Ministry of Defence
Defence R&D Organisation

STEC PAMPHLET - 22

SPECIFICATION OF FIRE DAMPER FOR AIR-CONDITIONING DUCTS IN EXPLOSIVES BUILDINGS

2025

Issued by

Storage & Transport of Explosives Committee
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CONTENT

PREFACE

Consequent to an accident in which fire propagated from one bay to other bays in a multi compartment building through air-conditioning duct, a need was felt to install fire dampers in such buildings. On the recommendation of the Fire Fighting Panel of STEC, a project was under-taken by CFEES for the design and development of suitable fire damper. After considerable efforts, the design and specification of damper for use in air conditioning ducts in explosives building was finalized. The specification No. DIFR/08833/R&D governs the construction of Fire Damper.

As per STEC regulations, it is mandatory to install fire dampers in the air-conditioning ducts of explosives buildings. Fire Damper is basically a device to prevent the propagation of smoke/flame/hot gases through the Air conditioning ducts from one compartment to other especially in multistoried buildings, explosive process plants and storage buildings.

It is hoped that users will find this revised STEC Pamphlet 2025 simpler, easier to understand and implement, thereby promoting the safe storage and transportation of military explosive. This publication supersedes STEC Pamphlet, 2017 on the subject.

1. SCOPE

The standard lays down general design criteria, material, construction, operation/performance and test procedure of fire damper assemblies rated for 2 hours (Max) as per IS:12458. The device is meant for use in Air conditioning and ventilating system ducts passing through fire partitions or fire resistive floors and is for installation in accordance with the standard of the National Fire Protection Association standard for the installation of Air conditioning & ventilating systems (Non-Residential) NFPA No. 90A.

2. RELATED SPECIFICATIONS

a) Reference is made in this specification to:

i.	IS 2:2022	-	Rules for rounding of numerical values.
ii.	IS 226:1975 (superseded by 2062:2011)	-	Structural Steel (Hot Rolled Medium and High Tensile Structural Steel- Specification)
iii.	IS 2175:1988	-	Specification for Heat sensitive fire detectors for use in automatic electrical fire alarm system.
iv.	IS 2189:2008	-	Selection, Installation and Maintenance of Automatic Fire Alarm System - Code of Practice.
v.	BS 6466:1988	-	Code of Practice for Design & Installation of Ceramic Fibre Furnace Linings.
vi.	IS 6911:2017	-	Stainless steel plate, sheet & strip-Specifications.
vii.	IS 11360:1985	-	Specification for Smoke detectors for use in automatic electrical fire alarm system.
viii.	IS 12458:2019	-	Fire Resistance of Through Penetration Firestops - Method of Test.

3. MATERIAL

a) Mild steel sheet IS: 228 shall be used for the construction of blades and channel frame for the main body of the fire damper. The thickness of the mild steel sheet shall not be less than 6 mm for blades and the dimensions of channel frame shall be as per the attached drawing. The size & No. of blades shall be according to the size of fire damper. However in no case, the number of blades shall be less than three

b) Ceramic wool of BS: 6466 or any other insulating material shall be used for cladding on both sides of the blades of the fire damper which could withstand two hours of fire ratings as per IS: 12458 under actual conditions of fire with no obstruction to its operation.

c) Stainless steel plate IS: 6911 shall be cladded on the top of both sides of each blade of fire damper to keep the ceramic wool or any other insulating material used intact and

to provide high heat resistance to the structure of fire damper. The thickness of stainless steel plate shall not be less than 1.5 mm

4. CONSTRUCTION

a) Fire damper shall be constructed to the shape and design as per the attached drawing. However, the size of the fire damper shall be as agreed between the user/purchaser and the manufacturer. The fire damper shall provide an effective barrier to hot gases/smoke/flame when in the closed position. The blades of the damper shall remain in almost horizontal position when in open position so that there is no obstruction to the air flowing through the duct. The blades shall be mounted in such a way that damper is closed automatically, when operated. The tension required to close the damper in case of operation is to be provided by the spring fitted outside of bush bearing and held by the centrally inserted pin under all time tension at the edge of the shaft. The surface of the blades and main body shall be smooth and there shall not be any dents, pits, holes, etc.

b) The spring tension, which is sufficient to keep the damper in horizontal position, is 4-5 kg for the size of fire damper included in this specification. However, the spring tension is to be worked out for different sizes separately.

