

Preparing Activity: USACE

UNIFIED FACILITIES GUIDE SPECIFICATIONS

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DIVISION 33 - UTILITIES

SECTION 33 52 43.12

AVIATION FUEL PANTOGRAPHS

02/10

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the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ASME INTERNATIONAL (ASME)

ASME B16.5 (2013) Pipe Flanges and Flanged Fittings:
NPS 1/2 Through NPS 24 Metric/Inch Standard

ASME B40.100 (2005; R 2010) Pressure Gauges and Gauge
Attachments

ASTM INTERNATIONAL (ASTM)

ASTM A312/A312M (2013) Standard Specification for
Seamless, Welded, and Heavily Cold Worked
Austenitic Stainless Steel Pipes

ASTM A36/A36M (2012) Standard Specification for Carbon
Structural Steel

ENERGY INSTITUTE (EI)

EI 1529 (2005; 6th Ed) Aviation Fueling Hose and
Hose Assemblies

EI 1584 (2001; Addenda 2007; 3rd Ed) Four-Inch
Hydrant System Components and Arrangements
(Hydrant Pit Valves and Intake Couplers)

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AS5877 (2007; Rev A) Aircraft Pressure Refueling
Nozzle

SAE J517 (2013) Hydraulic Hose

U.S. AIR FORCE (USAF)

AFI 91-202 (1998; Change 2010) US Air Force Mishap
Prevention Program

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-C-83260 (1972; Rev A; Notice 1 1996) Coupler,
Hydrant Valve GRU-16/e

MIL-DTL-24788 (2008; Rev A) Coupling Assembly,
Semi-Dry-Break, Quick-Disconnect Fuel With
or Without Continuity Switch

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-50696 (Basic) Reels, Static Discharge,
Grounding, 50 and 75 Foot Cable Lengths

1.2 ADMINISTRATIVE REQUIREMENTS

Provide aircraft pantograph approved by the [Air Force System Safety Engineer Analysis (AFSSEA) Team in accordance with AFI 91-202] [Navy (NAVAIR (AIR 4.4.5.1)] [APC]. Submit scaled assembly drawings identifying components and showing dimensions and tolerances. Complete technical literature shall be submitted on specific function equipment. OMSI information shall be submitted for the equipment items or systems specified. Refer to Section 01 78 23.33 OPERATION AND MAINTENANCE MANUALS FOR AVIATION FUEL SYSTEMS for the information to be submitted for various types of equipment and systems. Emergency dry breakaway coupler (EDBC) is required for USN/USMC projects.

1.3 SUBMITTALS

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project.

The Guide Specification technical editors have designated those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item, if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed

item for Army projects.

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Scaled assembly drawings[; G][; G, [_____]]

SD-03 Product Data

Flow meter[; G][; G, [_____]]
Hydrant coupler[; G][; G, [_____]]
Shut-off valve[; G][; G, [_____]]
Automatic pressure equalizing system[; G][; G, [_____]]
Pressure fueling nozzle[; G][; G, [_____]]
Venturi[; G][; G, [_____]]
Flanged Swivel joints[; G][; G, [_____]]
Pressure gage assembly[; G][; G, [_____]]
[Emergency dry breakaway coupler (EDBC)[; G][; G, [_____]]]

SD-07 Certificates

Materials[; G][; G, [_____]]

SD-10 Operation and Maintenance Data

Flow meter[; G][; G, [_____]]
Hydrant coupler[; G][; G, [_____]]
Shut-off valve[; G][; G, [_____]]
Automatic pressure equalizing system[; G][; G, [_____]]
Pressure fueling nozzle[; G][; G, [_____]]
Venturi[; G][; G, [_____]]
Flanged Swivel joints[; G][; G, [_____]]
Pressure gage assembly[; G][; G, [_____]]
[Emergency dry breakaway coupler (EDBC)[; G][; G, [_____]]]

