately 10-foot diameter
3. Tank shall be approximately 21-feet in length.

B. Inlet and Outlet
1. Tank inlet shall be sized and located as shown on the drawing.
2. Tank outlet shall be sized and located as shown on the drawing.
3. A 3-inch drain plug shall be installed in the tank.
4. A 2-inch threaded opening shall be installed on the top of the tank.
5. The tank shall be provided with a site glass as shown on the drawings
6. 2 1-inch threaded connections shall be mounted on the tank as shown on the drawings

C. Man Access
1. A 24-inch flanged manhole entrance shall be provided. Entrance manhole shall meet all codes

D. Support Saddle
1. 12-inch wide metal saddles shall be provided on the tank as shown on the drawings.
2. Saddles shall provide a minimum of 24-inches of clearance below the bottom of the tank.

E. Coatings
1. Interior of the tank shall be coated according to ANSI/NSF Standard 61
2. Exterior of the tank shall be primed with an Oxide Primer to prevent rust.
3. Exterior of the tank shall be field coated by the contractor with Tenemic Brand Paint.

F. Tank shall be labeled with the following information:
1. Name of manufacturer
2. Maximum allowable pressure of the tank as determined by the ASME Boiler Code.

2.3 MATERIALS, GENERAL

A. Steel
1. All material shall meet the requirements of the ASME Boiler Codes. The Pressure Vessel shall be design for 100 psi working pressure. The outer shell shall be sized using the ASME Boiler Codes to meet the required working pressure and the required factor of safety as defined by the ASME Boiler Codes.

PART 3 - EXECUTION

3.1 Assembly

A. Hydropneumatic tank shall be sand blasted to a white metal finish in the areas of the weld. The tank shall be completely assembled prior to testing.

3.2 Testing

A. Testing of the tank shall comply with the requirements of the ASME Boiler Codes. The tank shall be tested for any and all leaks.

3.3 Coating

A. Factor Coating
1. The interior of the tank shall be coated according to ANSI/NSF Standard 61
2. Exterior of the tank shall be primed with an Oxide Primer to prevent rust

B. Field Coating
1. Exterior of the tank shall be field coated by the contractor with Tenemic Brand Paint for metal exterior quality. Color shall be white.

3.4 Shipping & Handling

A. The tank shall be shipped to the site by the manufacturer.

B. The contactor shall be responsible for handling and storage of the tank upon arrival. The contract is responsible for inspection of the tank for any damages during shipping.

3.5 Installation

A. Hydropneumatic tank shall be installed on footings as shown on the drawings.

B. Contactor is responsible for all piping connections to the hydropneumatic tank.

END OF SECTION 5510

SECTION 15910 - HYDROPNEUMATIC TANK CONTROLER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Hydromaster Pressure Tank Controler

1.3 DEFINITIONS

A. Missouri Department of Natural Resources: Mo~DNR

1.4 SUBMITTALS

A. Product Data: For the following:

1. Hydromaster Pressure Tank Controller

B. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.

C. Shop Drawings: Installation details for the controller.

D. Shop Drawings: Diagram power, signal, and control wiring.

E. Operation and Maintenance Data: For Hydromaster Pressure Controller to include in emergency, operation, and mainfenance manuals.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of Pressure Tank Controller that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 1 year from date of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Master Level Controls

a. Hydromaster Pressure Tank Control

2.2 CONTROLS and FEATURES

A. The controller shall have the following Features:
1. Calibrated Pressure Switches
2. Leakproff Assembly
3. Air to Exact Pressure
4. Plug in Componets

B. Control Requirements
1. Voltage shall be 120 volt to the controller
2. Load contact 10 amps
3. Hydromaster 1 pump controller
4. Pressure range 10 to 100 psi
5. Nema 1 enclosure, gray enamel

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall examine the product upon arrival for any defects or damage during shipping.

3.2 HYDROMASTER INSTALLATION

A. Hydromaster shall be installed according to the manufactures guidelines

3.3 CONNECTIONS

A. Connect wiring according to manufactures shop drawings.

END OF SECTION 15910

MASTER LEVEL CONTROLS

Operation of Hydromaster

LEVEL

Pump starts at low level by an adjustable pressure switch. Pump(s) stop at precise high level by a probe. (NOT PRESSURE)

PRESSURE

A closing pressure switch controls either adding or venting air, depending on the model. Opening of pressure switch stops air.

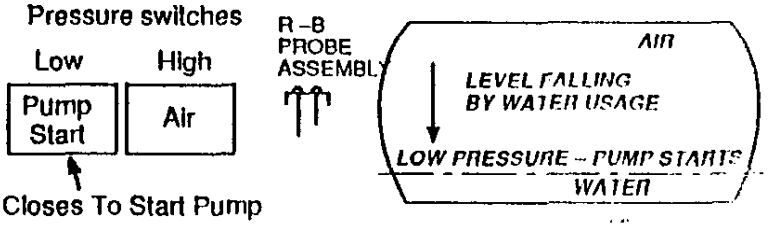
NOTE:

DOUBLE PROTECTION in air add Hydromaster. A dual purpose pressure switch for added emergency cutoff, in case of failure of the probe circuit. In normal operation this pressure switch does not stop the pump, the Red probe does.

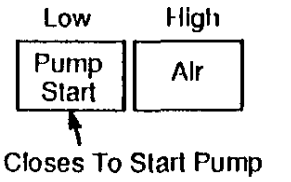
SEQUENCE OF OPERATION

1. Pump Start Low Pressure

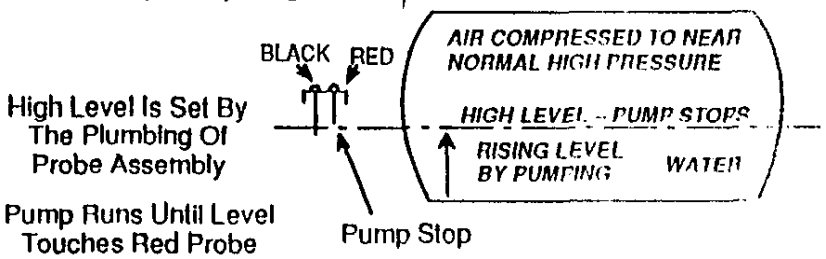
AIR ADD SYSTEM (H1)



