NATO STANDARD

AFLP-3784

TECHNICAL GUIDANCE FOR THE DESIGN AND CONSTRUCTION OF AVIATION AND GROUND FUEL INSTALLATIONS ON NATO AIRFIELDS

Edition A Version 2
AUGUST 2022

NORTH ATLANTIC TREATY ORGANIZATION

ALLIED FUELS AND LUBRICANTS PUBLICATION

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NORTH ATLANTIC TREATY ORGANIZATION (NATO)

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NATO LETTER OF PROMULGATION

9 August 2022

1. The enclosed Allied Fuels and Lubricants Publication AFLP-3784, Edition A, Version 2 TECHNICAL GUIDANCE FOR THE DESIGN AND CONSTRUCTION OF AVIATION AND GROUND FUEL INSTALLATIONS ON NATO AIRFIELDS which has been approved by the nations in the Petroleum Committee, is promulgated herewith. The agreement of nations to use this publication is recorded in STANAG 3784.

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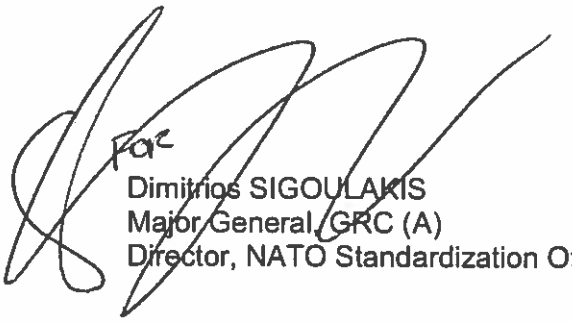

For
Dimitrios SIGOULAKIS
Major General, GRC (A)
Director, NATO Standardization Office

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RECORD OF RESERVATIONS

CHAPTER	RECORD OF RESERVATION BY NATIONS
Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.	

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RECORD OF SPECIFIC RESERVATIONS

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SECTION 1 GENERAL

0101. In the drafting of this STANAG, reference has been made to various STANAGs, and current approved NATO Criteria. This document develops the guidance pertinent to airfield on-base facilities now included in AC/4-N(2017)0002(INV). Any modification or amendment to the above STANAGs, NATO Criteria or other new STANAGs or criteria that are relevant, is applicable to this technical guidance. Facilities constructed according to the technical requirements as stated below will generally be eligible for common funding. Items which are not currently so eligible, are appropriately annotated. This STANAG describes a fully protected facility. The need for protecting elements of airfield fuel facilities has to be decided on a case by case basis by the Strategic Command and shall be discussed beforehand with the Strategic Command and NATO International Staff.

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SECTION 2 TECHNICAL REQUIREMENTS

LOCATION OF FUEL STORAGE

0201. All on-base aviation fuel storage is to be splinter protected as defined in current MNC Criteria. All on-base fuel storage tanks are to be constructed either underground, or semi-buried and mounded over with earth, and grouped together in installations. As a minimum, each Jet Fuel Storage Installation (JFSI) shall comprise the following:

(a) Receiving facilities.

(b) Storage/operating tank(s).

(c) Pumps and manifold pipework.

(d) Filter/water separators.

(e) Vehicle dispensing and/or aircraft dispensing points.

(f) Drain tank.

(g) Standby electric generator.

(h) Operator/control area.

(i) Access road and vehicle hardstanding.

(j) Security fencing and access gate.

(k) Drench shower. (Ineligible for common funding unless demanded by national law).

0202. For survival, each tactical airfield should have at least 2 JSFI as widely dispersed as is practicable, but sited near aircraft dispersal areas to reduce refueller vehicle transit time - JFSI to aircraft. The minimum distance between JFSIs, and the circumstances under which more than 2 are required, are detailed in approved current MNC Criteria.

0203. AVGAS storage is normally sited at only one location and should be combined with jet fuel storage in a JFSI. Siting of ground fuel storage and dispensing facilities should take into account the need to provide fuel for aircraft ground equipment and vehicles directly in support of airfield wartime operations, as well as the peacetime need to dispense fuel to administrative vehicles.

0204. The siting of pipeline terminal facilities and buffer storage tank(s), if required on an airfield, is largely governed by space availability and the direction from which the off-base supply pipeline comes. Consideration to dispersal and survival must be given.