1.4 QUALITY ASSURANCE

1.4.1 Design Conditions

Design shall be as specified in Section 33 52 43.11 AVIATION FUEL MECHANICAL EQUIPMENT. Components shall be ASME B16.5 Class 150 (9 MPa 275 psig at 38 degrees C 100 degrees F, except that swivel joints and pressure fueling nozzles shall be 824 kPa 125 psig at 58 degrees C 100 degrees F). Nominal diameters shall be as follows:

Hydrant coupler	100 mm4 inch
Piping sections	75 and 100 mm3 and 4 inch
Flanged connection	ASME B16.5 60 kg125 LB
Flow meter	100 mm4 inch ASME B16.5 70 kg150 LB
Shut-off valve/40 mesh strainer	62 or 75 mm2-1/2 or 3 inch
Dry break quick disconnects	62 or 75 mm2-1/2 or 3 inch
Flanged pantograph swivel joints	75 and 100 mm3 and 4 inch

Pressure fueling nozzle

62 mm2-1/2 inch outlet

PART 2 PRODUCTS

2.1 MATERIALS

The type of materials which come in contact with the fuel shall be noncorrosive. No zinc coated metals, brass, bronze or other copper bearing alloys shall be used in contact with the fuel. Additional requirements are as follows:

2.1.1 Piping

Construct all pipe and piping components of Schedule 10S, Grade TP304L, stainless steel conforming to ASTM A312/A312M. Only seamless pipe will be used.

2.1.2 Fitting and Bends

Same thickness as adjoining pipe.

2.1.3 Components

Aluminum alloy or stainless steel.

2.1.4 Structural Steel

Structural steel shall conform to ASTM A36/A36M, hot dipped galvanized after fabrication and painted a factory standard color.

2.2 EQUIPMENT AND MATERIAL

2.2.1 Detachable Aircraft Pantograph

- a. Detachable pantographs shall be designed in such a way that all wheel supports rest upon the apron regardless of the different terrain conditions.

**NOTE: Insert required Pantograph length obtained
from COMMAND FUEL FACILITIES Engineer.**

- b. Provide detachable pantographs consisting of three main sections, plus one connecting section and one dispensing end. Total length of the three main sections shall be [_____] mm feet.
- c. The connecting section shall consist of a hydrant coupler and flanged swivel joints, which allow the coupler to be connected to the hydrant control valve at levels of +/- 150 mm 6 inches from the level of the apron.
- d. The connecting section shall be supported by an adjustable spring, counterweight or hydraulically actuated cylinders which balance the weight of the hydrant coupler, flanged swivel joints and pipe connecting section.
- e. Design the dispensing end to be coupled to the aircraft at heights of 0.305 to 2.4 m 12 inches to 8 feet above the apron.

- f. The dispensing end shall be supported by an adjustable spring, counterbalance or hydraulically actuated cylinder which balances the weight of the pressure fueling nozzle, shut-off valve, flanged swivel joints and connecting pipes to ensure that only minimum force occurs when connecting the detachable pantograph to the aircraft. One person shall be able to operate the dispensing end.
- g. Hoses (except fuel sensing hose) shall not be permitted as a part of the detachable pantographs.
- h. Detachable pantographs shall be equipped with an adjustable **automatic pressure equalizing system**, relieving at **824 kPa 125 psig** to an equalizing reservoir, to compensate for thermal expansion and contraction.
- i. The equalizing reservoir's vent shall be equipped with a flame arrestor. The reservoir shall be sized for a maximum temperature differential of **62 degrees C 144 degrees F**.
- j. The pantograph shall be equipped with supporting structures each mounted on two spring-loaded casters.
- k. To avoid sagging, reinforcing shall be welded to the underside of the pipe sections.
- l. A tow bar shall be attached to the front support of the pantograph. Maximum tow speed is **8 km/h 5 mph**. Tow bar to be suitable for mounting to pintle hook.
- m. The connecting section and the dispensing end shall be locked to the main sections of the pantograph when in the stored or towing mode. Pantograph shall be provided with a nozzle hanging support.
- n. The three main sections of the pantograph shall be locked together when in the stored or towing mode.
- o. The overall electrical resistance between the hydrant coupler and the pressure fueling nozzle shall not exceed 1 kilo Ohm. Grounding straps across the flanged swivel joints are not permitted.
- p. The pantograph shall be equipped with two self winding grounding cable reels. The cable shall be at least **15 m 50 feet** long. Each cable reel, the grounding cable and the connection clamp shall be in accordance with **CID A-A-50696**.
- q. The pantograph shall be equipped with a permanent sampling, pressure gage, drain and vent assemblies.
- r. Detachable pantographs shall be provided with **7.5 m 25 feet** of [hydraulic] [nitrogen powered] deadman control hose. Hose shall be provided with stainless steel fittings, nylon stop ball and aluminum deadman control handle. Hose shall be dual type with Buna-N tube, vertically braided textile body with fuel resistant neoprene cover.

