INTERNAL COMBUSTION ENGINES

1. GENERAL

1.01 This section outlines suggested fire preventive and protective measures and certain recommendations with regard to blast and service protection for consideration in connection with the installation and operation of internal combustion engines employing gasoline, kerosene, diesel oil or gas.

1.02 For the purpose of this section, a critical location as referred to herein is defined as an area designated as a critical target area by the Federal Civil Defense Administration, offices serving important military or Atomic Energy installations, and/or regions subject to earthquakes.

1.03 This practice is revised and reissued to:

(a) Recommend certain safety considerations in connection with the location of engines and associated equipment.

(b) Indicate changes in materials recommended for piping for diesel oil.

(c) Recommend limiting connecting diesel engine exhaust pipes to flues, chimneys or stacks to multistory buildings.

(d) Recommend special anchorage of tanks in engine rooms and basements in critical locations.

(e) Recommend consideration of special anchorage of engines in accordance with Section AA610.006 of Bell System Practices for installations in critical locations.

(f) Recommend for buildings in critical locations the location of the engines in such buildings, to the extent practicable, to minimize damage from blast effects and to provide reasonable safety to the attending personnel from blast and nuclear radiation hazards.

(g) Recommend the engine cooling system be independent of public water supply in designated target areas.

(h) Recommend consideration of the provision of fuel tanks of sufficient capacity to meet anticipated conditions in designated critical target areas in the event of an actual enemy air attack.

(i) Include details regarding the construction of enclosures for tanks in buildings.

(j) Include revisions to conform to current recommendations of the National Board of Fire Underwriters.

(k) Recommend certain safety considerations in connection with the location, operation and storage of portable engines.

(l) Include changes in certain wording and rearrangement of the text. Arrows are used to indicate changes throughout the text.

1.04 The following suggestions are based in general on recommendations contained in Pamphlets 37 and 30 of the National Board of Fire Underwriters covering, respectively, the Installation and Use of Internal Combustion Engines, and Storage, Handling and Use of Flammable Liquids. Further details may be found in the current issues of these pamphlets.

1.05 Where local or state regulations are more restrictive than the procedures covered in this section, the legislated regulations should, of course, apply.

1.06 Instructions in detail for the installation of internal combustion engines and associated fuel equipment, exhaust silencers, ventilating equipment, and piping are covered in Section AA618.401 and the AA367.900 series of Bell System Practices.

1.07 All internal combustion engines for installation in buildings, together with fuel tanks, piping, fittings and valves should be installed in accordance with the standards of the National Board of Fire Underwriters unless otherwise required by more severe local regulations.

1.08 Plans for proposed installations of engines, storage tanks and piping are submitted where required to the local authorities for their approval.

1.09 On the basis that elimination of conditions favorable to the starting of fires is a most effective guard against damage, it is important that engine sets, exposed piping, valves, tanks, etc., be kept clean at all times. Rubbish, dirt or debris are not permitted to accumulate in rooms or space occupied by engines and their associated equipment.

1.10 It is important that open flames or smoking be prohibited in engine rooms or in space occupied by engines or fuel storage tanks.

1.11 Any gasoline supply for priming purposes is kept in a safety can outside the building. A closed can of not more than one pint capacity is used for priming operations at the engine. This may be kept in the engine room.

1.12 The requirements for fire protective apparatus in emergency engine rooms are covered in Section H43.010 of Bell System Practices.

1.13 The requirements for earthquake bracing for equipment in critical locations are covered in Section AA610.006 of Bell System Practices. Where engines are installed in critical locations consideration is given to the provision of special anchorage in accordance with Section AA610.006 of Bell System Practices.

2. ENGINES

Location

2.01 In order to minimize the transmission of noise to other parts of the building and to simplify the fuel supply systems, it is desirable that engines be located in the basement or on the ground floor wherever practicable. In this connection, considerations of possible flood hazards and vulnerability to damage by possible enemy air attack should not, of course, be overlooked. It is suggested that engines be located to the extent feasible, consistent with good judgment and sound engineering, especially when within a building situated in a designated critical target area, so as to afford a reasonable degree of protection to the engine from blast and to attending personnel from a standpoint of both blast and nuclear radiation.

2.02 Gasoline engines are placed in rooms used for no other purposes, having partition and ceiling construction at least equivalent to similar construction having a 2-hour fire resistance rating and doors bearing a Class "B" label. Where automatic operation gasoline engine sets are used, the door to the engine room is entered from the outside with no openings into other parts of the building through which gasoline vapors might pass. The location of small portable gasoline engines is covered in Paragraphs 4.01 to 4.05, inclusive, of this practice.