MOVEMENT OF JET FUEL

0205. Jet fuel may be received from road or rail tankers, tanker ships, barges or pipelines. Whenever feasible, each airfield is to have the ability to receive fuel by 2 different methods. The design of JFSI, interconnecting pipelines and feeder pipeline is governed by the required wartime delivery rate of jet fuel to the airfield. The feeder pipeline is the connecting line between the off-base pipeline terminating point and one of the JFSIs and is operated at low pressure. Off-base pipeline fuel resupply systems, provided under the POL category, should be completely isolated both cathodically and for pressure (by pressure reduction and relief valves) from the on-base system.

0206. The delivery of fuel, from operating/storage tanks in a JFSI, to aircraft, will normally be by an airfield refueller vehicle. Where operationally justified, delivery of fuel may be direct to aircraft, using a hydrant refuelling system. The number of dispensing points and rate of delivery shall be in accordance with the documents in paragraph 0202 above.

0207. Interconnecting pipelines are required to permit the transfer of jet fuel between JFSIs. The interconnecting pipelines also act as an extension of the feeder pipeline and permit the resupply of jet fuel into any JFSI from the off-base pipeline.

0208. Arrangements to return unused, surplus (recoverable) jet fuel from a refueller vehicle (or directly from an aircraft, where a hydrant system is provided) into a JFSI, are required (see paragraphs 0239 and 0255).

0209. Meters. Flow quantity meters are required at fuel receipt and dispensing points.

OPERATING/STORAGE TANKS

0210. Types. The type of tank used (horizontal or vertical cylindrical shapes) whilst primarily motivated by economy will also depend upon the volume of fuel to be stored, the geology of the site and the height of the water table. At JFSIs, new operating tanks shall normally have a capacity of at least 200 m^3. Tanks of 500 m^3 capacity and more will normally be designed as a vertical cylindrical tanks, semi-buried and earth covered. For MOGAS and DIESEL, tanks 150 m^3 or smaller, normally horizontal type, completely buried, gravity filled, steel double-walled or fiberglass (GRP) with hydrostatic tank monitor and overfill spill containment device, shall be provided. Calibration charts in millimeter increments, are to be provided for each type and size of storage tank.

0211. Usable Volume. New tanks shall be designed to a net usable capacity. An additional volume, not exceeding 5% of the usable volume, shall be allowed for, in order to accommodate liquid expansion caused by temperature variations.

0212. Spacing. The distance between tanks in a JFSI should be not less than:

(a) Two metres for buried, horizontal cylinder tanks.
(b) One tank diameter for vertical cylinder tanks.

0213. Water Table. To minimize problems of hydrostatic pressure, buoyancy and external corrosion, tanks should be positioned above the subsoil water level. To enhance survivability against remote, large weapon detonation, direct burial in wet, cohesive solid or wet, silty ground should be avoided.

0214. Design and Construction Material. The design of tanks and the materials selected for their construction, whilst primarily motivated by economy of storage/operation, should also take into account weapon effects and survivability. One wall of every fuel storage tank must normally be of steel construction. Day tanks for standby power installations and minor service tanks may be of plastic material.

0215. Double Walls. All vertical cylinder tanks should have double walls, each wall being structurally independent. The inner wall shall be of mild steel to provide the best safeguard for survival. Normally, the outer wall should be of reinforced concrete. In order to control the interstitial space, a leak detection system shall be provided by installing a liquid sensor and a drain between the concrete and steel wall and bottom, the content of which must be capable of being checked visually. Inter-wall water must be capable of being drained away by gravity or by a sump pump. In the case of one country this requirement can be satisfied by using a non-structural, sandwich lining constructed of glass reinforced polymer (GRP)/metal foil/GRP; the metal foil having an integral air gap capable of being checked for leaks **-** this technical solution is eligible for common funding because it is required by national law.

0216. Diameter/Height. For vertical cylinder tanks, smaller than 1,250 m^3, the proportion of height to diameter should range between 1:2 and 1:2.6. For tanks larger than 1,250 m^3, proportions between 1:2 to 1:6 are acceptable. Dimensions of steel plates, positioning pumps and limiting suction heads all influence tank dimensions. Local conditions may dictate tank diameter and height.

