

AIR LEAKAGE IN REFRIGERATED VANS

SPECIFICATION FOR

PROTOTYPE AIR LEAKAGE TEST SET

MASTER

B.A. BODENHEIMER & CO., INC.

Stamford, CT 06905

NOTICE

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Department of Energy, nor any of their employees, nor any of their contractors, sub-contractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product or process disclosed or represents that its use would not infringe privately owned rights.

JANUARY, 1978

Prepared for

THE UNITED STATES DEPARTMENT OF ENERGY

UNDER CONTRACT NO. EC-77-C-02-4338

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

TABLE OF CONTENTS

	<u>PAGE</u>
1.0 SCOPE	2
1.1 Purpose	2
1.2 Selection Criteria	2
1.3 Pressure Rating	2
2.0 APPLICABLE DOCUMENTS	4
3.0 REQUIREMENTS	5
3.1 Definitions	5
3.2 Materials of Construction	6
3.3 Performance Requirements	7
3.4 Design and Construction Requirements	12
3.5 Markings	25
3.6 Drawings	25
3.7 Manuals	27
4.0 QUALITY ASSURANCE	28
5.0 PREPARATION FOR DELIVERY	29
6.0 NOTES	30
6.1 Intended Use	30

1.0 SCOPE

1.1 PURPOSE - This document establishes the requirements for a prototype portable test set to be used for static overpressure measurement of air leakage in insulated and refrigerated truck bodies. The test set described herein is to be constructed as an independent system with no dependence on the local atmospheric conditions in which it is used, other than having available a pressurized air supply normally found in maintenance garages and manufacturing plants.

The instrumentation is to be capable of obtaining all data required for correcting field readings of air leakage for:

- a - temperature differences between the supply air and test vehicle;
- b - temperature differences between inside and outside of the test vehicle;
- c - differences in test pressures from those used in calibrating the instruments.

This specification also covers the requirements for calibration, operation and maintenance instructions to be furnished with the equipment.

1.2 SELECTION CRITERIA - Components of the system shall be selected so that the test set may be easily used by persons possessing a high school diploma plus a minimum of two years' experience as a mechanic or technician, or equivalent experience.

Insofar as practicable, selection of components shall be made from commercially available sources in the following order:

1.2.1 Components that require no periodic calibration prior to use.

1.2.2 Components with replaceable elements and provided with visual indication that replacement is required.

1.2.3 Components with replaceable elements requiring monitoring prior to or during use.

1.2.4 Components that require calibration prior to use.

1.2.5 Components that require calibration during use.

1.3 PRESSURE RATING - The instrumentation shall be capable of performing the overpressure test as described in Section 6.0 Intended Use, at air pressures of 100 ± 50 psi gage (6.8 ± 3.4 bar) and a flow capacity of $1842 \text{ ft}^3/\text{h}$ ($52.17 \text{ m}^3/\text{h}$) maximum, expressed in standard atmospheric conditions.

1.4 The prototype test set is to be used by the contractor in performance of tests under this contract. Upon completion of the work the contractor shall modify this specification based on field experience, and such modified specification for the test set shall be included in the final report as an appendix.

2.0 APPLICABLE DOCUMENTS

2.1 Specifications - None

2.2 Standards - None

2.3 Publications - None

2.4 References -

2.4.1 Technical Report C00-4338-**1**, United States
Department of Energy Air Leakage In Refrigerated Vans

2.4.2 International Organization for Standards,
Secretariat of Technical Committee 104, 1430 Broadway,
New York, N.Y., 10018, U.S.A. Document ISO 1496/II-1977
(E), entitled, "Series 1 Freight Containers-Specifications
and Testing - Part II: Thermal Containers". August 1977.

2.4.3 Truck Trailer Manufacturers Association, 2430
Pennsylvania Ave., N.W., Washington, D.C. 20037, U.S.A.
From RP#38-73, entitled, "Method for Rating Heat Trans-
mission of Refrigerated Vehicles", July 1973.