AIR VENT SYSTEM (HS1)



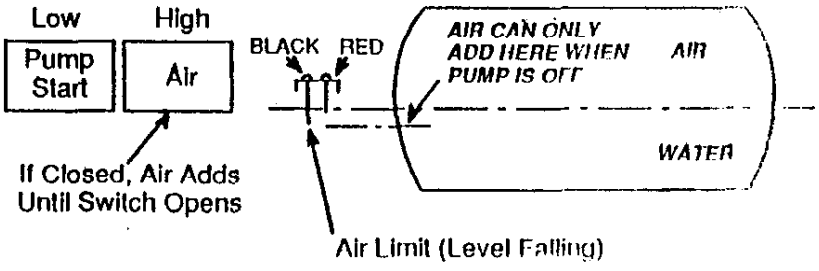
2. Pump Stop High Level

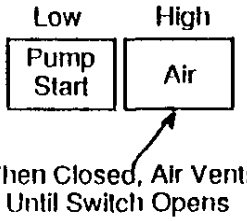


Pressure Switch Does Not Stop Pump.

Pump Runs Until Level Touches Red Probe

3. Air Correction





MASTER LEVEL CONTROLS

A3

HYDROPNEUMATIC TANK ENGINEERING DATA

A hydropneumatic tank is not only a water storage vessel, it must also contain compressed air which makes water flow from it under pressure.

The most efficient air/water ratio is that which permits maximum withdrawal between high and low pressure settings.

A common setting is 40% water and 60% air, between pressure limits of 40 and 60 PSI. This provides about 22% of the tank for use without pumping.

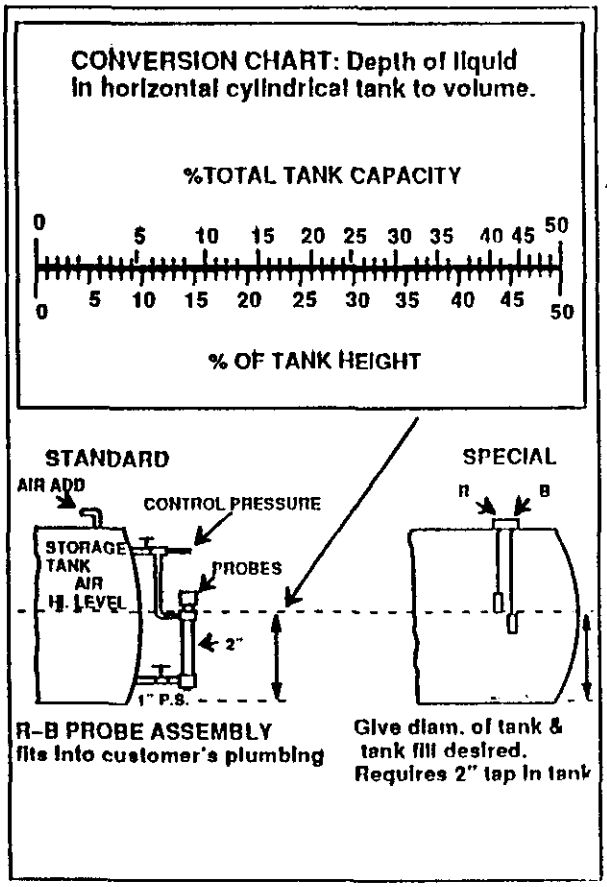
A hydropneumatic tank is different from an open tank as follows:

TANK FILL

Raising water level in the tank will NOT give more usable water, it gives LESS.

PRESSURE

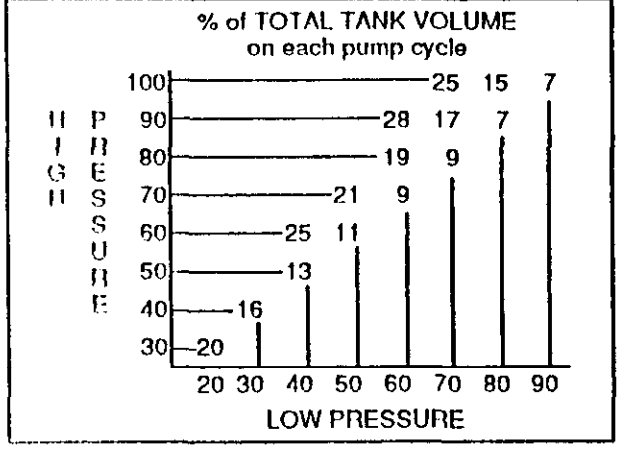
Decreasing pressure spread between high and low pressure limits to less than 20 PSI gives LESS usable water. At least 20 PSI is recommended; 40 – 60, 50 – 70, etc.



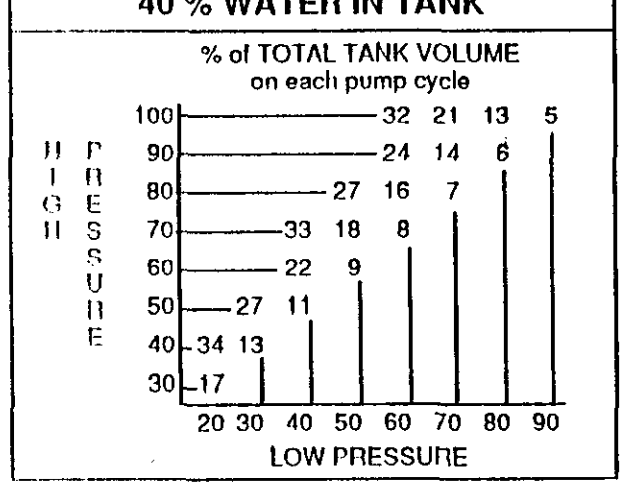
CHARTS

These charts show percentage of the total tank volume available on each pump cycle.