0217. Piping. Access pipes to a tank can suffer from corrosion if they are not adequately protected when buried in the ground; connecting pipes placed in valve pits and properly insulated do not corrode. Whilst delivery and draw-off pipes penetrating the tank walls are technical acceptable, the concept, requiring either an approach tunnel or pipe duct, has weaknesses from a survivability view point. Although adequate splinter protection of pipes and valves is provided by open approach tunnels, they allow the ingress of napalm and blast pressure. To prevent damage to the tanks' double walls,

there should be no construction continuity between duct wall and the outer tank wall. Arrangements should be made to limit the effects of napalm and reduce the effect of blast weapons.

0218. Gradient of Bottoms. The floors of vertical cylinder tanks shall have a 2-5% gradient fall towards a central sump (depending on the diameter of the tank); horizontal tanks should have minimum invert gradient of 1% to the end at which a sump pump is positioned.

0219. Welding of Plates. In the construction of both horizontal and vertical tanks, butt welding shall be used**.** The welding of the bottom on vertical tank must be controlled so as to minimize the undulation which may form during construction and which affects the ability of any undissolved water and sediment to gravitate to the sump.

0220. Structural Support. Support columns in vertical cylinder tanks shall be of tubular construction to facilitate coating and drainage of sediment to the bottom. If supporting rings are required in horizontal cylinder tanks, they should be fitted either externally or internally in accordance with national specifications. Tanks shall be designed to permit complete drainage of fuel and avoid trapping pockets of fuel in or around fittings.

0221. Tank Drainage. A collecting sump is to be provided on all tanks. Hand operated pumps shall be provided for emptying sumps of tanks up to and including 200 m^3 in size, and motorized pumps shall be provided for horizontal and vertical tanks larger than 200 m^3.

0222. Suction Pipes. The mouth of the draw-off pipe in a vertical tank should be a minimum of 1 m horizontally from the lowest point of the floor of the tank that is the lip of the sump, and no more than 30 cm above it. In horizontal tanks, the suction pipe should be a minimum of 1 m from the lowest end and must be positioned 5 cm above the bottom of the tank.

0223. Vent Openings and Flame Arrestors. Tanks of 200 m^3 capacity and larger shall be safeguarded by a minimum of two pressure vacuum relief valves (PVRV). Each valve may be constructed with a combined flame arrestor or the flame arrestor may be separate, but in both cases the flame arrestor will be positioned below the PVRV. The PVRV shall be mounted for easy maintenance. The design venting rate must be based upon the maximum filling and discharge rate, whichever is the greater, with 100% reserve venting capacity should the primary PVRV system fail. Tanks smaller than 200 m^3 are to be fitted with separate flame arrestor and open vent. All vents are to terminate in the open air, not less than 4 m above the ground level around the JFSI and not in an enclosed space.

0224. Internal Coating. All new tanks and tanks undergoing restoration in a JFSI (other than those fabricated of non-corrodible material) shall be internally coated with a minimum 200 micron film (when dry) of nationally approved, resin based, corrosion

protective material. The coating shall be applied to all internal tank surfaces. The coating serves the dual purpose of reducing steel surface corrosion and aiding settling of particles in suspension. To assist in the future maintenance and inspection of tanks, the top coating should be of a light colour. In those countries where national legislation requires a conductive coating, the coating shall be of the lightest shade possible.

0225. External Protection. The external surfaces of steel tanks directly buried are to be given protection against corrosion.

0226. Access Manholes. All new tanks are to be fitted with manholes of a minimum of 0.8 m, but normally 1 m diameter. The number of manholes required for each tank is:

(a) Horizontal tanks 2

(b) Vertical tanks below 2,500 m^3 3

(c) Vertical tanks 2,500 m^3 and above 4

(d) Horizontal ground fuel and drain tanks 2.

0227. Internal Fittings. All internal tank fittings, including pumps, should be designed in such a way as to permit maintenance without having to empty the tank. Fittings are to be provided for the following functions:

(a) Fuel Sampling and Temperature Readings. A stainless steel pipe of normally 150 mm, but at least 100 mm diameter, extending a maximum of 1 m below the tank roof or an adequately slotted extending to the bottom of the tank, is to be provided. The upper end of this pipe must be bonded, to eliminate the possibility of sparks from static discharge during sampling operations. A plate welded to the tank floor directly underneath the sampling pipe shall be provided, in order to prevent damage to the coating of the tank bottom.