2.03 From the standpoint of fire protection, separate rooms are not required for diesel engines. However, consideration is given to problems involved when engine is operating, such as noise, drafts and controls of ventilation as it might affect boiler combustion. Dependence on the boiler room door being closed results in less emphasis on need for partition around engine. This is on the basis of less interference with boiler draft. Diesel engines in unattended remotely located buildings, such as radio structures, are separated from equipment areas by a fire partition if the over-all investment is large and a service interruption would involve considerable loss. In such cases where diesel engines are used, a Class "B" fire door designed to close automatically, and remain closed when not in use, may be placed in the wall between the engine room and equipment room for the convenience of operating personnel.

2.04 It is desirable that engines be so located that any parts which might fly off during periods of ungoverned overspeed will not be liable to hit and damage vital equipment such as the house service panel, batteries, fuel tanks, etc.

2.05 It is recommended that where it is necessary to locate the radiators remote from the engine room, consideration be given to the possibility of providing an installation arrangement which will protect the radiator from pressure and flying or falling debris which might result from blasts or earthquakes. Roof top, areaway, or other exposed radiator installations are more vulnerable to this type of damage and are, therefore, considered generally undesirable. In this connection, locations utilizing the screening effect of structural features of the building or of adjacent structures and locations on the side of the building opposite from the probable direction of the blast are considered. Cooling systems for engines situated in critical locations should be independent of public water supply systems in that such systems might be severely damaged and service disrupted in the event of an enemy air attack or an earthquake.

2.06 The engine room accesses and the control point should be so arranged that it is not necessary to pass by the side of the engine in order to execute an emergency manual shutdown of the engine during periods of overspeed.

2.07 Suggestions for the ventilation of internal combustion engine rooms are covered in Section H34.284 of Bell System Practices, and requirements for the ventilating equipment in such rooms are outlined in Section AA360.015.

2.08 All Bell System standard type engine sets are designed to be installed in rooms with a ceiling height of 9 feet under the lowest structural ceiling projection except where the standard 300 kw or larger nonstandard diesel engine alternator set is used and in that case, a minimum height of 10 feet is necessary.

Fuel Piping

2.09 Fuel lines for gasoline, kerosene, or any fuel having a flash point lower than 100°F should be arranged to prevent gravity feed from the fuel storage tank to the engine, with all pipe connections made above the highest fuel level in the tank and all piping so graded as to drain back into the fuel tank. It is desirable that the above suggestions also be applied wherever practicable to fuel lines carrying diesel oil. In any case where it is necessary to enter the basement with exposed fuel piping, a hand operated shut-off valve is installed in the supply line inside the basement near the point of entry at the basement wall. All standard diesel sets now being manufactured for the Bell System are provided with suction pumps which will lift fuel from 12 feet below the pump. Therefore, supplementary pumps or tanks ordinarily would not be necessary. However, where a diesel oil storage tank is so located with respect to an engine that the engine fuel pump can not transmit the oil, a low capacity auxiliary "day tank" and auxiliary fuel pump are usually provided. Antisyphon valves are not required by the National Board of Fire Underwriters. The circle seal valve specified for standard diesel engine tank installations is an effective syphon check against approximately a 5-foot head of oil. The maximum permissible liquid capacity of supply tanks in buildings is given in Paragraph 3.09.

2.10 Piping material for diesel oil in order of preference is:

(a) Black wrought iron for sizes 3/4 inches and above.

(b) Brass tinned on the inside.

(c) Stainless steel.

(d) Red brass.

(e) Yellow brass.

No difficulties have been encountered with any of the foregoing materials where good stable diesel fuels as recommended in Bell System Practice A301.290 were used. Materials for piping carrying other fuels may be galvanized iron or brass tinned on the inside, and all piping should be standard iron pipe size. Tin lined cast brass fittings are used with tin lined brass pipe, cast stainless steel fittings with stainless steel pipe, cast brass fittings with brass pipe, galvanized cast iron fittings with galvanized pipe and black cast iron fittings with black iron pipe. It is important that fill pipes be buried sufficiently below grade to afford protection against accidental injury. All pipe connections are made up tight with glycerine and litharge compound or Permatex No. 1. Joints of piping laid in moist earth are thoroughly coated with moistureproof paint after the compound has set. If steel piping is to be buried in earth containing alkali, sometimes present in soils of arid regions, it is protected with a bituminous coating over a priming coat of red lead. These coatings may be protected if necessary by an asbestos fabric wrapping. Cinders are not placed in contact with metal pipe because they will accelerate corrosion. Pipe systems should be substantially supported and protected against physical damage and excessive stresses rising from settlements, vibration, expansion or contraction.