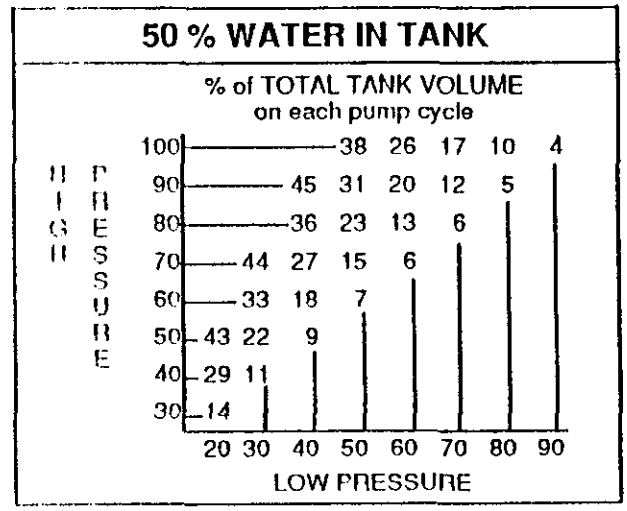
30 % WATER IN TANK



40 % WATER IN TANK



50 % WATER IN TANK



MASTER LEVEL CONTROLS

Descriptive Specifications

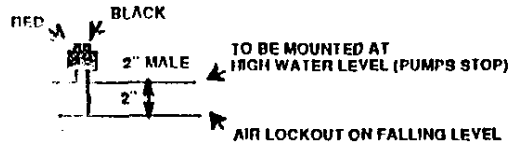
SUGGESTED SPECIFICATIONS –
BASIC AIR ADD HYDROMASTER CONTROL

There shall be furnished and installed as indicated on the plans, a combination pump and air pressure sensor assembly, having two calibrated pressure sensors. One for low pressure start of pump and one for high pressure. The high pressure sensor shall control the air compressor (or solenoid valve). The probe assembly shall be furnished for front mounting on the hydropneumatic tank to control the stopping of the pump at a precise level. The control and probe assembly shall be a Master Level Controls Co. Hydromaster_____(1,2 or,3) pump controller. The enclosure shall be NEMA _____(1, 3R , 4 or 12) .
Voltage shall be_____V. (120,240, or 460)
The pressure range shall be_____(100 or 200 PSI) PSI.

ADDITIONAL SPECIFICATIONS –
FOR A HYDROMASTER SYSTEM PANEL

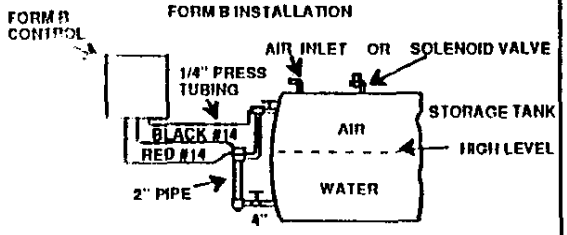
Included in the same enclosure shall be_____ combination motor starters consisting of_____amp 3 pole circuit breaker with_____ horsepower magnetic across–the–line starter with 3 thermal, phase sensing overload relays and a Hand–Off–Auto switch for each starter. Also included shall be a control circuit breaker. Incoming power to the panel shall be _____V., _____ Ph., Hz. ____ Wire Service. For air compressor (if used) shall be an across–the– line starter, breaker and a Hand–Off–Auto switch. Compressor shall be ____V., _____ Phase.

ONE FURNISHED WITH CONTROL
R-B PROBE ASSEMBLY
CONSISTS OF:
1– 3E2A PROBE HOLDER coded RED & BLACK
1– 2" S.S. PROBE ROD (RED)
1– 4" S.S. PROBE ROD (BLACK)



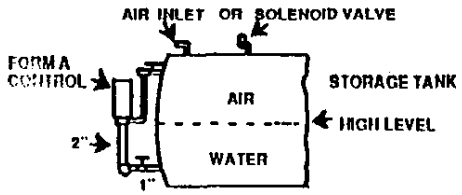
NEMA 4 cover is furnished but is not shown

FORM B WALL MOUNTED – STANDARD



Furnished in 2 parts: Control is for wall mounting. Probe assy. for tank mounting.

FORM A TANK MOUNTED – SMALL ENCLOSURES ONLY



One piece construction: Control fastened to probe assembly. Internal connections furnished & connected.

CONSTRUCTION DETAILS FOR BASIC HYDROMASTER

Enclosure . . . . . NEMA 1 general purpose, gray enamel.
Voltage . . . . . 120V. or 208/240V., 460V. available.
Pressure Ranges . . . . . 10 – 100 PSI standard. 20 – 200 PSI optional.
Pressure Sensors . . . . . Calibrated scales.
Load Contacts . . . . . 10A – 120V., 5A– 240V., non – inductive
3A – 480V. available.
Alternator . . . . . When furnished, – 2 standard plug in relays.

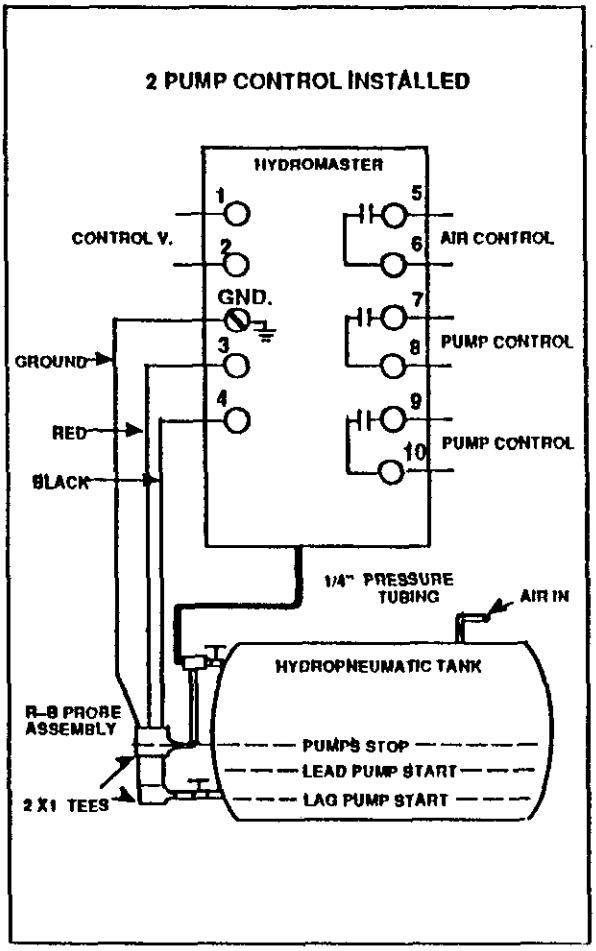
HYDROMASTER

Pressure Tank Control

CONTROLS BOTH PUMPS AND AIR

FEATURES

- **Calibrated Pressure Switches** – Easy adjustment of operating pressures.
- **Leakproof Probe Assembly** – No floats under pressure or periodic adjustment is required.
- **Air To Exact Pressure** – Positive pressure protection.
- **Plug In Components** – Control and alternator relays are standard industrial type available nationwide.