c) Components such as spring, bush, bearing, shaft etc. used in the assembly of fire damper shall be made of material having resistance to atmospheric corrosion equivalent to brass or bronze.

d) The ceramic wool or any other insulating material shall be fixed on both sides of each blade of the fire damper so as to give a thickness of not less than 25mm to provide protection to the M.S. sheet used for construction of damper upto 1000°C for not more than 2 hours.

e) The stainless steel plate shall be fixed on both sides of each blade of damper to keep the insulating material intact thus providing high heat resistance to the structure of the fire damper. The thickness of the stainless steel plate shall not be less than 1.5 mm. The stainless steel plate shall either be riveted or fixed with the operation of fire damper. The complete assembly of fire damper shall be such that when in closed position; the blades of the damper overlap with adjacent blades in such a way that there is no leakage of flame/smoke/hot gases to the other side of the damper. However, vertical through openings at the sides of dampers for operating clearance shall not exceed 3/8” or 9.5 mm and horizontal through opening for operating clearance shall not exceed 1/32” or 0.8mm. These have been permitted for expansion of M.S. Sheet under Fire condition.

f) A Central arm/lever shall be provided connected with each blade so that it can hold a fusible link when in open position. The one end/hook of the fusible link shall be hanged from a loop of wire fixed on the upper portion of duct and the other end in a hole/loop made in the Central arm lever in such a way that the blades of damper remain in

horizontal position. The wire used for loop shall be made from material having resistance to atmospheric corrosion equivalent to brass or bronze.

g) The fusible link used for the operation of fire damper shall either be metallic or made of plastic to the shape, size and design as agreed between user/purchaser and the manufacturer. The material of plastic fusible link developed by this Institute is Low Density Polyethylene-400 (LDPE-400). The Specn. of LDPE-400 fusible link is:-

(i)	Melting Point	:	70 + 50°C
(ii)	Load bearing capacity	:	Min 4-5 kg for a period of 3 months.
(iii)	Life	:	Min 3 months Max 12 months (after quarterly inspection For its distortion to shape and size).
(iv)	Dimensions & Shape		As per drawing Specn No. 5

h) The probable source of supply for metallic/non-metallic fusible links may be obtained from The Director, Directorate of Quality Assurance (Engg.Eqpt.) Kashmir House, New Delhi-110 011

5. QUALITY

Examination of samples of each size of the damper taken from any portion of a supply shall show that fire damper conforms to the following requirement when tested according to the methods mentioned against each:-

	Tests	**Requirements**	**Methods** (refer to)
1.	Performance of Fire Damper with heat/smoke Under actual condition.		Appendix 'A'
2.	Fire Rating & Hose Stream Test	2 h (Max)	IS:12458
3.	Closing Reliability	200 operations	Appendix 'B'
4.	Operation of Damper with Heat under controlled temp Condition.	70 ± 5^0C	Appendix 'C'

6. MAINTENANCE AND TESTING SCHEDULE OF FIRE DAMPER

The following maintenance schedule shall be observed for the fire damper and its allied parts/components:-

a) The inspection of smoke detector and heat detector shall be carried out as per IS: 11360 & IS: 2175 every quarterly.

b) The functional testing of control panel without actual actuation of fire damper shall be carried out every month.

c) The smoke detector, heat detector, spring, bush, shaft etc. shall be kept dust free by using vacuum cleaner so that there is no failure of fire damper in case of fire.

7 MARKING

A nameplate with details like make of damper & detectors, date of manufacturing and date of last inspection of fusible link shall be affixed at a convenient place near the damper installation.

Appendix 'A'

PERFORMANCE OF FIRE DAMPER WITH HEAT/SMOKE UNDER ACTUAL FIRE CONDITIONS

A.1 Equipment/Apparatus Required

A.1.1 Experimental Duct Insulated from out-side having servicing window.

A.1.2 Bimetallic Heat Sensor/Detector to operate at 70 ± 5^{0}C.

A.1.3 Smoke Detector Ionization Type.

A.1.4 Fusible Link.

A.1.5 Control Panel having all the arrangement for automatic actuation, alarm system etc. connected to fusible link & Heat/smoke detectors as per IS: 2175/IS: 11360.

A.1.6 Heating Coil.

A.1.7 Fan for circulating the hot air.

A.2 Procedure

A.2.1 Experimental duct is fabricated according to the size of fire damper. The damper is then fitted at the Centre of the duct & near the servicing window. Servicing window is provided for maintenance & replacement of fusible link etc.