(b) Removal of Unusable Fuel. In every storage tank there shall be means of removing water and slop drainage from the lowest point of the tank bottom (see paragraph 0221).

(c) Filling. In vertical tanks, the fill pipes are to terminate and discharge not more than 10 cm above the sloping tank bottom. In horizontal tanks, the fill pipes are to discharge not more than 5 cm above tank bottom. To reduce the danger of static electricity build-up, an internal relaxation pipe, close to the bottom and along the tank sidewall, must be provided following good engineering practice. Additionally, the product flow velocity, at the point of entry into the

tank, must not exceed the velocity given by the following formula until such time as the outfall within the tank is covered by fuel

$V = \sqrt{0.64/D}$, where

V= is the velocity flow in metres per second
D= is the diameter of pipe in metres.

(d) Draw Off/Suction. The maximum suction lift at normal ambient temperatures for aviation petroleum products is of the order of 3 m (including friction head losses from all sources). The maximum suction lift for each installation, however, will depend upon the characteristics of the installed pumps. In most cases, all pumps should be positioned so as to have a positive head on the suction side. Where that is not practical, pump priming may be achieved by means of either a priming system or a foot/check valve on the suction pipe to retain priming.

0228. External Fittings. All external fittings to tanks shall be weatherproof or be protected against the weather and readily accessible for inspection and maintenance. External fittings are to be provided for the following functions:

(a) Automatic Shut-Off: A fuel operated, automatic, high level control valve or other means of fail-safe control shall be provided to shut-off fuel receipt to a tank. A warning alarm shall be activated prior to closure of the high level control valve. Similarly, a low level control is also required as an automatic safety device to prevent accidents associated with fuel levels below the pump suction level.

(b) Gauge. Every tank shall have a gauge located on it in a protected position. The gauge should show the tank's fuel content, as directly measured in the internal gauging device. The gauge shall have an accuracy at 1 mm increments. In addition, other selected tank content information may be provided in accordance with STANAG 7011, i.e., water level, temperature, density and volume.

(c) Remote Data Indicators. Devices to relay the tank's data to remote indicators shall be provided; the remote indicators are to be located in the JFSI control room.

0229. Protection. All storage/operating tanks are to be constructed underground or mounded over with earth to give protection from natural hazards and enemy action. Siting and protection, as laid down in approved current MNC Criteria, should be implemented. Advantage should be taken of existing topography and ground contours to obtain maximum concealment. Concrete slabs may be used in lieu of earth if site conditions make such a form of protection more practicable. Upon completion of

construction the battered sides of earth-covered tanks should be grassed in order to protect and retain the earth against weather erosion. Other suitable forms of low growth vegetation may be used if grass growth cannot be sustained.

FILTRATION

0230. The following filtration requirements shall be satisfied when designing on-base installations:

(a) Removal of particles in the incoming fuel.

(b) Final filtration of fuel prior to delivery into a refuelling vehicle or aircraft.

0231. Incoming Filtration/Straining. Any filtration performed on incoming fuel, which is being directly delivered from a pipeline, must be arranged so as not to affect or interrupt that pipeline's operation. All fuel being received into a JFSI shall first pass through a strainer of at least 100 mesh to the linear inch, or 150 micron, and then through a filter/water separator. Where existing JFSI do not have filter/water separators on the receipt side, such filtration shall be introduced when the facility is next due for restoration/modification or at such other time as may be militarily justified. The provision of a filter/water separator on the receipt side of an installation allows simultaneous receipt and issue of fuel. The previously recommended minimum settling time of 2 hour per meter of fuel depth is considered operationally unacceptable for on-base JFSI. Filter separators, or performance equal to the latest issue of STANAG 3967 or equivalent national specification, are to be used in JFSI. A sampling connection at the inlet and outlet of each filter/separator shall be provided.

0232. Pre-Filtration Station. Additional filtration of incoming jet fuel may be technically warranted for those airfields connected directly to the off-base pipeline system. Where justified, consideration may be given to the construction of a pre-filtration station, located on-base, near the beginning of the low pressure feeder pipeline delivering fuels to on-base JFSI.