AIR ADD OPERATION

High level stop is determined by plumbing the upper 2 x 1 tee at the desired stop level.

Pump starts by pressure switch settings. Pumps run until level reaches the red probe.

If pressure is low when pumps stop, then air is added until a pressure switch opens. This is a dial adjustment.

All dial adjustments are clearly marked.

The alternator when furnished is all relay type with magnetic latch with no cogs or mechanical latches to wear. One of the pumps is lead and one is standby on each cycle. Alternates when pumps are off.

Air can be supplied directly from an air compressor with a check valve in the line or from a compressor tank by controlling a solenoid valve in the air line. The pressure must be higher than the highest pressure in the hydropneumatic tank.

LOW VOLTAGE TO PROBES

The 3 leads from control to the probes are low voltage and can be any size insulated wire. They should be installed in 1/2" dry conduit. The R-B probe holder is NEMA 4 and gasketed to keep the leads dry. If there is any possibility of moisture entry, seal the conduit. The Red and Black leads are color coded to prevent possible reversal. The ground lead can go to a cover screw of the unit.

SECTION 15150 - FLOW METER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Detail Specification of the Master Well Flow Meter

1.3 DEFINITIONS

A. Missouri Department of Natural Resources: Mo~DNR

B. American Water Works Association: AWWA

1.4 SYSTEM DESCRIPTION

A. Flow meter shall be a propeller driven meter measuring flow in gallons.

1.5 PERFORMANCE REQUIREMENTS

A. The meter shall meet the requirements of AWWA D150 and AWWA Standard C-702

1.6 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of the flow meter that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Faulty operation of inaccurate meter readings or no readings.
   b. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period: 1 year from date of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Sensus Flow Meters
   2. Master Meter Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine flow meter for any apparent factory or shipping defects prior to installation.

3.2 FLOW METER INSTALLATION

A. Install flow meter according to manufactures guidelines.

END OF SECTION 15150

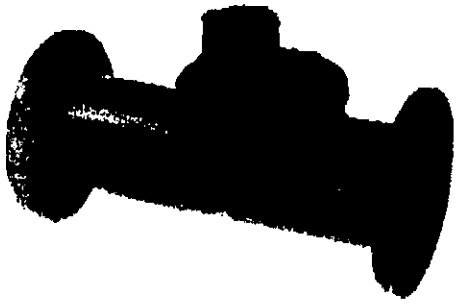
MAINLINE PROPELLER METERS

SENSUS.

MODELS 101/102
150 psi (10 bar) Working Pressure Magnetic Drive Flanged Tube Type

Standard Sealed Register

E-ROFI Register



6" Model 101 Propeller Meter

DESCRIPTION

MODEL: Sensus 101/102 Propeller Meters are primarily intended for accountability measurement of potable and non-potable cold water with flow in one direction only. Registration accuracy is 100% ± 2% of actual thruput within specified normal flow ranges. Because all appropriate parts are sealed for protection, the meters can be used in water containing particulate solids (such as sand), without causing undue wear.

PERFORMANCE: The design of the Sensus 101/102 Propeller Meters permits continuous operation up to the maximum rated flow capacity listed for each size, without affecting long term accuracy or causing undue wear. For accurate measurement, a full flow of water through the meter and stated minimum flow rates are required.

CONSTRUCTION: The meter consists of two basic assemblies—the meter tube body and the meter head assembly. Integral straightening vanes in the meter tube body minimize the swirl upstream of the meter so as to direct the flow evenly to the propeller. The 3" through 12" meter tube bodies are internally and externally protected by a superior fusion-bonded epoxy coating for use in potable water systems. The 14" and larger sizes are protected with an epoxy painted finish. The meter head assembly consists of the propeller, bronze gear box and sealed direct reading register.

MAGNETIC DRIVE: Direct magnetic drive eliminates mechanical gearing normally required to operate propeller meter type registers. A ceramic sleeve-type magnet in the propeller assembly drives a follower magnet located in a one piece, all bronze gear box. This gear box is oil filled and factory sealed to provide lubrication and long life to the register drive shaft.

PROPELLER: The propeller and nut are made of polypropylene and rotate on a ceramic coated stainless steel spindle.

REGISTERS: Sensus Model 101 Propeller Meters come equipped with a sealed direct reading (DR) register with low flow indicator. The Model 102 is equipped with an electronic rate of flow indicator (E-ROFI) register. The E-ROFI register is an hermetically sealed unit that electronically displays and transmits totalization and flow rate data to various Sensus act-pak instrumentation to monitor, control and record volume and rate of flow. Other register options available are the impulse contactor (IC) and high speed pickup (HSP). All registers can be positioned in any of four directions for reading ease. Refer to bulletin E-1116 for HSP and bulletin E-1110 for the E-ROFI register.

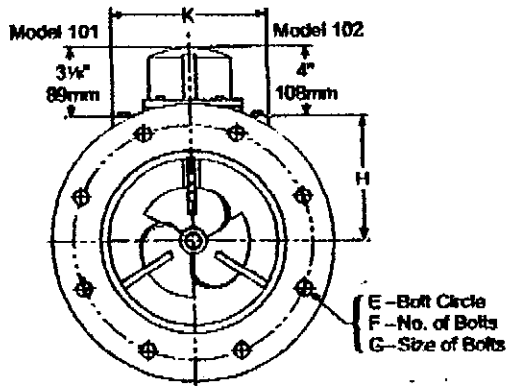
INSTALLATION: Sensus Propeller Meters can be installed in a horizontal, vertical or inclined position. Valves, fittings or other equipment that might create flow turbulence should be positioned at least 5 pipe diameters upstream of the meter and no less than 3 pipe diameters downstream.