A.2.2 A smoke detector/heat sensor is to be fitted on the top of the servicing window. These are connected to control panel for operation.

A.2.3 A fusible link is fixed with the help of hooks in such a way that the upper hook is hanged on the loop fitted on top and lower end in a hole/loop in the central arm/lever. The blades of fire damper shall remain in horizontal position when in open position. The link is also connected to control panel.

A.2.4 A heating coil is placed at about half metre away from fire damper on leeward side and a fan is fitted at the end of duct to circulate the hot air in the duct so that the heat is uniform throughout.

A.3 Operation

A.3.1 The first operation is carried out by smoke generated by artificial means. The smoke sensor on sensing the smoke actuates the system and damper is closed giving alarm fitted in control panel or outside.

A.3.2 The second operation is carried out by heat generated with heating coil placed in the

duct & hot air is circulated by a fan. When the temperature inside the duct reaches to a predetermined temperature set in bimetallic heat detector, the system is actuated and the damper is closed by giving alarm.

A.3.3 The third operation is carried out by heat generated by burning petrol/n-heptane in a circular tray of dia. 6 inch & height also 6 inch. The tray is filled 2 inch with water & 2 inch thick layer of the petrol/n-heptane is poured over it. The amount of water and solvent shall not cover more than three-fourth of the tray. The solvent is then burnt & placed at about 30 cm away from the damper. The fusible link melts at pre-determined temp of link & breads, thus closing the damper & sounding the alarm.

A.3.4 The operating temperature in A.3.3 above may not be consistent because the heat produced from the burning of solvent may not be uniform throughout the duct. However this shall be tested under controlled temperature conditions as per the test given in Appendix 'C'.

A.3.5 The fourth operation is carried out manually by operating the fire damper with the help of PVC Bakelite insulated mild steel rod, which is hinged to the fire damper as per drawing No. DIFR/08833/R&D/4(Fig 4). The handle is to be given a slight downward pull/jerk thus breaking the fusible link and closing the blades of fire damper.

A.3.6 The manual override/arrangement has been provided in the fire damper in case of failure of power or automatic actuation system develops some fault and during that period there is a fire spread through A.C. duct, the fire damper is closed manually.

A.3.7 In all the above operations the first damper shall close immediately after the link breaks and there shall not be any obstruction in the closing of the damper.

Appendix 'B'

CLOSING RELIABILITY TEST

B.1 A damper assembly shall close from the open position, during each of 200 operations and shall throughout this test show no evidence of undue wear or damage.

Appendix 'C'

ACTUATION OF FUSIBLE LINK WITH HEAT UNDER CONTROLLED TEMPERATURE CONDITIONS

C.1 Equipment/Apparatus Required

C.1.1 Electrical Oven –Temp range from 20 to 200°C controlled automatically.

C.1.2 Spring Balance for measuring the tension of the fusible link.

C.1.3 Pulley system for hanging the fusible link and spring balance to keep the link under tension.

C.1.4 Weight & pan to counter balance the tension of the link.

C.1.5 Thermometers to measure the temperature of actuation of fusible link.

C.1.6 Stand

C.1.7 Wire for hanging fusible link, spring balance etc.

C.2 Procedure

C.2.1 The equipment is assembled as shown in the drawing No. DIFR/08833/R&D/03(Fig3). The upper hook of fusible link is hanged in the loop made of wire and connected to spring balance and the lower hook is hanged with loop attached to the bottom pan in the oven. The tension in the spring balance is adjusted in such a way by putting weight in the pan attached with spring balance through a pulley system that spring balance shows the reading which is the actual load of the fire damper in open position. Thus it gives the same tension to the link as in actual condition. Thermometers are fitted on the both sides of the oven to record the actuation temp
(**Note:** The tension in the whole cycle due to the spring balance may be adjusted to zero before putting it into operation).