0233. Filtration Safeguards. Pre-filtration stations should normally have duplicate filters, permitting alternate, automatic filtration without interruption to the incoming jet fuel flow; the changeover between filters being activated by differential pressure limiters. A by-pass should be provided to the receipt filter/water separator in a JFSI, the changeover to which must also be controlled by a differential pressure limiter. For airfields supplied directly from a nearby off-base depot, the automatic differential pressure-actuated by-pass control valve may be eliminated.

0234. Final Filtration. All aviation fuel must pass through a filter/water separator prior to delivery to a vehicle dispensing point, or into an aircraft hydrant system. A capability for complete recirculation of fuel that has remained still on the delivery side of the final filter must be provided. Only freshly filtered/separated aviation fuel should be delivered.

If existing pipework arrangements at JFSI do not allow fresh final filtration, modifications are to be made when the installation is next restored/modified. The capacity of a filter should be allied to the design delivery pumping rate of a JFSI, which normally are to be 2000 l/min. At least two final filters (one operational and one a spare) are to be installed to guarantee continuous fuel delivery to dispensing points. Filter/water separators, of performance equal to the latest issue of STANAG 3967 or equivalent national specification, are to be used in JFSI. A sampling connection at the inlet and outlet of each filter/water separator shall be provided.

0235. Protection. All filters/water separators and associated pipework and valves are to be installed in underground pits or be splinter protected in accordance with current MNC Criteria.

0236. Internal Coating. The internal wetted surfaces of a filter/water separator if made of carbon steel shall be coated with a minimum of 125 micron of an approved coating material referred to in paragraph 0224.

DISPENSING

0237. Requirement/Location. Each JFSI shall normally have two vehicle dispensing points, each capable of simultaneously dispensing at least 1,000 l/min, but adjustable between 1,000 l/min and 2,000 l/m, of freshly filtered fuel. For JFSIs equipped with standard 2000 l/min pumps, each pump shall provide 2000 l/min at one dispensing point or concurrently 1000 l/m at each of two dispensing points. At those installations with AVGAS storage, one additional dispensing point with a minimum capacity of 500 l/min, is to be provided. It is essential that AVGAS and jet fuel dispensing points, pipework, filters and manifolds, are completely isolated to prevent the accidental mixing of aviation fuel. Aircraft hydrant pumping rates are dependent upon the type of aircraft, capacity and operational requirements and are to be designed on a case-by-case basis, subject to a minimum of 1,000 l/min per hydrant. Vehicle points shall be sufficiently separated to allow independent movement of refueller vehicles; commonly an 8 m wide hardstand should be provided (4m as loading platform plus 4m as passing lane).

0238. Main Hydrant Piping and Interconnecting Pipelines. The velocity of fuel flow should be sufficient to enable removal of free water, from the low points within the pipes, utilizing the "flushing" concept. This capability is important for hydrant systems not frequently used. For hydrant fuelling systems the velocity of fuel should be governed by the system hydraulic surge calculations, but typically a minimum of 1.9 metres per second. For interconnecting pipelines a similar concept could be achieved, providing local conditions such as terrain, size and capacity of available pumps allow for a high speed flushing.

0239. Receiving Fuel. Each dispensing point must also be fitted with a suitable connection to receive fuel from road tanker vehicles and to delivery it through a strainer and filter/water separator, to a storage tank (see paragraph 0231). Where the primary

means of resupply of fuel to an airfield is by road tanker vehicle, a separate off-load point, remote from the dispensing points must be provided (see paragraph 0261).

0240. Vehicle Connection. Connection of the dispensing point to the vehicle may be made either through an articulated corrosion resistant metal, mechanical loading arm or through a flexible rubber hose. Each dispensing point shall be provided with the capability of bottom loading refuelling vehicles; overhead filling arms are also required in exceptional cases where the users' vehicles do not have a bottom loading capability.

0241. Aircraft Connection. Aircraft fuelling hydrants should be connected to aircraft by articulated mechanical loading arms or conventional hoses and couplings.

0242. Controlled Delivery. Each dispensing point and aircraft hydrant should be provided with a fuel actuated (dead man) control valve or equivalent safety devices. The maximum flow rate should be governed to prevent generation of static electrical charge and excessive surge pressures. Pressures shall be controlled in accordance with STANAG 3681.