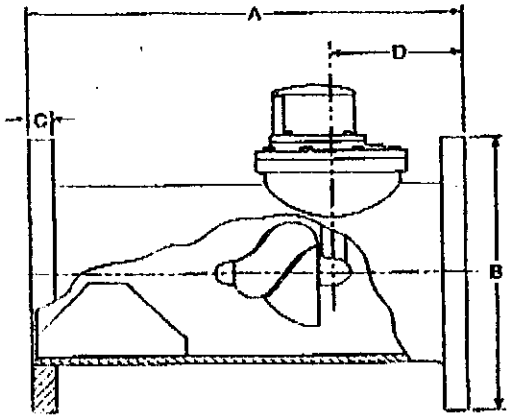
MAINTENANCE: The meter head assembly can be removed, repaired and/or replaced without disturbing the meter tube body in line. A spare meter head assembly can be utilized in the event maintenance is required. Cover plates are also available for maintaining service or flushing of lines when the meter head assembly is removed. Factory testing, repair and meter head assembly exchange programs are available.

SPECIFICATIONS

SERVICE	Measurement of cold water (potable and non-potable) up to 100°F (38°C) with flow in one direction only.
OPERATING RANGE	Continuous Flows: Refer to the chart on next page Intermittent Flows: 25% over the maximum rated capacity of any given size.
ACCURACY	100% ± 2% of actual thruput
LOW FLOW	Refer to the chart on next page
MAXIMUM OPERATING PRESSURE	150 psi (10 bar)
CLASS	3" Size: Round, AWWA 150 Class 4"-12" Sizes: Round, AWWA Class D 14"-36" Sizes: Round, AWWA 150 Class
REGISTER	Hermetically Sealed Direct Reading Register with Low Flow Indicator
METER REGISTRATION	Standard: Six digit, straight reading type with Low Flow Indicator. Full 3" dial face with 100 division increments and a center sweep hand. E-ROFI: Twin six digit, LCD totalizer and rate of flow display. Powered by a "C" size lithium battery factory sealed in an hermetically sealed register. Register replacement is recommended every five (5) years.
MATERIALS—METER TUBE BODY	3" and 4" Size: Ductile Iron 6"-36" Sizes: Fabricated Steel
STRAIGHTENING VANES	Fabricated Steel
COATINGS	3"-12" Sizes: Fusion-Bonded Epoxy 14"-36" Sizes: Epoxy Paint
METER HEAD	Ductile Iron
PROPELLER AND NUT	Polypropylene
PROPELLER SPINDLE	Ceramic Coated Stainless Steel
GEAR HOUSING	One Piece Cast Bronze
TRIM	Stainless Steel
BEARINGS	Ceramic

Models 101 and 102
150 psi (10 bar)





Meter Size	Low Flow GPM m^3/h ①	Normal Range GPM m^3/h ②	Dimensions A in mm	B in mm	C in mm	D in mm	E in mm	F #	G in mm	H in mm	K in mm	Shipping Weight Pounds kg
3" DN 80mm	80 GPM 18.2 m^3/h	100-250 GPM 23-57 m^3/h	16" 406mm	7-1/2" 190mm	3/4" 19mm	6-1/2" 165mm	6" 152mm	4	5/8" 16mm	3-3/8" 86mm	5" 127mm	70 lbs. 32 kg
4" DN 100mm	82 18.6	125-500 28-114	18" 457mm	9" 229mm	5/8" 16mm	7-1/2" 190mm	7-1/2" 190mm	8	5/8" 16mm	3-7/8" 99mm	7-1/2" 190mm	65 lbs. 39 kg
6" DN 150mm	180 36.3	220-1200 50-273	22" 559mm	11" 279mm	11/16" 17mm	9" 229mm	9-1/2" 241mm	8	3/4" 19mm	5" 127mm	9" 229mm	115 lbs. 52 kg
8" DN 200mm	190 43.2	250-1650 57-375	24" 610mm	13-1/2" 343mm	11/16" 17mm	9" 229mm	11-3/4" 298mm	8	3/4" 19mm	6" 152mm	9" 229mm	150 lbs. 68 kg
10" DN 250mm	280 59.0	330-2500 75-568	26" 660mm	16" 406mm	11/16" 17mm	10" 254mm	14-1/4" 362mm	12	7/8" 22mm	7-3/8" 187mm	11" 279mm	200 lbs. 91 kg
12" DN 300mm	275 62.4	350-3500 80-795	28" 711mm	19" 483mm	13/16" 21mm	10" 254mm	17" 432mm	12	7/8" 22mm	8-3/8" 213mm	11" 279mm	290 lbs. 132 kg
14" DN 350mm	350 79.5	450-4500 102-1022	42" 1067mm	21" 533mm	1-3/8" 35mm	12" 305mm	18-3/4" 476mm	12	1" 25mm	9-1/4" 235mm	13-1/2" 343mm	450 lbs. 204 kg
16" DN 400mm	450 102.2	550-5500 125-1249	48" 1219mm	23-1/2" 597mm	1-7/16" 37mm	12" 305mm	21-1/4" 504mm	16	1" 25mm	10-1/4" 260mm	13-1/2" 343mm	550 lbs. 249 kg
18" DN 450mm	550 124.9	752-7250 165-1647	54" 1372mm	25" 635mm	1-9/16" 40mm	15" 381mm	22-3/4" 578mm	16	1-1/8" 29mm	11-5/8" 295mm	13-1/2" 343mm	620 lbs. 281 kg
20" DN 500mm	700 159.0	850-9000 193-2044	60" 1524mm	27-1/2" 699mm	1-11/16" 43mm	15" 381mm	25" 635mm	20	1-1/8" 29mm	12-5/8" 321mm	13-1/2" 343mm	820 lbs. 372 kg
24" DN 600mm	1000 227.1	1300-13000 259-2592	72" 1829mm	32" 813mm	1-7/8" 48mm	18" 457mm	29-1/4" 749mm	20	1-1/4" 32mm	12-5/8" 321mm	13-1/2" 343mm	1000 lbs. 454 kg
30" DN 750mm	1600 363.4	2100-18600 477-4224	84" 2133mm	38-3/4" 984mm	2-1/8" 54mm	18" 457mm	36" 914mm	28	1-1/4" 32mm	12-5/8" 321mm	13-1/2" 343mm	1150 lbs. 522 kg
36" DN 900mm	2400 545.0	3000-24000 681-5450	96" 2438mm	46" 1168mm	2-5/8" 67mm	20" 508mm	42-3/4" 1086mm	32	1-1/2" 38mm	12-5/8" 321mm	13-1/2" 343mm	1350 lbs. 613 kg

① Low Flow — 95% minimum accuracy
② Intermittent Flow — 25% over maximum rated capacity

SENSUS TECHNOLOGIES, INC.