2.11 Flexible sections of braided metal pipe are run as straight as possible. They should not be bent to meet the connecting pipes.

Exhaust Piping

2.12 Exhaust pipes are of full weight genuine wrought iron or steel and it is desirable that they be made up with a minimum number of bends and fittings consistent with adequate facilities for accommodating expansion and for dismantling when cleaning or making repairs.

2.13 A separate exhaust line extended to the roof as directly as practicable is usually provided for each gasoline engine; however, in the case of diesel engines, a common exhaust may be used provided shut-off valves are installed at each entry from a two-cycle engine. Individual or common diesel exhausts may be exhausted into boiler flues or chimneys as outlined in Paragraph 2.16. Where appearance is not controlling and where adequate stack facilities do not exist, a savings in cost and an increased dissipation of heat may be effected by placing exhaust piping on the exterior of the building in accordance with ED-80924-01. The piping should be securely connected to the engine and silencer and be adequately supported for its entire length. It is important that provision be made for expansion of pipe as shown on Drawing ED-80926-01.

2.14 Exhaust pipes are arranged to discharge away from any window or building ventilation opening and it is desirable that the pipe termination be located at least 15 feet distant from such openings.

2.15 Exhaust pipes for Gasoline, Kerosene or Illuminating Gas Engines are run outside the building or extended to the roof through suitable masonry enclosed flues which are used for no other purposes. Exhaust pipes for diesel engines using standard fuels, which includes kerosenes with flash point ratings better than 115°F, are not included in the above limitations and may be exhausted into boiler flues as described in Paragraph 2.16. The limitations described in Paragraph 2.17 to prevent exhaust pulsation damage are applicable to these engines.

2.16 Exhaust pipes for diesel engines may be run on the outside of buildings, extended to the roof in a masonry enclosed flue or exhausted into an inside flue or chimney equivalent to 8 inches of brickwork with standard flue lining, or 6 inches of reinforced concrete, with no woodwork within 4 inches of the flue or chimney; or diesel exhaust pipes may, in the case of multistory buildings, be connected to any interior or exterior flue, chimney or stack in use or previously used for a medium or high heat appliance, including building boilers, provided the chimney or stack is in good condition, adequate in size, impervious to exhaust gases, preferably free from offsets, and without openings in chimney, smoke pipe or breeching where flue gases might be forced out, for example, into boiler room when engine is operating. In order to assure the absence of negative pressure conditions in boiler rooms or engine rooms it is essential that adequate supplies of air be provided to these spaces. This will insure that the engine combustion-air will not be drawn from the boiler room and cause reverse flow of exhaust gases out of the stack during periods when the boiler is not operating. Where diesel exhaust pipes discharge into such flues it is desirable that they be provided with a suitable full caliber long sweep tee as shown on Drawing ED-80926-01. The cross-sectional area of the flue should not be less than 150% of the total cross-sectional area of all pipes that would be used if one pipe were extended from each engine. While it is usually desirable that flues into which diesel exhaust pipes are discharged have a continual draft induced by boilers, incinerators or hot water heaters, experience has proved that this is not essential to satisfactory operation. Therefore, diesel exhausts may usually be discharged into standby boiler flues or abandoned boiler flues provided the other requirements of this paragraph are met. Diesel exhaust pipes are not connected to boiler breechings.

2.17 The conclusions in the preceding paragraph are based on 1200 rpm minimum, two-cycle diesel engines with frequency of exhaust explosions not being below 40 per second. The frequency of explosions that result in damage to masonry flues is usually 8 to 10 per second, or sometimes as high as 20 per second. These conditions may be found in some of the older nonstandard engines. Round straight flues receiving the discharge from exhaust pipes develop less vibration, noise and friction than rectangular flues and offset flues. However, the present standard engines with appropriate silencers usually may be exhausted into round, square or rectangular flues without danger of damage due to pressure waves being built up in the flue if the stack and lining are of substantial construction with all mortar joints completely filled.