NOTE: Per COMMAND FUELS FACILITY Engineer, or
Service Headquarters.

- s. Detachable pantographs shall be equipped with a flow meter, pantograph control valve, [fuel filter separator,] [control valve,] [additive injector,] and a venturi. The flow meter shall be provided with additional support.

NOTE: Per COMMAND FUELS FACILITY Engineer, or
Service Headquarters.

- t. The pantograph shall be equipped with a minimum of eight (8) terrain spring loaded casters made of steel or cast steel, galvanized or hot-dip galvanized. The caster swivel head shall be equipped with two lubricated ball bearings with grease nipples. The wheels shall have an overall diameter of at least 305 mm 12 inches and shall be equipped with two lubricated grooved ball bearings with grease nipples. The wheels shall be coated with rubber. Two of the casters shall be equipped with brakes which positively lock the unit in place once at rest. Two casters shall be equipped with an additional device which can be adjusted to lock automatically for towing the pantograph.

2.2.2 High Reach Pantographs

- a. The high reach pantograph unit consists of a steel frame with spring loaded casters and a lifting platform. The pipe sections are interconnected by swivel joints.
- b. The platform with the dispensing end shall be easily extended up to a connection height of 2.1 to 4.8 m 7 to 16 feet above ground level operated by hand. No electric energy shall be used. An extensionable ladder fixed at the frame allows to reach the platform at any position.
- c. The platform must be secured with a railing and automatically closing door.
- d. The high reach pantograph shall be equipped with devices for draining, pressure gauging and venting.
- e. Support structures, counter balance systems and all other equipment made of steel shall not be welded to the stainless steel pipe. It shall be only bolted by clamps to the pipe and shall be easily replaceable by common tools in case of repair or maintenance.
- f. A tow bar shall be attached to the front support of the pantograph. Maximum tow speed is 8 km/h 5 mph. Tow bar to be suitable for mounting to pintle hook.
- g. The connecting section and the dispensing end shall be locked to the main sections of the pantograph when in the stored or towing mode. Pantograph shall be provided with a nozzle hanging support.
- h. The overall electrical resistance between the hydrant coupler and the pressure fueling nozzle shall not exceed 1 kilo Ohm. Grounding straps across the flanged swivel joints are not permitted.
- i. The pantograph shall be equipped with two self winding grounding cable reels. The cable shall be at least 15 m 50 feet long. Each cable reel, the grounding cable and the connection clamp shall be in

accordance with CID A-A-50696.

- j. The pantograph shall be equipped with a permanent sampling, pressure gage, drain and vent assemblies.
- k. The pantograph shall be equipped with labeling to provide safety warnings such as don't use around power lines, and use limits such as weight limitations.
- l. The pantograph shall be equipped with a minimum of four (4) terrain spring loaded casters made of steel or cast steel, galvanized or hot-dip galvanized. The caster swivel head shall be equipped with two lubricated ball bearings with grease nipples. The wheels shall have an overall diameter of at least 305 mm 12 inches and shall be equipped with two lubricated grooved ball bearings with grease nipples. The wheels shall be coated with rubber. Two of the casters shall be equipped with brakes which positively lock the unit in place once at rest. Two casters shall be equipped with an additional device which can be adjusted to lock automatically for towing the pantograph.