An Invensys company

Sensus Technologies
P.O. Box 427
450 E. Dallas Avenue
Uniontown, PA 15401
1-800-METER-IT
1-800-638-3748
FAX (Direct to Factory)
Local: (724) 438-7725
Toll Free: 1-800-638-2468
Web site: www.sensus.com
Email: info@sensus.com

AUTHORIZED SENSUS DISTRIBUTOR

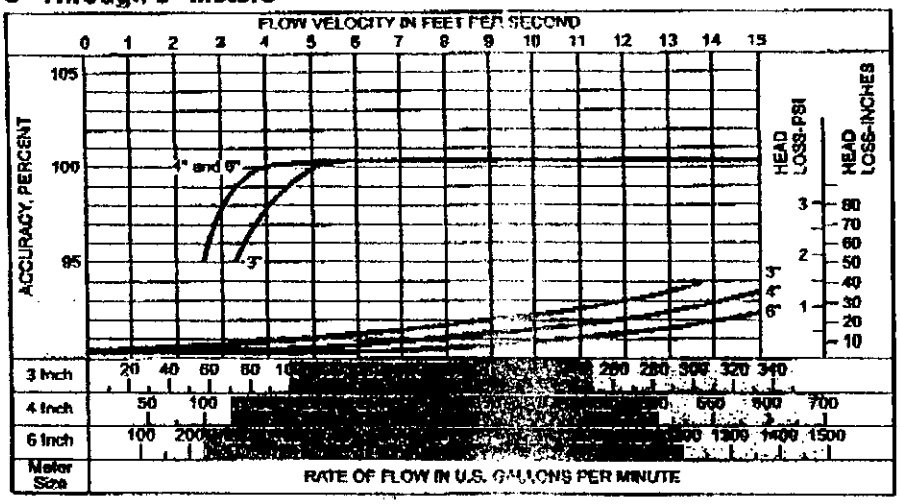
Your Local Sensus Distributor

PROPELLER METERS

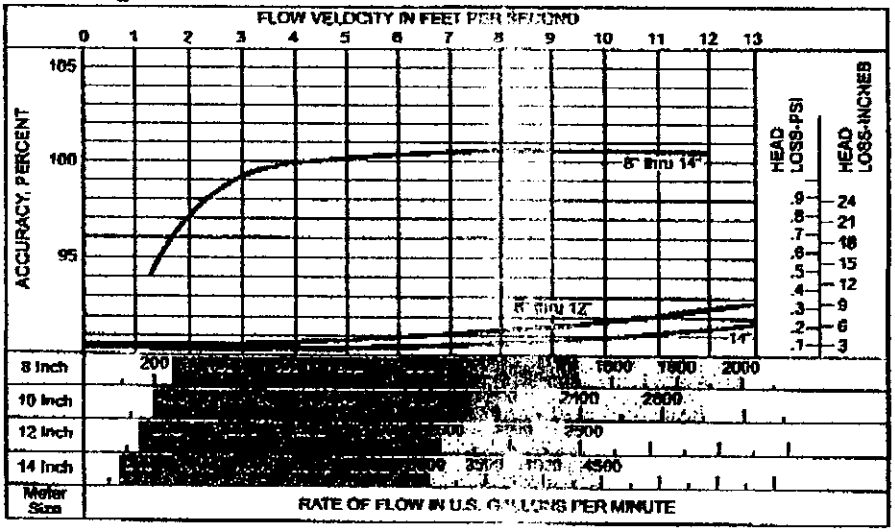
SENSUS

ACCURACY AND HEAD LOSS CURVES (PAGE 1 OF 2)

3" Through 6" Meters



8" Through 14" Meters



Low Flow
Normal Flow Range
Information Flows

G.P.M. CONVERSION TABLE

1 I.G.P.M. = 1.2 U.S.G.P.M.
1 M.G.D. = 694.4 G.P.M.
1 C.F.S. = 448.831 G.P.M.
1 B.P.D. = .02917 G.P.M.

1 Statutory Miner's Inch (No. Calif.) = 11.22 G.P.M.
1 Miner's Inch (So. Calif.) = 8.98 G.P.M.
1 Acre Foot = 325,851 Gallons

SECTION 15862 - OIL-LESS AIR COMPRESSOR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Oil-Less Air Compressor

1.3 DEFINITIONS

A. Missouri Department of Natural Resources: Mo-DNR

B. American Water Works Association: AWWA

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Oil-Less Air Compressor:

a. Thomas Ultra Air-Pac Compressor

2.2 COMPRESSOR REQUIREMENTS

A. Compressor Requirements
1. Motor
   a. 1 hp or larger
   b. 120 volt single phase
   c. UL listed
2. Compressor and Air Tank
   a. Compressor shall deliver 2.85 cfm @ 90 psi
   b. Tank shall be a minimum of 4 gallons
   c. Tank shall meet all ASME Pressure Vessel Codes:
   d. Tank Shall be Equipped with a 140 psi ASME rated safety valve.

PART 3 - EXECUTION

3.1 COMPRESSOR INSTALLATION

A. The compressor shall be mounted as shown on the drawings. Compressor may be mounted on a bench or a shelf capable of supporting the weight of the compressor.

3.2 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

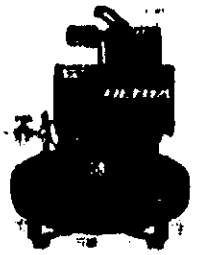
B. Install piping adjacent to machine to allow service and maintenance.