0243. MOGAS and DIESEL Dispensing. At the MOGAS and DIESEL station, dispensing equipment is to be of the normal metering column type, as used by civil filling stations.

0244. Protection. Dispensing point equipment at JFSIs is to be installed in underground pits or to be splinter protected in accordance with current MNC Criteria. Detachable aircraft connecting devices shall be similarly protected.

PIPEWORK

0245. Size. The diameter of pipework is generally governed by maximum flow rates, friction losses, and limiting surge pressure and static charge generation. Interconnecting pipelines between JFSIs should be at least 150 mm diameter for new construction, compatible with efficient transmission of bulk fuel.

0246. Valves and Fitting. Valves are to be of cast or forged steel and are to be the gate, ball, or non-lubricated plug type. On new constructions the surface of valves and fittings in contact with the fuel downstream of filter separators are to be of corrosion-resistant material. Swivel joints must be non-lubricated type.

0247. Corrosion Resistance. All pipework and fittings carrying filtered fuel are to be of corrosion-resistant material. The exterior of all pipework should be treated with an approved protective coating. The whole pipework and tankage system is to be electrically grounded except for those parts that have cathodic protection. Internally coated pipes, using a 125 micron lining of the material referred to in paragraph 0224, may be considered where operational concerns and lifetime costs are favourable. Zinc,

copper and zinc- or copper-bearing alloys shall not be used for pipes, valves, equipment, and accessories when in contact with aviation turbine fuels.

0248. Surge Pressures. Pipework systems should be designed to avoid unacceptable high surge pressures arising during operations. Shock alleviators may be used, but only in exceptional cases where it is not otherwise practicable to design the pipework systems to safely accommodate the anticipated surge pressures.

0249. Protection. All pipework, valves and fitting should be splinter protected as required by current MNC criteria. If dual runway crossings are required for survival for interconnecting pipelines, the crossings should be separated by at least 100 m. There should be valve pits at the dividing/joining points. Only single crossings are currently supported for common funding.

DRAIN TANK

0250. Type. A small drain tank for fuel recovery is required in each JFSI to hold temporarily unused/surplus fuel. For AVGAS a separate drain tank is required. It shall normally be of horizontal cylinder double wall design with a capacity of up to 10 m^3. The bottom of the tank should slope to one end at a gradient of 1%. An overfill protection device shall be included in this type of installation.

0251. Location. The drain tank should be separated from storage/operating tanks and located at a point convenient to drain operating tanks, manifold filter, pumping and dispensing points. Storm water run-off from paved surfaces is not to be collected in drain tanks.

0252. Tank Level. The drain tank should be sited low enough to permit free drainage by gravity of all elements of a JFSI into it.

0253. Re-Use of Fuel. The pipework arrangement should allow fuel in the drain tank to be refiltered, water separated and after a suitable settling period, returned to an operating/storage tank.

0254. Transfer. For the transfer of contaminated fuel from a vehicle to the drain tank or the transfer from the drain tank to a road vehicle, a connection shall be provided at each JFSI, normally at the drain tank itself.

PUMPS, MOTORS AND ELECTRICAL EQUIPMENT

0255. Pumps. Main pumps must be capable of delivering fuel to dispensing outlets at the minimum rate. Each JFSI shall have at least two main pumps, arranged in parallel so that each may be stand-by for the other, and also arranged for concurrent operation. Normally all pumps should have electric motors. Smaller hand-operated sump pumps are adequate for the removal of unusable fuel from horizontal storage tanks up to 200

m^3 (see paragraph 0221). Sump pumps of vertical storage tanks shall be provided with electric motors.

0256. Flexibility. The pipework in the manifold filter station should be arranged to permit concurrent dispensing and tank to tank transfer of fuel within one JFSI. Transfer is to be achieved by means of either of the main pumps, when it is not in use for dispensing. Additionally, a main pump in one JFSI must be capable of delivering fuel to a tank in another JFSI, through the interconnecting pipeline, at whatever rate is achievable. Constant pressure type JFSIs have shown operational advantages when resuming fuel dispensing in war damaged JFSI.

0257. Hand Pump. A portable hand pump may be used to remove spillages from sumps in dispensing points and manifold filter stations at those JFSIs where complete drainage is not a legal requirement.