2.2.3 Permanent Pantograph Fabrication - [Hoseless] [Hose End] Type

NOTE: The requirements of this paragraph should be added for KC-10, E-4, and other aircraft that incorporate fueling adapters located more than 2.4 m (8 feet) above the apron.

Per COMMAND FUELS FACILITY Engineer or Service Headquarters.

- a. The permanent pantograph shall be designed in such a way that all wheel supports rest upon the apron regardless of the different terrain conditions.

NOTE: Insert required Pantograph number of sections and length obtained from COMMAND FUELS FACILITY Engineer.

- b. The permanent pantograph shall consist of [two] [three] main sections, plus one connecting section and one dispensing end. Total length of the main sections shall be [_____] mm feet.

NOTE: Insert required height reach of Pantograph obtained from COMMAND FUELS FACILITY Engineer.

- c. The dispensing end shall be designed to be coupled to the aircraft at heights of 305 mm 12 inches to [_____] mm feet above the apron.
- d. The dispensing end shall be supported by an adjustable spring, weight device or hydraulically actuated cylinder to counter balance the weight of the pressure fueling nozzle, shut-off valve, flanged swivel joints and connecting pipes to ensure that only minimum force occurs when connecting pantograph to aircraft. One person shall be able to operate

the dispensing end.

- e. Hoses (except fuel sensing hose) shall not be permitted as a part of the pantograph.
- f. The dispensing end shall consist of a 3 m 10 foot section of aviation fueling hose, as specified herein after, a [D-1] [D-1R] [D-2] [D-2R] pressure refueling nozzle and a bonding wire wrapped a minimum of 10 coils around the exterior of the hose and connected to both hose-end NTP fittings. A shut-off valve between the hose end and the pressure refueling nozzle shall not be provided.
- g. A suitable trough for storing the fueling hose shall be provided on top of the final pantograph leg.
- h. Provide a draw bar or pull cable with handle for positioning the pantograph.
- i. To avoid sagging, reinforcing shall be welded to the underside of the pipe sections.
- j. The main sections of the pantograph shall be locked together and to the non-movable portion of the pantograph when in the stored mode.
- k. The overall electrical resistance between the pantograph control valve and the pressure fueling nozzle shall not exceed 1 kilo Ohm. Grounding straps across the flanged swivel joints are not permitted.
- l. The pantograph shall be equipped with a permanent sampling, pressure gage, drain and vent assemblies.
- m. The fixed portion of the pantograph shall include a pantograph control valve, venturi, and flow meter.
- n. A refueling adapter meeting the requirements of MIL-DTL-24788 shall be mounted to the return piping for the purpose of flushing the permanent pantograph. The refueling adapter shall have a 100 mm 4-inch flange mounting and be equipped with a metal vacuum tight locking dust cap that mates with the lugs of the refueling adapter.
- o. Intermediate and end swivel joints shall have 200 mm 8 inch diameter solid oil resistant tires and shall be equipped with two lubricated grooved ball bearings with grease nipples. The wheels shall be coated with rubber.

NOTE: EDBC required for NAVY/MARINE CORPS projects.

- p. Install an emergency dry breakaway coupler (EDBC) between the last swivel and the dispensing hose.

2.2.4 Truck Fill Stand Pantograph Fabrication - (Non-Recessable)

- a. Truck fill stand pantographs shall consist of three main sections, plus one connecting section and one dispensing end. Total length of the three main sections shall be 3 m 10 feet.
- b. The dispensing end shall be designed to be coupled to the refueling

truck at heights of 395 to 1400 mm 12 to 55 inches above the road.

- c. The dispensing end shall be supported by an adjustable spring, weight device or hydraulically actuated cylinder to counter balance the weight of the pressure fueling nozzle, shut-off valve, flanged swivel joints and connecting pipes to ensure that only minimum force occurs when connecting pantograph to tank trucks. One person shall be able to operate the dispensing end. Pantograph shall be provided with a nozzle hanging support.
- d. Hoses shall not be permitted as a part of the truck fill stand pantograph.
- e. The three main sections of the pantograph shall be locked together when stored.
- f. The overall electrical resistance between the flanged end and the pressure fueling nozzle shall not exceed 1 kilo Ohm. Grounding straps across the swivel joints are not permitted.
- g. The pantograph shall be equipped with a permanent sampling, pressure gage, drain and vent assemblies.
- h. The connecting section and the dispensing end shall be locked to the main sections of the pantograph when in the stored mode.