2.18 In general, extending a diesel engine exhaust pipe to the outside point of discharge is considered preferable to exhausting into a flue or chimney, since the former arrangement is less liable to leakage and requires less attention to the condition of the enclosing flue and masonry. Flues lined with metal less than number 11 gauge (1/8-inch thick) have not been found satisfactory because of possible vibration of the metal.

2.19 Exhaust pipes should not be embedded in a wall or floor, and exhaust piping of gas or gasoline engines should not be covered with any heat-retaining covering.

2.20 Nonwater-cooled exhaust pipes are not placed within 9 inches of wood lath and plaster partition, ceiling or other combustible material. Where nonwater-cooled exhaust piping is exposed to contact by employees it is protected by suitably ventilated metal guards. Horizontal runs are kept as short as possible.

2.21 Where nonwater-cooled exhaust pipes pass through combustible partitions they are provided with galvanized iron ventilated thimbles at least 12 inches larger in diameter than the pipes, or with galvanized iron sleeves having a diameter not less than 1-1/2 inches larger than the outside diameter of the pipe and built into panels of brickwork or other incombustible material extending at least 8 inches beyond all sides of the sleeves. It is desirable, where pipes pass through finished walls enclosing air spaces, that protection be furnished to prevent flammable material from dropping on the hot pipe.

2.22 A nonwater-cooled exhaust pipe passing through a brick or concrete partition is provided with a galvanized iron sleeve having a diameter at least 1-1/2 inches larger than that of the pipe.

2.23 An exhaust pipe passing through a brick or concrete wall to the outside of a building is usually furnished with a metal sleeve having an inside diameter at least 3 inches larger than the outside diameter of the exhaust pipe to allow for expansion of the vertical run of pipe. This clearance space is closed at the outer wall surface by clamping a sheet copper facing flange to the pipe. A copper flashing guard is attached to the outside face of the wall above the sleeve to shed rain away from the pipe where it enters the building.

2.24 The bottom of the exhaust pipe run and the lowest point of each horizontally mounted silencer are provided with suitable means for drainage.

2.25 It is important that silencers be securely supported and so located that no metal portion of any silencer will be nearer than 12 inches to any woodwork or other combustible material.

3. FUEL SUPPLY SYSTEMS

Diesel Fuel Tanks

3.01 Subject to the limitations described in Paragraphs 3.06 to 3.09, inclusive, small diesel fuel storage tanks may be located in the engine room or basement provided local regulations permit. Unenclosed diesel tanks are not located within 5 feet horizontally of any fire or flame. However, buried tanks described in succeeding paragraphs are considered preferable unless unusual conditions are encountered. Diesel fuel tanks should be constructed of tank steel (not galvanized).

Gasoline Tanks

3.02 A buried gasoline tank is located preferably outside the building where property is available and where excessive or otherwise costly excavation would not be required. A location remote from adjoining property is preferable where a choice can be made, but consideration is given to places which will be out of the path of possible growth of the building.

3.03 Gasoline tanks having capacities up to 2000 gallons may be installed either outside the building or under the basement floor, provided that the top of the tank is lower than the lowest floor, basement, cellar or pit of any building within a radius of 10 feet from the tank. A basement location is generally resorted to where the building covers the entire property, where the ground line is considerably above the basement level with no courts or areaways available to reduce the required excavation, or where rock and water are encountered.

3.04 If the top of an underground tank is not lower than the lowest floor, basement, cellar or pit of any building within a 10-foot radius, its capacity is restricted to 550 gallons.

3.05 It is desirable that all pipe connections to buried storage tanks be provided with swivel joints or otherwise arranged so that a slight settlement of the tank will not place undue stress on the piping or fittings.

Setting Diesel Fuel Storage Tanks in Engine Rooms or Basement

3.06 The tank is located as near the engine as practicable to avoid long runs of piping and minimize the number of bends. Where possible, tanks should not be located adjacent to an engine where parts flying off as mentioned in Paragraph 2.04, may damage the tank.

3.07 Tanks are installed on a firm foundation such as a substantial concrete floor. Small auxiliary "day" tanks are preferably mounted on masonry or concrete walls or partitions. Special anchorage of tanks is recommended in critical locations in accordance with Section AA610.006 of Bell System Practices.