5

3.0 REQUIREMENTS

3.1 DEFINITIONS

3.1.1 Ambient Air Temperature - The temperature of a substance surrounding a body. Thus the ambient temperature of a vehicle holding a refrigerated cargo would be the temperature of the air to which it is exposed on its outside surface.

3.1.2 SCFH - See Standard Cubic Feet per Hour

3.1.3 Overpressure Test - An air leakage test wherein air from inside a van body escapes to the outside of the container, and is replaced by air from the outside by mechanical means. It is conducted at a fixed internal pressure level.

3.1.4 Standard Cubic Feet per Hour - (SCFH) - a volume unit taken when a gas is at a standard or base condition, generally at 14.7 psia and 70°F.

3.1.5 W.C. - Water column - a measure of pressure used as a standard. (1 inch W.C. = 0.03613 psi).

3.2 MATERIALS OF CONSTRUCTION

3.2.1 Unless required for proper operation, all components, instruments, metallic tubing and piping, valves and fittings, and all hardware are to be constructed of corrosion resisting materials or are to be protected against corrosion by suitable coatings.

3.2.2 All hose, flexible tubing, gaskets and valve seats are to be made of materials that are water and oil resistant. All materials used in the system are to be fully compatible.

3.2.3 All components used on the inlet side of the test set up to and including the pressure regulator shall have a pressure rating of at least 150 psi (10.1 bar).

3.2.4 All components downstream of the pressure regulator shall have a minimum operating pressure rating of 50 psig (3.4 bar).

3.2.5 All components shall have a minimum burst pressure rating of at least $2\frac{1}{2}$ times the operating pressure rating.

3.2.6 All piping and tubing shall be selected to produce a pressure drop not exceeding 10 percent of the applied pressure per 100 ft. (30.48 m) of such pipe or tubing. No pipe or tubing less than $\frac{1}{4}$ inch (6.35 mm) nominal size shall be used.

NOTICE

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Department of Energy, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

3.3 PERFORMANCE REQUIREMENTS

3.3.1 Design Test Limits

3.3.1.1 The test set is to be designed for use in truck maintenance facilities or in vehicle manufacturing plants. Although such facilities are normally maintained at temperatures between 50⁰F (10⁰C) and 90⁰F (32⁰C), the test set shall be designed to be used in ambient air temperatures between 0⁰F (-18⁰C) and 120⁰F (50⁰C). The air used for testing is to be free of moisture if the supply air temperature is below 35⁰F (2⁰C) to prevent formation of frost or ice in the instrumentation.

3.3.1.2 The test set shall be capable of performing static air leakage overpressure tests within the following ranges.

Ambient Air Temperature	0 to 120 ⁰ F (-18 to 50 ⁰ C)
Air Supply Temperature and Humidity	a) 0 ⁰ F to 35 ⁰ F (-18 to 2 ⁰ C) dry air only b) 35 ⁰ F to 180 ⁰ F (2 ⁰ C to 82 ⁰ C) with 0 to 100% relative humidity
Overpressure in Test Body	0.05 to 2.0 inch W.C.
Test Body Internal Temperature	-20 ⁰ F to 100 ⁰ F (-29 to 38 ⁰ C)

3.3.2 System Description

Figure 1 is a schematic of the components of the test system. The function of the individual components is as follows:

3.3.2.1 Air Supply Connection - This provides a means of connecting the test set to a source of pressurized air.

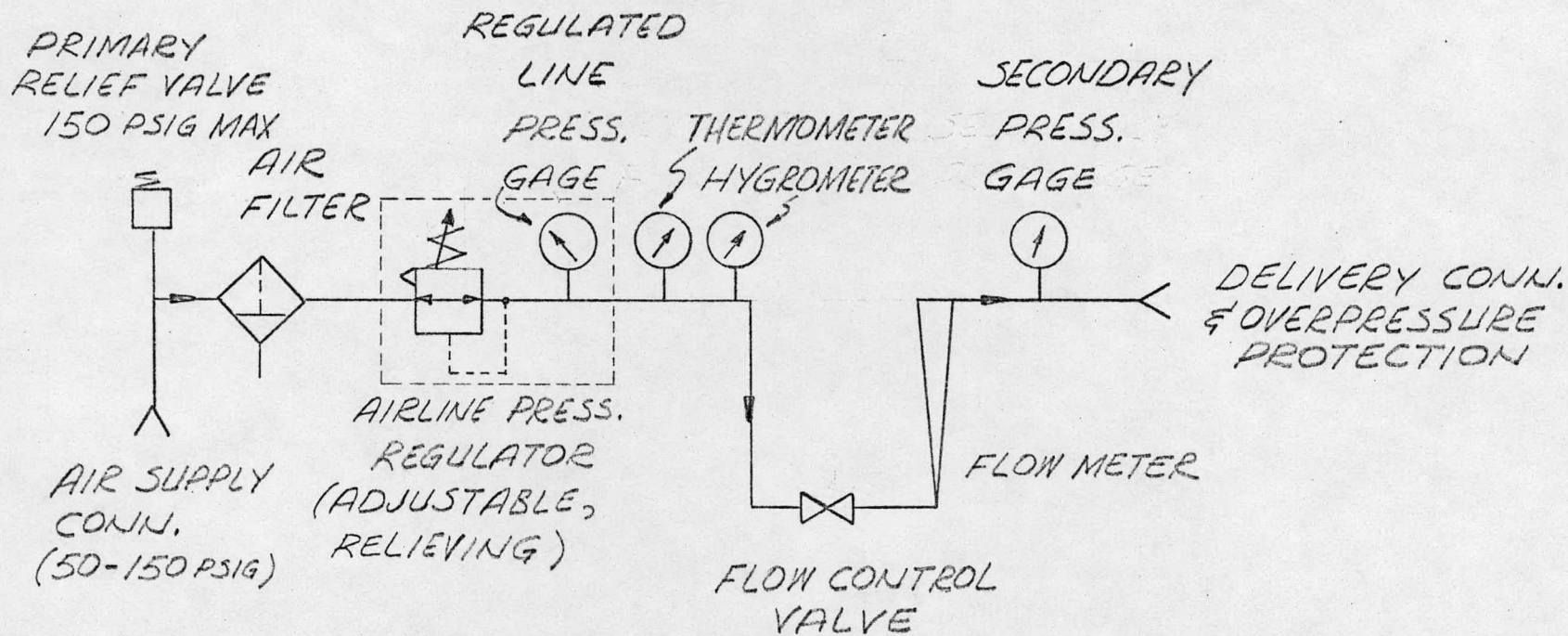
3.3.2.2 Primary Pressure Relief Valve - This valve provides a means of preventing pressures in excess of 150 psi gage (10.1 bar) from being inadvertently applied to the test set.


3.3.2.3 Air Filter - The air filter provides a means of removing entrained dust, water, and oil from the air supply, and to drain liquid contaminants from the system.


3.3.2.4 Pressure Regulator - The pressure regulator reduces the supply air pressure to the level required by the system design.

3.3.2.5 Regulated Line Pressure Gage - The Regulated Line Pressure Gage gives the operator a visual indication of the system pressure after the regulator .

3.3.2.6 Regulated Line Pressure Relief Valve -




AMBIENT
THERMOMETER


TEST BODY
THERMOMETER



MANOMETER

FIGURE 1
TEST SYSTEM SCHEMATIC AND COMPONENT ARRANGEMENT

3
10
The Regulated Line Pressure Relief Valve provides a means of preventing pressures in excess of the set pressure from entering the regulated line.

3.3.2.7 Regulated Line Air Thermometer - The thermometer provides a means of measuring the temperature of the air in the regulated line to enable correction factors to be applied to the flow readings.

3.3.2.8 Hygrometer - The hygrometer provides a means of measuring the relative humidity of the air in the regulated line to enable correction factors to be applied to the flow readings.

3.3.2.9 Flow Control Valve - The Flow Control Valve is provided to manually regulate the quantity of air admitted to the body under test.

3.3.2.10 Flow Meter - The flow meter provides a means of measuring the quantity of air being supplied to the body under test. It shall read in SCFH so that readings may be compared to existing standards.