2.2.5 Truck Fill Stand Pantograph Fabrication (Recessable)

- a. The truck fill stand pantograph shall be designed for bottom loading of refueling trucks and shall be designed in such a way that it can be completely lowered into the pit. Pantograph construction and pit configuration shall be coordinated such that interferences and restrictions in operation of the pantograph are eliminated.
- b. A combination of flanged swivel joints and pipe sections shall permit the required vertical and horizontal adjustments. The pantograph shall automatically lock in the up position.
- c. The guiding unit for vertical adjustment shall be maintenance free.
- d. The pantograph shall consist of three main sections, plus one connecting section and one dispensing end. Total length of the three main sections shall be 3 m 10 feet.
- e. The dispensing end shall be designed to be coupled to the refueling truck at heights of 305 to 1380 mm 12 to 55 inches above the road.
- f. The dispensing end shall be supported by an adjustable spring, weight device or hydraulically actuated cylinder to counter balance the weight of the pressure fueling nozzle, shut-off valve, flanged swivel joints and connecting pipes to ensure that only minimum force occurs when connecting pantograph to tank trucks. One person shall be able to operate the dispensing end.
- g. Hoses shall not be permitted as a part of the truck fill stand pantograph.
- h. The three main sections of the pantograph shall be locked together when stored.

- i. The overall electrical resistance between the flanged end and the pressure fueling nozzle shall not exceed 1 kilo Ohm. Grounding straps across the swivel joints are not permitted.
- j. The pantograph shall be equipped with a permanent sampling, pressure gage, drain and vent assemblies.

2.2.6 Flanged Swivel Joints

- a. Anchor end, intermediate, and hose end pantograph swivel joints shall be stainless steel, [single plane,] flanged capable of rotating 360 degrees. Welded swivel joints and welding of swivel joints to the pipe and/or elbow is not permitted. Welding of swivel joints to flange joints is permitted. Swivel joints shall be of the non-lubricated, maintenance free type with non-lubricated bearings and no lubricating fittings[, and shall be arctic-grade].
- b. No leakage shall be permitted under positive or negative pressure conditions. No leakage shall be permitted under high or low temperature conditions. The swivel joints shall be warranted for three years against leakage due to both positive and negative pressure conditions.
- c. There must be electrical continuity from one flange to the other without the use of ground straps. The electrical continuity from one flange to another (without the use of ground straps) shall be less than 1000 ohms. Each swivel joint shall have at least two ball bearings and one roller bearing and two seals.

NOTE: Include Item 'd' for NAVY/MARINE CORPS
projects and delete [SINGLE PLANE,] in Item 'a'
above.

- d. Only NAVAIR approved swivels (Aeroequip single plane; EMCO-Wheaton single plane; CLA-VAL 2-plane; and Carter Ground Fueling single and 2-plane) shall be used.

2.2.7 Flow Meter

The flow meter shall be stainless steel or aluminum, double case, positive displacement, rotor type, bi-directional, temperature compensating. Provide an adjustor for calibrating the meter. Meter shall have large visible 5-digit reset totalizer and small visible 8-digit non-reset totalizer. [Meter readout shall be mounted on a swivel.] The unit of measurement shall be L gal and the increment of measurement shall be one L gal.

[2.2.8 Emergency Dry Breakaway Coupler (EDBC)

NOTE: EDBC required for NAVY/MARINE CORPS Projects.

The EDBC unit shall operate independently of internal pressure and separate at a nominal +/- 18 kg 50 pound tensile pull. The EDBC shall be capable of reinstallation without replacement parts or the use of special tools.

The NAVAIR approved EDBC's for use on aircraft refueling pantographs are the Aeroquip AE1284U and the Carter Ground Fueling 64227.