3.08 Main supply tanks larger than 60 gallons capacity should not be located above the lowest story, cellar or basement.

3.09 Supply tanks in buildings do not exceed 275 gallons individual capacity, or 550 gallons aggregate capacity in one building unless installed in an approved enclosure constructed as follows: The walls of the enclosure should be constructed of reinforced concrete at least 6 inches thick or of brick at least 8 inches thick. Such enclosures should be installed only on concrete or other fire resistive floors and should be bonded to the floors. Enclosures should have tops of reinforced concrete at least 5 inches thick or equivalent fire resistive construction, except that where floor or roof construction above the enclosure is concrete or other fire resistive construction, the walls may be extended to and bonded to the underside of the construction above in lieu of the provision of a separate top. Any openings to such enclosure should be provided with fire doors or other approved closures and 6-inch noncombustible liquid tight

sills or ramps. Provision should be made for adequate ventilation of such enclosures prior to entering for inspection or repairs to tanks.

3.10 Diesel fuel storage tanks installed inside buildings are designed and constructed in accordance with the recommendations of Paragraph 2.12 of Pamphlet No. 30, standards of the National Board of Fire Underwriters for the storage, handling and use of flammable liquids, April, 1952.

Setting of Buried Tanks

3.11 The tank is located as near the engine as practicable to avoid long runs and excessive number of bends in the piping. Locating tanks where the suction lift exceeds 12 feet is avoided where possible since lifts over 12 feet require supplementary pumps.

3.12 It is important that the tank be set on a firm foundation and surrounded with soft earth or sand well tamped in place. Prior to installation, tanks are protected against corrosion on the outside, equivalent to two preliminary coatings of red lead followed by a heavy coating of hot asphalt.

3.13 Tanks outside the building are buried underground with the top below the level of any piping connected to the tank and not less than 2 feet below the surface of the ground, except that instead of the 2-foot cover, the tank may be buried under 1 foot of earth overlaid with a slab of reinforced concrete or equal construction at least 4 inches thick except for an access manhole to the piping. The concrete slab is set on a firm well-tamped earth foundation and extends at least 1 foot beyond the outline of the tank in all directions. Where necessary to prevent floating, tanks are securely anchored or weighted.

3.14 If the tank is under a driveway subject to traffic by heavy vehicles the total coverage above the top is not less than 3 feet, except that 2 feet is permissible if the driveway has a 6-inch thick reinforced concrete pavement.

3.15 Tanks buried under the floor are so installed and protected as to comply with the foregoing requirements for outside tanks.

3.16 Buried tanks installed inside buildings are designed and constructed in accordance with the recommendations of Paragraph 2.12 of Pamphlet No. 30, standards of the National Board of Fire Underwriters for the storage, handling and use of flammable liquids, April, 1952.

Access Opening

3.17 When tanks are buried, an access opening and cover are provided above the tank where pipe connections are located, other than fill and vent pipe, and the space between the top of the tank and the underside of the cover is kept filled with sand when not in use. Covers should be securely fastened by bolts or other means so as to make access difficult by unauthorized persons. Access opening is not used for filling purposes. Detail of access opening is shown on Standard Drawing No. ED-80925-011.

Venting of Tanks

3.18 Storage tanks are equipped with an open vent or an approved automatically operated vent, arranged to discharge to the open air. Vent pipes are so laid as to drain toward the tank without sags or traps in which liquid can collect. They are located so that they will not be subjected to physical damage above ground. The lower end of the vent pipe enters the tank through the top and extends into the tank for a distance of not more than 1 inch.

3.19 Each tank is vented through piping adequate in size to prevent blowback of vapor or liquid at the fill opening and to permit proper inflow of liquid while tank is being filled. Vent pipes should be the same size as the fill pipes, but in no instance should pipes smaller than 1-1/4-inch nominal inside diameter be used. When storage tanks are filled by the use of a pump through tight connections special consideration should be given to the size of the vent pipes to insure that it is adequate to prevent the development of abnormal pressure in the tank during filling. This may be accomplished by providing a vent pipe not less in size than the discharge of the pump.

3.20 Vent pipes from tanks storing gasoline are so located that the discharge point is outside of buildings, not less than 12 feet above the top of the fill pipe, and not less than 12 feet above the ground level adjacent to the vent pipe. Vent pipe outlets for gasoline tanks are so located that flammable vapors will not enter building openings, or be trapped under eaves or other obstructions. If the vent pipe for a gasoline tank is less than 10 feet in length or greater than 2 inches in nominal inside diameter, the outlet is provided with a vacuum and pressure relief device or an approved flame arrestor is located in the vent line at the outlet or within the approved distance from the outlet. In no instance, is a flame arrestor located more than 15 feet from

the outlet end of a vent line. Permanently open vent pipes are provided with weatherproof fittings at the outlets.