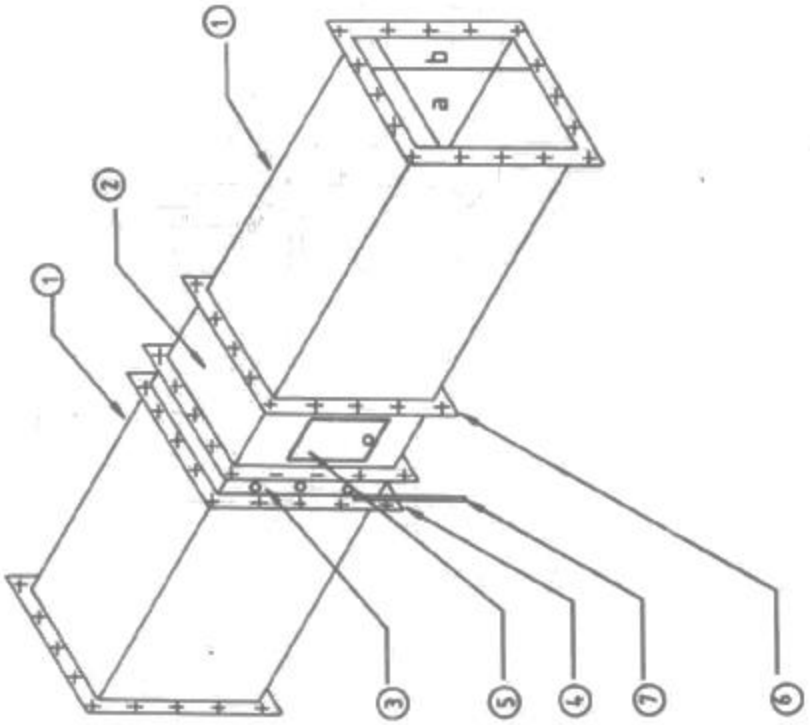
C.2.2 The oven after complete assembly is then closed and switched on. The temp is regulated in such a way that rate of rise in temp is approx. 10°C per minute. The temperature at which the fusible link actuates/breaks is recorded. In one batch a minimum of 5 samples are tested and the average temp is taken as the actuation temp. Of fusible link. After every test the oven is cooled down to same initial temp/ambient temp. in each case.

C.3 Maintenance

C.3.1 The fusible link shall be subjected to quarterly visual inspection and be replaced at least once in a year or earlier as & when found defective.