2.2.9 Sampling Connection

Sampling connection shall be provided. Materials shall be Type 316 stainless steel. Material for ball valve, quick disconnect coupling shall be Type 316 stainless steel. Each sampling connection shall consist of a 6 mm 1/4-inch sampling probe where the probe faces upstream, ball valve, a quick disconnect coupling and aluminum dust cap. The sampling connections shall be capable of accepting a sampling kit for drawing the samples required to assure fuel quality. Provide a 1 m 3-foot, fuel resistant sampling hose with mating quick disconnect fitting.

2.2.10 Pressure gage assembly

Assembly shall consist of 100 mm 4-inch ASME B40.100 pressure gage and pressure gage stop cock. Pressure gage shall be liquid filled type with an indicating range 0-1.8 MPa 0-275 psig. Material shall be Type 316 stainless steel.

2.2.11 Drain and Vent Assemblies

Assemblies shall consist of a 13 mm 1/2 inch ball valve and shall terminate with a 180 degree pipe gooseneck and screwed cap for the vent, and the drain shall have a 13mm 1/2 inch ball valve and shall terminate with a cam type quick disconnect.

2.2.12 Hydrant Coupler

NOTE: Select either Military Specification
Pantographs or Commercial Specification for use with
hose trucks or as directed by COMMAND FUEL FACILITY
Engineer. For new designs use the Commercial
Specification. Some installations and countries use
the Military Specification couplers and adaptors
even though the specification is inactive. Some
companies make couplers and adaptors to this
specification. Hydrant Control Valve Adapter shall
match selection. Delete this paragraph if only
permanent Pantographs are to be used.

The hydrant coupler is the connection between the hydrant system and the pantograph. It shall comply with [MIL-C-83260] [EI 1584]. The coupler shall be provided with suitable, non-lubricated 360 degree rotation swivel joint and shall be suitable for mounting to flanged connection. In addition to the bicycle handle grips, the nozzle shall be provided with a half circle ring handle.

2.2.13 Shut-Off Valve

NOTE: Delete this paragraph for NAVY/MARINE CORPS
projects. For AIR FORCE projects this paragraph
will be deleted at the direction of the COMMAND
FUELS FACILITY Engineer if only hose end Pantographs
are to be used.

A [64 mm 2-1/2 inch] [75 mm 3-inch] shutoff valve shall be mounted upstream of the pressure fueling nozzle and shall provide safe shutoff of the pantograph for inspection of the dry break quick disconnect strainer.

2.2.14 Dry Break Quick Disconnect

A [64 mm 2-1/2 inch] [75 mm 3-inch] semi-dry break quick disconnect (MIL-DTL-24788, Class 1 or equivalent) shall be mounted between the [shut-off valve] [hose end] and the pressure fueling nozzle. The semi-dry break quick disconnect shall be capable of swiveling through 360 degrees and shall incorporate a 60 mesh strainer in the portion attached to the pressure refueling nozzle (also known as the male half).

2.2.15 Pressure Fueling Nozzle

NOTE: D-1R, D-2R and D-3R Nozzles incorporate either a 380 kPa (55 psi) (NAVY/MARINE CORPS) or 311 kPa (45 psi) (ARMY) hose end pressure regulator. Provide the type of nozzle directed by the COMMAND FUELS FACILITY Engineer or Service Headquarters. For NAVY/MARINE CORPS projects provide D-1R Nozzles having 380 kPa (55 psig) hose end regulators unless specific approval for a different nozzle type is received from NAVAIR.

SAE AS5877, 64 mm2-1/2-inch nozzle [D-1] [D-2] [D-1R (D-1 with [3.8] [3.0] MPa [55] [45] psig hose end pressure regulator)] [D-2R (D-2 with [3.8] [3.0] MPa [55] [45] psig hose end pressure regulator)] [D-3R (D-3 with [3.8] [3.0] MPa [55] [45] psig hose end regulator)] shall be provided for the connection between pantograph and aircraft. Design shall be for single point fueling of [aircraft] [and] [truck] at a flow rate of 36 L/s 600 gpm with maximum pressure drop of 2 kPa 30 psig. Nozzle shall be provided with a permanently installed quick disconnect sampling coupler. (Gammon GTP-235-3/8 Jet Test QD meets this requirement.) Provide pressure gage with 0-7 MPa 0-100 psig indicating range mounted on actuator for use with quick disconnect sampling coupler.