C. Air Solenoid Valve shall meet the requirements of the controller and be installed in the air line to the Hydropneumatic Tank

END OF SECTION 15862

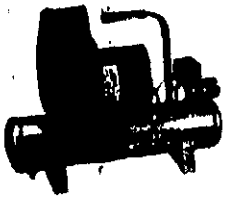
SPEEDAIRE

THOMAS



No. 3Z888
Pancake

No. 5F252
Stack



No. 5F237
Hot Dog

No. 4YN55
Twin

Oil-Less Portable Contractor Compressors

Now you can approach the job from virtually any angle. Lightweight, direct-drive models for easy use around the job site. Oil-less design allows operation at multiple angles. Also eliminates the need for oil changes.

THOMAS ULTRA AIR-PAC COMPRESSORS

Thomas professional grade air compressors are designed for the professional contractor's demanding needs. Lightweight compressors have a sturdy handle and a low center of gravity for exceptional stability. Perma-Lube design provides a long life. Circuit saver units draw less than 15 amps, helping to prevent breaker trips. Cold weather start units run in all types of weather. Heavy-duty aluminum compressor components provide long life and eliminate unnecessary weight. All units include regulator, tank, and regulated pressure gauge (except No. 5Z683). All compressors incorporate a high efficiency, high torque, thermally protected induction motor. Balanced eccentrics provide smooth, low vibration operation and reduce noise level. Solid brass fittings. User-friendly tank drain. Black/red finish.

- UL Listed pressure switch turns unit On at 100 psi and Off at 125 psi
- 140 psi ASME safety valve

SPEEDAIRE COMPRESSORS

No belts or pulleys are necessary with these direct-drive design models. Compact for easy carrying or maneuvering. Durable 4-port switch with auto pressure setting, regulated tank, and outlet pressure gauges. Include 6' power cord.

- Low RPM motor for reduced noise

Made In USA

Amp Rating Range	Length Of Wire in Feet For 120V/240V 25/50	50/100
MINIMUM GAUGE FOR WIRING AND EXTENSION CORDS		
8-10	14 ga.	10 ga.
10-12	12	10
12-14	12	—
14-16	12	—

(*) Use air hose wherever possible.
Caution: Very long extension cords can cause excessive draw, leading to non-starts and premature motor failure. Use longer air hose instead.

Peak/ Developed HP**	Running Motor HP**	Volts, 60 Hz	Amp Draw	Tank Gal.	Tank Type	(F)NPT Outlet (In.)	Free Air CFM @ psi 90	125	Max. psi	Rated Pump Life† (Hrs.)	Dimensions (In.) L	W	H	Mfr.	Mfr. Model	Stock No.	List	Each
1/2	—	115	4.2	2	Hot dog	1/4	1.0	0.70	125	—	16.5	8.0	16.0	Thomas	T-617HD	5Z683‡*	$349.50	$314.7
3/4	—	115	11.4	4.5	Pancake	1/4	2.25	1.85	125	—	16.0	16.0	20.0	Thomas	T-20HP	5Z408‡*	389.00	350.7
3/4	—	115	11.4	4.0	Stack	1/4	2.25	1.85	125	—	19.0	15.5	16.5	Thomas	T-20ST	5Z694‡*	399.50	359.7
1	—	115	10	4.0	Hot Dog	1/4	2.6	2.25	125	—	27.0	9.0	19.3	Thomas	T-35HD	6B516‡*	402.00	362.0
1	.71	115	10	3	Hot Dog	1/4	2.9	1.7	125	2500	28	14	21	Speedaire	—	5F237*	249.00	199.0
1	.68	115	11.5	3	Hot Dog		3.2	2.3	125	1500	28	10	20	Speedaire	—	5Z598*	309.00	239.0
1¼	—	115	12	4.5	Pancake	1/4	2.85	2.50	125	—	16.0	16.0	20.0	Thomas	T-30HP	3Z888‡*	514.50	463.2
1¼	—	115	12	4	Stack	1/4	2.85	2.50	125	—	19.0	15.5	16.5	Thomas	T-30ST	5Z595‡*	506.50	456.0
1½	.90	115	14	4	Pancake	1/4	3.1	2.4	125	2500	16	16	20	Speedaire	—	5F222*	289.00	249.0
2	—	115	12.5	4.5	Pancake	1/4	5.0	4.10	125	—	16.0	16.0	22.0	Thomas	T-150HP	6B518#*	501.50	451.5
2	—	115	12.5	4	Stack	1/4	5.0	4.10	125	—	20.0	15.5	21.0	Thomas	T-150ST	5F252#*	501.50	451.5
2	1.60	115	13	4	Stack	1/4	4.3	3.4	125	2500	19	15	17	Speedaire	—	5F562*	339.00	289.00
3	1.80	115	14	4	Stack	1/4	5.5	4.2	125	1500	19	15	17	Speedaire	—	4YN53*	339.00	319.00
3	1.80	115	14	8	Twin	1/4	5.5	4.2	125	1500	48	22	22	Speedaire	—	4YN55*	389.00	359.0

(*) UL Listed. (**) For specific HP rating explanations, see page 2880. Individual life will vary depending on duty cycle, ambient temperature, air intake quality, and manufacturing part tolerances. (†) As rated by the standard B-10 bearing life of the pump. See page 2880 for B-10 rating explanation. (‡) CSA Certified. (#) CUL Listed. (##) CSA/NRTL Certified.

THOMAS

No. 5Z685

Portable Tank Dolly

Provides an additional six gallons of high pressure air storage without taking up space. Has sturdy two wheel dolly with wide rubber wheels, increasing maneuverability. Accepts all Thomas brand pancake, wide tank, and stack-tank models. Versatile design permits mounting of a variety of compressors. Includes storage for hoses and cords. Easy and fast assembly.

Description	Stock No.	List	Each
Portable Tank Dolly	5Z685	$239.00	$234.2

SECTION 15867 - ELECTRIC HEATER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Wall Mount Electric Heater

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Electric Wall Heater

a. Qmark

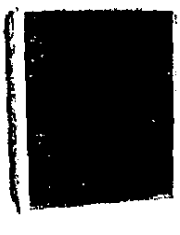
B. Heater Requirement
1. 3600/4800 watts; 240 volt
2. wall mounted minimum 36-inches above the finish floor.

PART 3 - EXECUTION

3.1 INSTALLATION

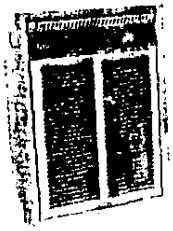
A. Wall Heater shall be mounted according to the manufactures requirements. Wiring to the heater shall meet all NEC codes and local building codes.