0258. Switches. All motor driven pumps shall have control (ON-OFF) switches inside each pump room. In addition to the automatic safety devices, emergency switches must be positioned at/in:

(a) Each pump room.

(b) Each dispensing point.

(c) JFSI control room (if provided).

0259. Safety. Pumping equipment is to be provided with the necessary overload safety devices, including flow/pressure controls. All host nation legal safety regulations are to be satisfied. Particular attention is to be paid to the positioning of motors and electrical equipment in confined and potentially dangerous, gas laden locations; in those locations explosion-proof types of equipment should be installed. Where natural ventilation cannot be relied upon to clear vapour, forced air ventilation should be fitted.

0260. Duplication. Vertical tanks of 750 m^3 and larger capacity, served by submersible centrifugal pumps, are to have two pumps and two delivery main pipes, each capable of achieving the minimum delivery rate of 2 x 1,000 l/min at the dispensing points. Tanks smaller than 750 m^3 normally need only be fitted with one main pump.

0261. Receipt Pump. At those airfields where fuel is delivered to a JFSI by road tankers and trailers not fitted with pumps, a receiving pump with a capacity of 1,000 l/min placed in a splinter protected location is to be provided (see paragraph 0239). System shall have the capacity to prevent the introduction of air into the JFSI and to shut the pumps off when receipt is completed.

0262. Protection. All pumps, motors and related electric panels, switchboards, and standby electrical generators, etc., are to be splinter protected in accordance with current MNC Criteria.

CATHODIC, FIRE AND ENVIRONMENTAL PROTECTION

0263. Cathodic Protection. External cathodic protection for the underground metal pipe network, interconnecting pipeline, feeder and horizontal metal storage tanks shall be provided. Prior to design and installation, a corrosion survey should be carried out to determine the most effective method of protection - sacrificial anode or impressed current system.

0264. Fire Protection. At fuel installations, local fire protection is to be provided by portable or mobile fire fighting equipment, using foam and/or powder. The provision of a water supply to a JFSI is not supported for NATO common funding as, in the airfield category, all on-base fire fighting is, in principle, a national funding responsibility.

0265. Environmental Protection. A hardstand shall be constructed for vehicles, or aircraft receiving (or delivering) fuels. Each hardstand should have adequate water drainage sumps and, where national legal and environmental protection regulations dictate, all dispensing points should have curb containment, water/fuel separator and reservoir to protect the surrounding soil and water sources from hydrocarbon contamination (see paragraph 0237).

SECURITY

0266. JFSIs are to be enclosed within a security fence, as required under current MNC Criteria. As a general guide, fencing should be sited 30 m away from vent openings and dispensing points (distances as small as 20 m have been accepted at some JFSIs).

UTILITIES

0267. Primary Electrical Power. Normally electrical power for fuel installations is to be provided from the primary airfield supply.

0268. Standby Electrical Power. To ensure continued operations if primary power is cut off, each JFSI is to have a dedicated, standby generator. The capacity of the generator must be capable of meeting the combined power requirements of one main pump motor, running on load, and the surge start power of a second main pump motor. Generators of up to 100 KVA are normally required; larger capacity generators should be provided where technically justified.

0269. Exterior Lighting and Communication. Each JFSI should be provided with a minimum of exterior lighting at each dispensing point and between facilities and walkways. A telephone shall be provided for normal and emergency purposes.

STANDARD DESIGNS

0270. The development of standard design elements allows for the rapid design of new JFSI. Such designs have been developed in the past and continue to be encouraged by the International Staff. To become NATO-approved standard designs, host nations should submit them to the NATO International Staff and MNCs for examination and approval. NATO approval will be formally recorded in a letter of protocol (Memorandum of Understanding) to which future Type B cost estimates may refer. Once a design is NATO approved, only airfield plan, site plans, detail drawings, where different from the standard, and utility plans are required to accompany project fund requests to NATO.

STANDARDIZATION OF MAIN EQUIPMENT

0271. Interchangeability. Following sabotage or war damage to JFSIs, the recovery of refuelling operations is enhanced if the installed main equipment is readily interchangeable. User nations in co-operation with host nations should foster rapid recovery in wartime, both by holding adequate 90-day spare parts and by cannibalization between JFSIs.

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