[2.2.16 Aviation Fuel Hose

Fueling hose shall conform to EI 1529, Grade 2, Type C, semi-hardwall, [75] [62] mm [3] [2.5]-inch nominal hose designed for use with specified fuel for a working pressure of 2 MPa 300 PSIG over a working temperature range of 0 to 55 degrees C -22 to 131 degrees F. Hose shall be constructed of braided synthetic cord surrounded by an interior rubber tube and an exterior rubber cover. Provide permanent brass, threaded, male NPT, both ends.

]2.2.17 Venturi

- a. The venturi provides for compensated pressure regulation to each permanent aircraft pantograph control valve and on each hydrant control valve. Venturi shall be constructed of stainless steel. The venturi shall be sized to compensate for pressure drop of entire pantograph assembly at minimum through maximum design flow rate. The amount of recovery shall be adjustable and the maximum unrecoverable pressure

drop at 36 L/s 600 gpm shall be less than 69 kPa 10 psi.

- b. Provide venturi control lines with needle valve to be used during final adjustment of pantograph. Venturi control lines shall be provided with pressure gauge and pressure gauge stop cock. Indicating range shall be 0-667 kPa 0-100 psig. Material shall be Type 316 stainless steel.
- c. Detachable pantograph venturi shall be provided with a 10 mm 3/8 inch stainless steel fuel sensing line and 2.4 m 8 feet of 8 mm 5/16-inch fuel sensing hose. Fuel sensing line and hose shall be provided with a stainless steel plug and socket type quick disconnect for coupling together at the pantograph and opposite end of fuel sensing hose suitable for connection to hydrant control valve's pilot system.
- d. Fuel sensing hose tube and cover shall be resistant to the effects of hydrocarbon fuels and shall conform to SAE J517-100R7.

2.2.18 Pantograph Control Valve

NOTE: Per COMMAND FUELS FACILITY Engineer or
COMMAND Service Headquarter direction.

Refer to Section 33 52 43.14 AVIATION FUEL CONTROL VALVES.

[2.2.19 Fuel Separator

NOTE: Per COMMAND FUELS FACILITY Engineer or
COMMAND Service Headquarter direction.

Refer to Section 33 52 43.28 FILTER SEPARATOR, AVIATION FUELING SYSTEM.

]2.2.20 Additive Injector

NOTE: Per COMMAND FUELS FACILITY Engineer or
COMMAND Service Headquarter direction.

Refer to Section 33 52 43.11 AVIATION FUEL MECHANICAL EQUIPMENT.

]2.2.21 Nitrogen Powered Deadman Control System

NOTE: Include only if selected in paragraph
DETACHABLE AIRCRAFT PANTOGRAPH, in PART 1.

Provide pantographs with a 1.09 cubic m 39 cubic foot nitrogen cylinder, adjustable pressure regulator, quick release shuttle for the nitrogen, interconnecting control tubing, pressure gauge, and all necessary hardware to operate the pneumatic deadman pilot system on the hydrant control valve. The nitrogen bottle shall be mounted to the pantograph. Provide 3 m 10 feet of air/nitrogen control hose to connect the deadman control system to the hydrant control valve air deadman connection. Provide stainless steel plug and socket type quick disconnect for coupling together the air

control hose at the pantograph and a quick disconnect suitable for connection to the hydrant control valve's pilot system at the other end.

PART 3 EXECUTION

3.1 ASSEMBLY

The pantograph shall be delivered completely assembled.

3.2 TESTING

The pantograph shall be tested as described in Section 33 08 53 AVIATION FUEL DISTRIBUTION SYSTEM START-UP.

-- End of Section --