3.3.2.11 Secondary Pressure Gage - The Secondary Pressure Gage provides a means of accurately measuring the line pressure downstream of the flow meter to enable correction factors to be applied to the flow meter readings.

3.3.2.12 Delivery Connection and Vehicle Overpressure Protection - The delivery connection provides a means of connecting the test set to the truck body under test. The Vehicle Overpressure Protection limits the overpressure in the test vehicle to prevent structural damage.

3.3.2.13 Ambient Air Thermometer - The thermometer provides a means of measuring the ambient air temperature during the test.

3.3.2.14 Manometer - The manometer provides a means of measuring the over-pressure in the vehicle body under test.

3.3.2.15 Test Body Thermometer - The test body thermometer provides a means of measuring the temperature in the body under test when the vehicle is not equipped with such a thermometer.

3.3.2.16 Enclosure - The enclosure provides a means of housing all of the system components for portability and protection during transport and use. It also provides means for levelling the instrument package.

3.4 DESIGN AND CONSTRUCTION REQUIREMENTS

3.4.1 Air Supply Connection

3.4.1.1 The air supply connection shall be located within the enclosure and shall be easily accessible. It shall be a 3/8 inch, male, sleeve type quick connect fitting of the "Industrial Commercial Interchange" type.

3.4.1.2 Adapters shall be provided to allow attachment of an air hose equipped with a 1/4 inch quick connect fitting, as well as to attach any air hose directly by means of an automotive type clamp.

3.4.1.3 The supply connection shall be clearly marked to indicate the maximum safe operating pressure.

3.4.1.4 The supply connection shall be so located that the operator, in normal operating position, is not endangered in case of supply connection failure.

3.4.1.5 The adapters supplied with the test kit shall be at least 24 inches (61 cm) long. All hose shall be of Buna N rubber with a minimum of

13
250 psi (16.8 bar) working pressure rating.

3.4.1.6 A durable and easily removable dust cap shall be provided to prevent contamination of the system when not in use.

3.4.2 Primary Pressure Relief Valve

3.4.2.1 The Primary Pressure Relief Valve shall be located immediately after the supply fitting and before any other component.

3.4.2.2 The Primary Pressure Relief Valve shall be tamper proof, or shall be so mounted that it is not accessible to the operator.

3.4.2.3 The exhaust port of the relief valve shall be provided with a deflector cap or suitable device to divert high pressure blasts away from the operator when in a normal work position.

3.4.2.4 The relief valve shall be set at a cracking pressure of 150 psi (10.1 bar) gage $\pm 5\%$.

3.4.2.5 The pressure relief valve seal shall provide line contact with a poppet seat, and shall reseal to a dead tight condition at a pressure not less than 70 percent of cracking

pressure.

3.4.2.6 The valve seat shall be made of Buna N rubber.

3.4.3 Air Filter

3.4.3.1 The Air Filter shall remove liquid (water and oil) entrained in the air supply and allow it to collect for removal. The filter shall have a retention efficiency greater than 95 percent for 0.6 micron particle size.

3.4.3.2 The Air Filter shall be capable of operating with dry air supplied at a temperature between 0°F (-18°C) and 35°F (2°C); and with moist air from 35°F (2°C) to 180°F (82°C). It shall be capable of processing air supplied at a pressure of 150 psi (10.1 bar) gage at a rate of 1842 SCFH (52.17 m³/h).

3.4.3.3 The maximum pressure drop through the filter at a flow of 1842 SCFH (52.17 m³/h) shall not exceed 10 psig (0.67 bar).

3.4.3.4 The air filter shall be a rigid housing enclosing a borosilicate glass microfiber core. The air flow shall be from "inside to outside" through the filter core.

3.4.3.5 The filter housing shall have a see through filter bowl and be provided with a bowl guard. The housing shall accommodate a single, self supporting and self gasketing core. The bowl shall seal after each change of core by means of a gasket and screw retainer.

3.4.3.6 The housing shall have a collection area at its bottom for the collection of coalesced liquid and shall have a sealed, manual drain for the removal of collected liquid before the level of liquid reaches the bottom of the filter core. The drain shall be so positioned, or provided with suitable tubing, to assure that liquids are drained free of the enclosure.