END OF SECTION 15867



No. 5E176 [A] No. 5E177

QMARK



No. 3UF58 [B]

BUILT-IN ELECTRIC WALL HEATERS FEATURE:

- Heavy-duty steel finned metal sheath heating element
- Built-in fan delay switch energizes fan motor only after elements are heated
- Integral thermostat for quick installation
- Motors are totally enclosed, impedance protected with permanently lubricated bearings
- For use in applications where energy management is critical

Repair Parts Avail
1-800-323-0620

[A] TAMPER-RESISTANT HEATERS

Tamper-resistant, commercial-grade construction features are ideal for small entryways, lobbies, corridors, stairwells, rest rooms, churches, schools, offices, stores and other public buildings where supplementary heat is required. Integral thermostat is tamper-resistant and adjustable only by inserting narrow blade screwdriver through front bar grille of heater. Permanently lubricated totally enclosed fan motor provides long life and low maintenance; gently distributes 100 CFM warm air throughout room area. Contemporary heavy-duty 16-gauge steel bar grille available in bronze brown baked enamel finish and satin finished aluminum frame or Navajo white unit and frame. Recess mounts in standard 2" x 4" stud walls. Housing measures 14⅛"W x 18⅛"H x 3⅛"D. Use No. 5E188 (Bronze Brown) or No. 5E189 (Northern White) frames for surface mounting applications.

SURFACE MOUNTING FRAMES FOR TAMPER-RESISTANT HEATERS

For surface installation on brick, concrete block, wood, and plaster walls. Frame extends 3⅛". Screws and mounting hardware included.

No. 5E188. Bronze brown frame; QMark brand (AWH-SM). Shpg. wt. 4.0 lbs. List $68.48. Each $48.55

No. 5E189. Navajo white frame. QMark brand (FRA-SM). Shpg. wt. 4.0 lbs. List $68.48. Each $48.55

[B] ARCHITECTURAL / COMMERCIAL GRADE HEATERS

Highly styled design is ideal for supplementary heating of offices, reception rooms, game rooms, family rooms and similar light duty commercial and residential applications. Rugged stamped steel front covers attractively finished in Northern White baked enamel with a brushed gold and silver trimmed face plate. Hole plugs provided for tamper resistant installations. Separate tamper resistant front cover, in Northern White finish avail
3UF59 thru 3UF63. Nos. 3UF
have a built-in fan only
3UF60, 3UF61, 3UF59, 3UF
grille dimensions are 19¼"
1½"D); Openings are 18⅛"H x
No. 3UF58 grille dimensions
11⅞"W x 1⅛"D); Opening is 12
3⅛"D. QMark.

SURFACE MOUNTING FRAMES

No. 4TM74. Surface Mounting Frame. QMark brand (CWHSMI) used with No.
only. Shpg. wt. 2.0 lbs. List $69.66. Each .....

No. 4TM75. Surface Mounting Frame. QMark brand (FZSM) used with Nos. 3UF
3UF13 and 3UF611 on page 3458. Shpg. wt. 2.0 lbs. List $44.89. Each .....

No. 3UF66. Surface Mounting Frame. Use with Nos. 3UF59, 3UF60, 3UF61, 3UF
3UF63. Frame extends 3". QMark brand (CWH3-SM). Shpg. wt. 2.0 lbs. List
Each .....

No. 3UF64. Surface Mounting Frame. 1" Deep surface mounting sleeve for semi
installation. QMark brand (CWH3S-1). Shpg. wt. 2.0 lbs. List $57.66. Each.....

No. 3UF65. Surface Mounting Frame. 2" Deep Surface mounting sleeve for semi
installation. QMark brand (CWH3S-2). Shpg. wt. 2.0 lbs. List $57.66. Each.....

No. 3UG58. Security Front Cover. For Nos. 3UF59 through 3UF63 and 3UG56 thr
3UG57 (sold on page 3[illegible]). 14-Gauge steel, Northern White finish. QMark br
(ULKSFC). Shpg. wt. 6.0 lbs. List $88.64. Each .....

Key	Heater Description	Watts	Btuh	Volts	Amps	Enamel Finish	Q Mark Model	Stock No.	List	Each
A	Tamper-Resistant	1500	5120	[illegible]	5.5	Brown	AWH-1157	5E176	$450.16	$342.2
		1500	5120	[illegible]	5.5	White	AWH-1157MG	5E177	450.16	342.2
		2000	6812	[illegible]	10.0	Brown	AWH-1208	5E178	450.16	342.2
		2000	6812	[illegible]	10.0	White	AWH-1208MG	5E179	450.16	342.2
		2000	6842	[illegible]	8.5	Brown	AWH-4204	5E180	450.16	342.2
		2000	6842	[illegible]	8.5	White	AWH-4204MG	5E181	450.16	342.2
		4000	13,650	208	19.5	Brown	AWH-4408	5E182	515.53	391.7
		4000	13,650	208	19.5	White	AWH-4408MG	5E183	515.53	391.7
		4000	13,650	240	16.7	Brown	AWH-4404	5E184	515.53	391.7
		4000	13,650	240	16.7	White	AWH-4404MG	5E185	515.53	391.7
		4000	13,650	277	14.5	Brown	AWH-4407	5E186	515.53	391.7
		4000	13,650	277	14.5	White	AWH-4407MG	5E187	515.53	391.7
B	Architectural/ Commercial Grade	1500/750 2000/1000	5120/2560 6826/3413	208/240	2/3 6.8/3.4 2	White	CWH2202	3UF58	191.06	136.0
		3000/4000	10,239/13,652	208/240	14.5/16.7	White	CWH3104	3UF60	379.00	269.7
		3000/4000	10,239/13,652	240/277	12.5/14.5	White	CWH3107	3UF61	379.00	269.7
		3000	10,239	277	10.8	White	CWH3307	3UF59	379.00	269.7
		3600/4800	10,287/16,382	208/240	17 3/20.0	White	CWH3504	3UF62	379.00	269.7
		3600/4800	12,287/16,382	240/277	15.0/17.3	White	CWH3507	3UF63	379.00	269.7