3.21 Vent pipes from tanks storing diesel fuel are terminated outside of buildings and higher than the fill pipe opening. Vent pipes for diesel tanks are terminated sufficiently above ground to prevent obstruction by snow and ice and are fitted with return bends, coarse screens or other devices to minimize ingress of foreign material.

Facilities for Filling Tanks

3.22 Storage tanks are filled only through fill pipes terminating outside of buildings at a point at least 5 feet from any building opening at the same or lower level. Each fill terminal is within a heavy cast metal box so designed as to make access difficult by unauthorized persons. Each fill box bears an appropriate designation "Gasoline" or "Fuel Oil" cast in the metal frame.

3.23 Fill pipes are screened, or provided with a trap or seal, or are carried to within 4 inches of the bottom of the tank.

3.24 Where both gasoline and fuel oil tanks are provided at an installation the fill boxes are as widely separated as practicable. The inner cap of the gasoline fill box is painted red and stenciled "Gasoline" unless this designation is cast on the stationary part of the cap. The inner cap of the fuel oil fill box would in such cases be painted green and stenciled or otherwise designated "Fuel Oil." It is important that the locks provided on such fill boxes have different key control, and that the keys be in the personal custody of the Wire Chief.

3.25 Diesel oil tanks that are an integral part of the engine or engine base are filled from the main storage tank by means of a manually operated pump so located as to be within sight of the fuel pipe connection to the engine tank.

3.26 Fuel tanks mounted on or that are an integral part of small kerosene engines are filled from approved safety cans.

Care and Attendance

3.27 In no instance should a fuel storage tank which feeds directly to the engine be filled while the engine is running. It is desirable that fuel storage tanks be filled during daylight hours. When tanks are to be taken out of service for some time they are completely emptied and then filled with water which has been treated to minimize rusting.

3.28 When a tank gauge is installed its operation is checked at the time of the first tank filling. Thereafter it should be observed periodically when fuel is added to see that the gauge indication agrees approximately with the amount of fuel added.

Size of Fuel Tanks

3.29 In determining the size of a fuel tank consideration should be given to the provision of sufficient capacity to permit the maintenance of a certain minimum fuel supply for those installations located in designated critical target areas. An appraisal of each installation may be made to determine the requirements for emergency standby fuel based on factors such as: the possibility of access routes for fuel deliveries being blocked by debris, the vulnerability to conflagration of the area in which the supplier is situated, the availability of alternate sources of supply with consideration of their location, the vulnerability of the supplier to damage and his provisions for emergency pumping if required, the minimum delivery requirements of the supplier to maintain a desired reserve in the fuel tank under normal conditions, etc.

4. SMALL PORTABLE ENGINES - GASOLINE

4.01 Portable gasoline engines and their particular type of fuel system are considered more hazardous than stationary engines. These hazards should be recognized.

4.02 The term "small portable," as applied to engines in this practice includes those gasoline engines mounted on skids as well as those mounted on wheels or otherwise so arranged that they can be moved from place to place as the necessities of service demand.

4.03 Small portable engines are operated outside of buildings and may or may not be housed in a metal enclosure and may be placed on a concrete pad or concrete blocks or directly on the ground. Such locations outside of buildings are preferably adjacent to but no less than 5 feet from a masonry wall without openings. Where it is not possible to avoid wall openings a minimum clear distance of 10 feet from wired glass windows and doors should be maintained. Where exterior wall is of frame construction a minimum distance of 15 feet should be maintained. Operating locations should not be near areaways or low sections of ground where gas pocket conditions might

develop. The potential hazard of flammable mixtures of gasoline vapors and air should be considered for each location.

4.04 Fuel may be supplied from buried tanks, from small standard portable gasoline safety cans that may or may not be directly connected to the engine, or from tanks mounted integrally with the engine itself. The setting of buried tanks is covered in Paragraphs 3.10 to 3.16, inclusive. Carburetion engines having fuel supply tanks mounted on the engine are considered as introducing a greater hazard than those using underground or separate fuel tanks.

4.05 Where portable engines when not in use are stored within the building, all gasoline should be removed from the tank, fuel line, carburetor and fuel cup before the engine is placed within the building. After draining, at least one complete filling with kerosene and a subsequent draining should be accomplished to flush out the remaining traces of gasoline and gasoline vapor before the unit is placed in storage.