3.4.3.7 A decal shall be applied to the filter to detail operation and instructions for filter replacement.

3.4.4 Pressure Regulator

3.4.4.1 The Pressure Reducing Regulator shall be a spring loaded type with air inlet pressure rating not less than 150 psi (10.1 bar) gage, and shall be capable of throttling the supply air to a regulated line pressure between zero and 50^{+2} psi ($3.4^{+10.2}$ bar) gage.

3.4.4.2 The pressure regulator shall have a manual control of outlet pressure.

3.4.5 Regulated Line Pressure Gage

3.4.5.1 The regulated line pressure gage, to indicate the pressure downstream of the pressure regulator, shall be mounted integrally with the pressure regulator.

3.4.5.2 The regulated line pressure gage shall have a range of at least 0 to 60 psi (0 to 4.03 bar), a dial size of at least 2 inches (51 mm) diameter, and shall have an accuracy of at least 3 percent of full scale.

3.4.6 Regulated Line Pressure Relief Valve

3.4.6.1 The regulated line pressure relief valve shall maintain the regulated set pressure and shall be integral with the regulator.

3.4.6.2 The valve shall be sized to accommodate maximum flow and shall re-seal to a dead tight condition at a pressure no less than 70 percent of cracking pressure.

3.4.6.3 The exhaust part from the pressure relief

17

valve shall be provided with a deflector cap, or other suitable means, to divert high pressure blasts away from the operator when in normal working position.

3.4.7 Regulated Line Air Thermometer

3.4.7.1 The thermometer shall be a dial type having a minimum range of 0°F to 180°F . (-18°C to 82°C)

3.4.7.2 The thermometer shall be graduated in increments no greater than 2°F . (1°C)

3.4.7.3 The thermometer shall be mounted so that its sensing element is exposed directly to the air stream.

3.4.7.4 If required, the face of the dial shall be color coded to indicate any portions of the scale for which no correction values need to be applied to the flowmeter readings.

3.4.7.5 The accuracy of the thermometer shall be $\pm 2\%$ of full scale reading, or better.

3.4.7.6 The thermometer may be mounted integrally with the hygrometer of paragraph 3.4.8.

3.4.8 Hygrometer

3.4.8.1 The hygrometer shall be a dial type having a range of 0 to 100% relative humidity.

3.4.8.2 The hygrometer shall be graduated in increments no greater than 2 percent of relative humidity.

3.4.8.3 The hygrometer shall be mounted so that its sensing element is exposed directly to the air stream.

3.4.8.4 If required, the face of the dial shall be color coded to indicate any portions of the scale for which no correction values need to be applied to the flowmeter readings.

3.4.8.5 The accuracy of the hygrometer shall be +3% of the relative humidity, or better.

3.4.8.6 The hygrometer may be mounted integrally with the thermometer of paragraph 3.4.7.

3.4.9 Flow Control Valve

3.4.9.1 The Flow Control Valve shall be of the

needle valve type.

3.4.9.2 Only one flow control valve shall be used in the circuit to preclude error in control of the flow setting.

3.4.9.3 The flow control valve shall be provided with a large diameter, round knob to facilitate adjustment.

3.4.9.4 The flow control valve shall be designed to hold settings without mechanical drift.

3.4.10 Flow Meter

3.4.10.1 The flow meter shall be of the variable-area type suitable for air service.

3.4.10.2 The flow meter shall be capable of measuring the rate of flow of the air within a range of 184 to 1842 SCFH (5.2 to 52.17 m³/h). It shall be calibrated for an outlet pressure of 10 psi (0.66 bar) gage and a temperature of 70°F. (21°C)

3.4.10.3 The air flow meter shall be accurate to +1% of the flow reading, dry air basis.

3.4.10.4 The air flow meter shall be capable of operating within a pressure range of 0 to 20 psi

(0 to 1.3 bar) gage outlet pressure.

3.4.10.5 The flow meter shall be provided with a float appropriately guided within the tube by a guide rod assembly. There shall be no float bounce or chatter during operation of the meter.