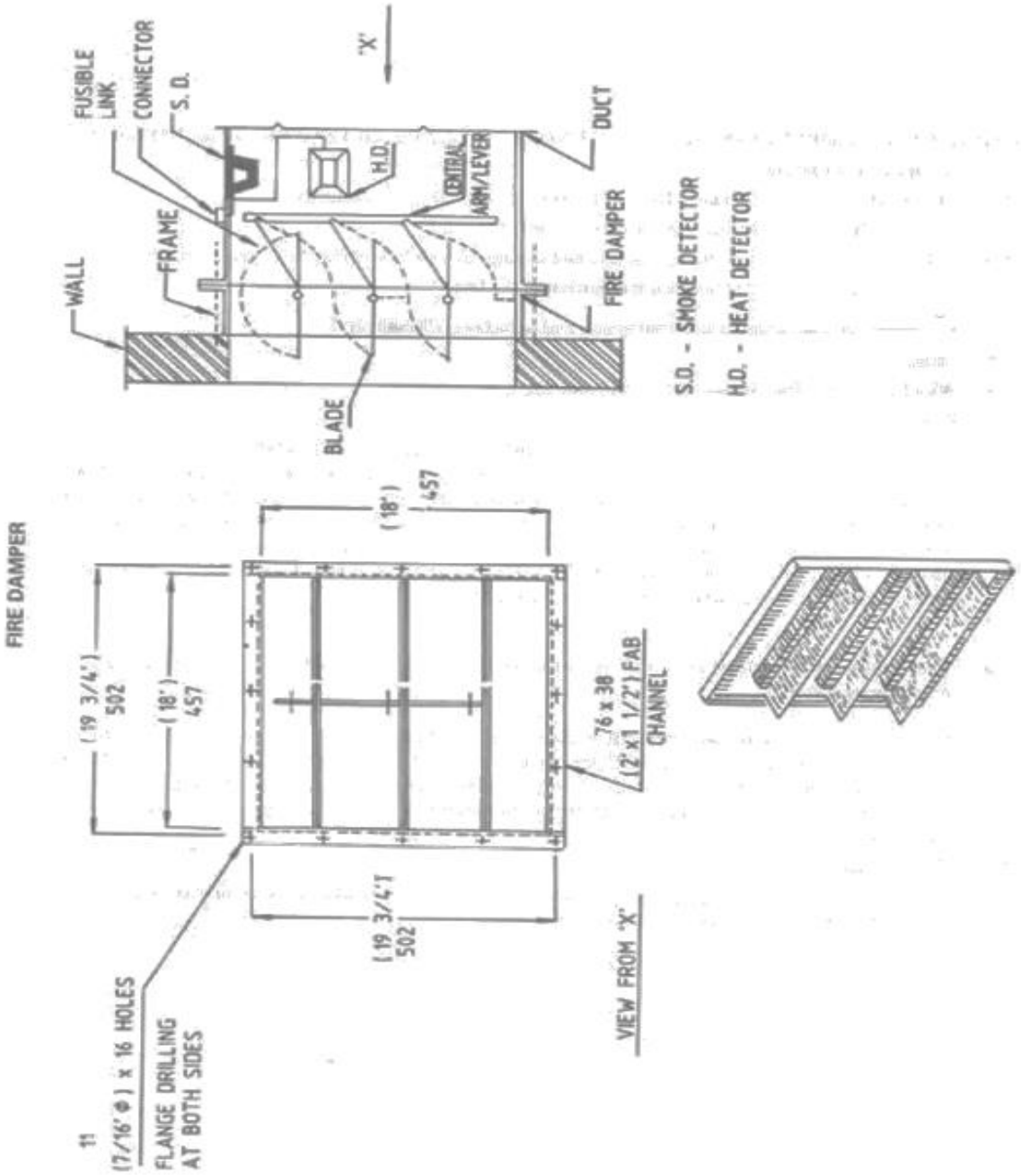
FIRE DAMPER IN AC DUCT SYSTEM

S.No	DESCRIPTION
1	MAINDUCT SIZE (axb)
2	SERVICE BAY DUCT
3	MS CHANNEL FRAME
4	FIRE DAMPER SIZE (axb)
5	OPERATION WINDOW
6	CONNECTION BOLTS 10mm
7	MANUAL OVERIDE