3.4.10.6 The air flow meter shall have its scale markings in SCFH.

3.4.10.7 The scale markings shall be no more than 1/8 inch apart.

3.4.10.8 The flow meter shall be furnished with correction curves to enable adjustment of the scale reading for temperatures and pressures other than those used in calibration.

3.4.11 Secondary Pressure Gage

3.4.11.1 The secondary pressure gage shall indicate pressure of the air downstream of the flow meter within a range of 0 to 15 psi (0 to 1 bar) gage.

3.4.11.2 The secondary pressure gage shall be free from fluctuations and pulsations in operation. It shall be resistant to overpressure to a maximum of 50 psi.

3.4.11.3 The secondary pressure gage shall have a

zero adjustment screw to adjust the dial pointer. The adjustment screw shall be accessible from the face side of the dial.

3.4.11.4 The secondary pressure gage shall be accurate to $\pm 3\%$ of full scale.

3.4.12 Delivery Connection and Vehicle Overpressure Protection.

3.4.12.1 The delivery connection shall consist of flexible plastic tubing and shall be at least 25 feet (9.6 m) in length.

3.4.12.2 The delivery tubing shall be $\frac{1}{2}$ inch (13 mm) in diameter.

3.4.12.3 The delivery connection shall terminate in a "T", one end of which is connected to a "U" tube. This tube is to be filled with water to the desired level to provide overpressure protection to the test body in an amount varying with body construction and air flow.

The second end of the "T" connection shall be provided with a hose barb so that short pieces of flexible plastic tubing may be connected to the test body through existing openings in the body. Ten foot (3 m) lengths of tubing, in sizes

from $\frac{1}{4}$ inch to 1 inch (6.35 to 25 mm) in $\frac{1}{4}$ inch increments (6.35 mm) shall be provided as adapters for this purpose.

3.4.12.4 A durable and easily removable dust cap shall be provided to prevent contamination of the system when not in use.

3.4.13 Ambient Air Thermometer

3.4.13.1 The thermometer shall be a dial type having a minimum range of 0°F to 120°F. (-18°C to 49°C)

3.4.13.2 The thermometer shall be mounted so that its sensing element is exposed to ambient air.

3.4.13.3 The thermometer shall be accurate to 1% of full scale reading.

3.4.14 Manometer

3.4.14.1 The manometer used in the prototype unit shall have the capability of measuring the air pressure inside the container within a range of 0.05 to 5.00 inches water column.

3.4.14.2 The manometer shall have provisions for leveling of the instrument by use of a built-in spirit level.

3.4.14.3 The manometer shall be capable of adjustment of its fluid height and of zeroing the gage by means of built in bubble levels and adjustment screws.

3.4.14.4 The manometer fluid shall be non-toxic in nature and have color for easy visibility. The manometer shall have provision for easy fluid replacement.

3.4.14.5 The manometer accuracy shall be no less than +1% of the full scale reading.

3.4.14.6 The manometer shall be supplied with at least 25 feet of $\frac{1}{4}$ inch diameter (6.35 mm) of tubing to connect it to the body under test.

3.4.15 Test Body Thermometer

3.4.15.1 The thermometer shall have a minimum range of -20°F to 120°F .

3.4.15.2 The thermometer shall be graduated in increments no greater than 2°F .

3.4.15.3 The thermometer shall have a remote sensor at least 15 feet long so that the sensor can be located within the body under test. A means of suspending the thermometer probe approximately in the center of the free volume shall be provided.

3.4.15.4 The thermometer shall be accurate to at least $\pm 2\%$ of full scale reading.

3.4.16 Enclosure

3.4.16.1 The enclosure shall be capable of housing all components comprising the test system.

3.4.16.2 The enclosure shall be portable, capable of being fastened shut and accommodate a lock. The total weight of the enclosure and instruments shall not exceed 150 pounds (68 Kg).

3.4.16.3 The enclosure shall be provided with handles.

3.4.16.4 The enclosure is to provide mounting for the components which will allow the removal and replacement of the components in the field without the use of special tools.

3.4.16.5 Where required, the enclosure shall have devices that will allow levelling of the instruments housed within the cases from at least 5° out of level attitude. The devices shall have the capability of maintaining the level position during the "hands-on" activity of a test performance.

3.5 MARKINGS

3.5.1 All components not marked by the manufacturer shall be marked to indicate function in black letters at least $\frac{1}{4}$ inch (6.35 mm) high on a contrasting background.

3.5.2 All scale markings used on instruments shall be in English units. Dual markings (English and metric) shall not be used to preclude operator error.

3.5.3 An abbreviated, but complete set of operating instructions, in step by step format, shall be included in each test set and shall be protected by a plastic sheet or be plasticized, to prevent accidental removal or obliteration.

3.5.4 Decals shall be applied to individual components indicating direction of rotation for opening and closing valves, frequency of calibration, etc.

3.6 DRAWINGS.

3.6.1 One set of detail drawings for the "as built" prototype test set shall be furnished upon completion of the contract.

3.6.2 Drawings shall be to commercial format, and shall detail all components required to produce the equipment.

3.6.3 Standard commercial parts shall be called out by

26
manufacturer's model and part number. No drawings shall
be furnished for such parts.

27

3.7 MANUALS

3.7.1 A complete, durable instruction manual for the use, calibration, operation and maintenance of the test set shall be furnished.

3.7.2 Provision shall be made in the enclosure to store the manual, and a copy of the manual shall be so provided.

3.7.3 The instruction manual shall include a sample data sheet and shall specify all test measurements to be observed. All calculations shall be in customary English Units.

3.7.4 The instruction manual shall include instructions for calibration and recommended time intervals for such calibration.

3.7.5 All correction factors required shall be given in tabular or graphic form within the manual. No additional reference material shall be required.

8

4.0 QUALITY ASSURANCE

4.1 All components of the system shall be inspected prior to assembly to assure compliance with these specifications and with the drawings.

4.2 As provided under the contract, a plan shall be prepared for verifying compliance of the test set performance to the performance requirements set forth herein.

5.0 PREPARATION FOR DELIVERY

5.1 The prototype test set shall be retained by the contractor until completion of all tests to be performed under the contract.

5.2 If, during the test work to be performed by the contractor, the range of gages and instruments called for herein shall be found to be unsuitable for the work, the contractor shall replace such gages and instruments with others of like accuracy and quality to enable the test work to be performed.

5.3 Prior to final delivery, the contractor shall refurbish the test set to replace any damaged items, normal wear and tear excepted.

5.4 The test set shall be delivered as directed by the contracting Officer.

6.0 NOTES

6.1 INTENDED USE - The prototype test set is to be used to conduct overpressure tests on truck and container bodies to investigate the relationships between air leakage rates at varying internal test body temperatures and pressures. The general procedure to be followed is:

6.1.1 The test set is used in a garage or factory location close to an available air supply. It is levelled to insure instrument accuracy.

6.1.2 Prior to use, all protective caps are removed and the pressure regulator position is adjusted to zero regulated pressure. The flow control valve is opened fully.

6.1.3 The air supply is connected to the input connection.

6.1.4 With the delivery connection disconnected from the test vehicle, the regulator handle is slowly turned until air is discharged from the delivery connection. The regulated pressure is increased until the flow meter reads full scale. After this check the handle is turned to close the regulator until all flow ceases.

6.1.5 The test vehicle is now prepared by installation of the delivery connection. The delivery hose is fed to the vehicle through an existing opening, such as a floor

31

drain, or through one of the door seals. The delivery opening is then sealed by a nonhardening modeling compound such as duct seal.

6.1.6 The manometer is connected to the test vehicle in a similar manner. It is leveled and zero adjustments are made.

6.1.7 The test body thermometer is installed in the vehicle at approximately the center of the free volume of the body.

6.1.8 The pressure regulator handle is now turned until the overpressure in the test body reads approximately 1.0 inches of water. Flow is continued until all readings have stabilized for at least 2 minutes, after which all system values, ie flow, pressure, temperatures and relative humidity are read and recorded.