All Dimensions in mm

Fig. 1



All Dimensions in mm

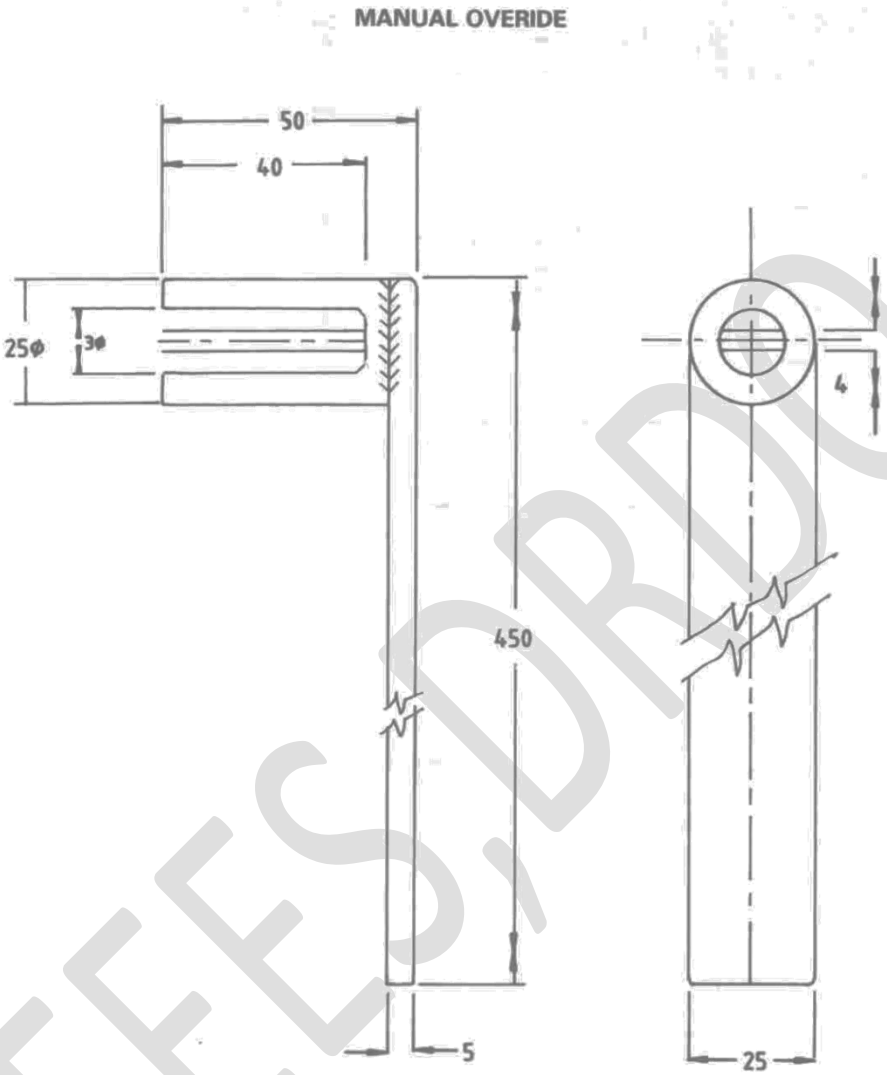
Fig. 2

TEST FACILITY-FUSIBLE LINK

S.No	DESCRIPTION	S.No	DESCRIPTION
1	TENSIOMETER	7	PULLEY
2	FUSIBLE LINK	8	DROP PLATFORM
3	REACTION FRAME	9	THERMOMETER
4	THERMOMETER	10	OVEN
5	REACTION PLANE	11	ADJUSTER
6	PAN	12	TENSION CORD

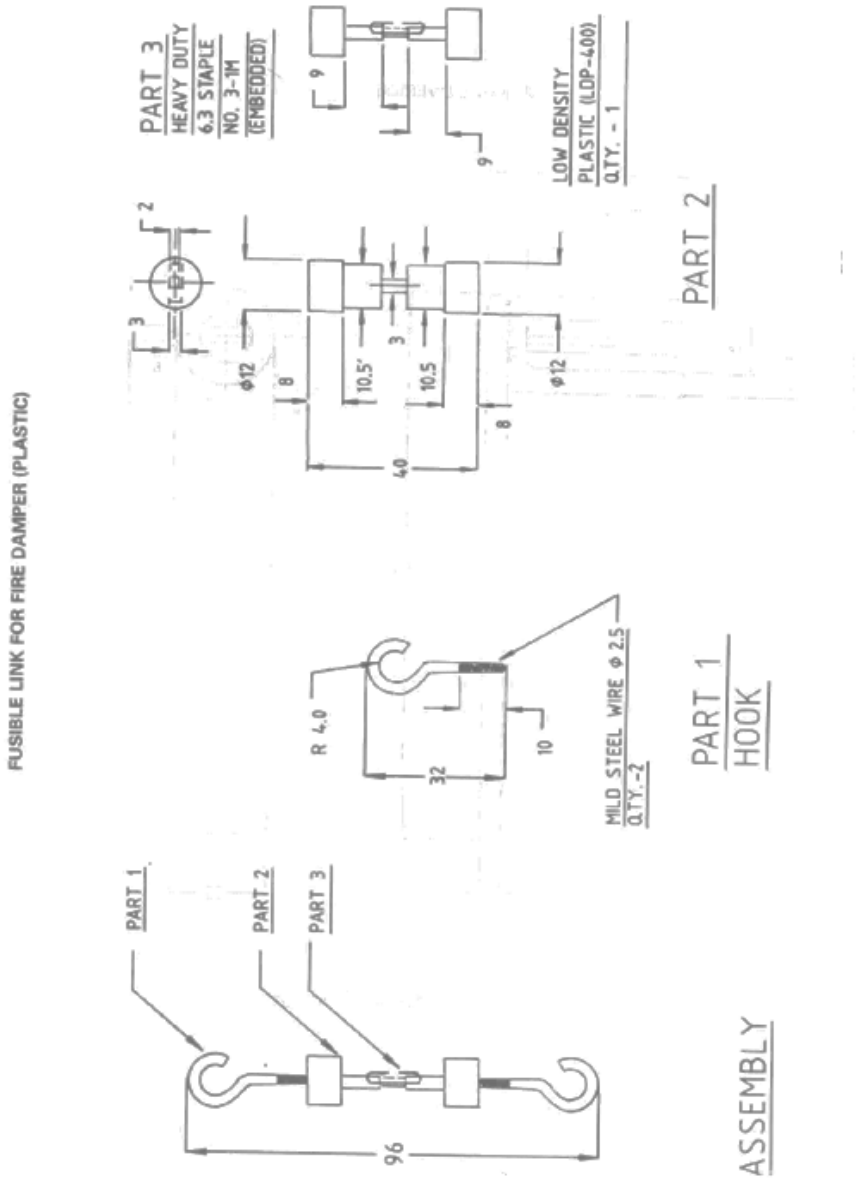
All Dimensions in mm

Fig. 3



All Dimensions in mm

Fig. 4



All Dimensions in mm

Fig. 5