SPRAY COATING

A guide to the Spray Coating Regulations 1962

issued by the department of labour — new zealand

IMPORTANT NOTE:

The Spray Coating Regulations 1962 still apply but there have been significant changes in legislation since this booklet was first published. The section on Electrical Installations (p13) has accordingly been amended, and some publications relevant to spray painters are listed on page 26.

This booklet should be read in conjunction with the OSH information sheet *Spray Coating: Information on Legislation*.

It should also be remembered there have been technological changes since the Regulations and booklet were first issued. Given these limitations, the booklet should be treated as a general guide to the 1962 Regulations only, and if doubt, advice should be sought from the Occupational Safety and Health Service.

The booklet is likely to be superseded by an Approved Code of Practice for Spray Painting during the year 2000.

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A GUIDE TO THE SPRAY COATING REGULATIONS 1962

ISSUED BY THE DEPARTMENT OF LABOUR
NEW ZEALAND

FOREWORD

The Spray Coating Regulations 1962 came into force on I June 1962 and are wider in scope than the Spray Painting Regulations 1940 which they replace. They were prepared in consultation with representatives of Industry including the following organizations:

The New Zealand Employers Federation

The New Zealand Manufacturers Federation

The New Zealand Motor Body Builders Industrial Union of Employers

The New Zealand Federation of Labour and

The New Zealand Engineering, Coachhuilding, Aircraft and Related Trades Industrial Union of Workers.

This booklet has been prepared by the Department of Labour to explain the provisions of the regulations and to offer advice which may be helpful to owners of spraying equipment.

SPRAY COATING

In recent years the application of material to surfaces by spraying has become widespread throughout industry. Although at one time it was largely restricted to the application of paint it is now used to apply many other materials. New techniques have also been developed. Thus the term "spray painting" seems no longer appropriate and "spray coating" has been coined as being more descriptive of the process.

The three main processes for the application of materials by spraying are:

(1) The atomisation of the material by mixing it with air and its subsequent projection on to the article to be coated. This, until recently, has been the usual method of spray painting.

(2) The atomisation of the material by forcing it through a small orifice by means of hydraulic pressure. This is known as the airless spraying system as no air is mixed with the material to force it through the orifice. High fluid pressures are involved in this system, up to 20 670 kPa being required depending on the viscosity of the material and the size of the orifice.

(3) The application of the material by electrostatic means. In this system the material is delivered to a rotating disc or bell, usually by low pressure compressed air. Here it is atomised under the influence of an electrostatic field created by high voltage between the disc or bell and the article to be coated. The principle of electrostatic spray coating is an application of the well-known law that like electric charges repel each other and, if the charges are on particles of matter which are free to move, they will follow the shortest path to an opposite charge or to an earthed object and there discharge themselves.

In spite of these new processes the hazards associated with spray coating — the risk of fire and the danger to health — have not been removed.

The Risk of Fire

The fire risk is usually the most prominent. In order to obtain high-gloss finishes or to speed up production many of the substances sprayed are quick drying. This means that they are highly volatile and generally highly flammable*. The risk of fire and explosion is increased when these substances are mixed with air in a finely divided state and further increased when heat is applied to speed the evaporation.

The Risk to Health

Many of the substances sprayed are toxic, the solids may contain antimony, lead, silica, or asbestos while solvents may be harmful to the lungs or to the skin.

As poisons are absorbed by the body through the mouth, lungs, and skin, they are absorbed more readily when the surrounding air is saturated. The air needs to be changed continuously during spraying operations in order to remove the contamination and, in addition, proper care and protection is necessary in handling the coating substance — this may require the use of personal protective equipment. Means for cleansing both the body and equipment are also essential.

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*The regulations use the term “inflammable”. However because the prefix “in” commonly negatives a word, this term has come to be regarded overseas as likely to lead to confusion — a confusion which should not be permitted when dealing with hazardous substances. In this booklet, therefore, the word “flamable” — which is now preferred by overseas authorities — is used.

In spite of all precautions some substances are so dangerous that their use in spray coating is prohibited. Details are contained m regulations 32, 33, and 34 and in the Second Schedule to the regulations.

The Spray Coating Regulations 1962

The Spray Coating Regulations 1962 lay down the legal obligations of employers, and of persons engaged in, or in the vicinity of, spray coating processes.

They apply to all spray coating work in factories. That is to say in any building, office, or place which is a factory as defined by the Factories Act 1946. It should be noted that the approval of booths, as required by the 1940 regulations, does not now apply, the onus being with the booth occupier to meet the requirements of the regulations.

Location of Spray Coating

Spray coating is required to be performed in a booth of one of the specified types and every booth must be equipped with an effective system of air control. There are certain exceptions to this requirement in cases where spray coating is carried out in the open air upon boilers and heavy articles usually made in engineering works, upon aircraft or large parts of aircraft, and on small areas of repaired articles requiring not more than 10 minutes of application with 50 minutes between each application.

Exemptions from the use of a booth may be granted by the Chief Inspector of Factories if he is satisfied that the substance sprayed is neither noxious nor flammable or that by reason of exceptional circumstances or infrequency of process, the use of a booth is not necessary for safeguarding the safety, health, or welfare of persons engaged in or exposed to spray coating.

Where spray coating is performed in places other than a booth, persons engaged or working within 6m of the process are to be provided with protective masks and clothing.

Care should be taken in the selection of masks to ensure that they are provided with filters which give protection from the particular material being sprayed.

The regulations also require the air in the work place to be changed at least 20 times per hour. (This does not apply to a process performed in the open air.) There are very few situations where natural ventilation can be relied upon to achieve this so mechanical fans should be provided in all such cases.

Types and Construction of Booths

Regulation 7 specifies the types of booths that may be used, viz, a cabinet booth (figs. 1 and 2), a

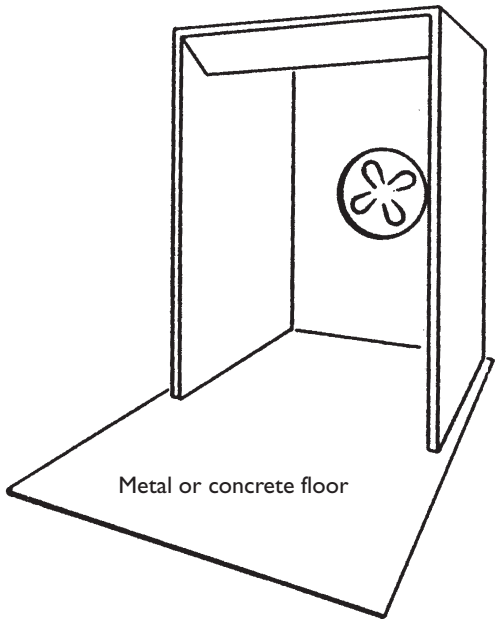

Fig. 1—CABINET BOOTH

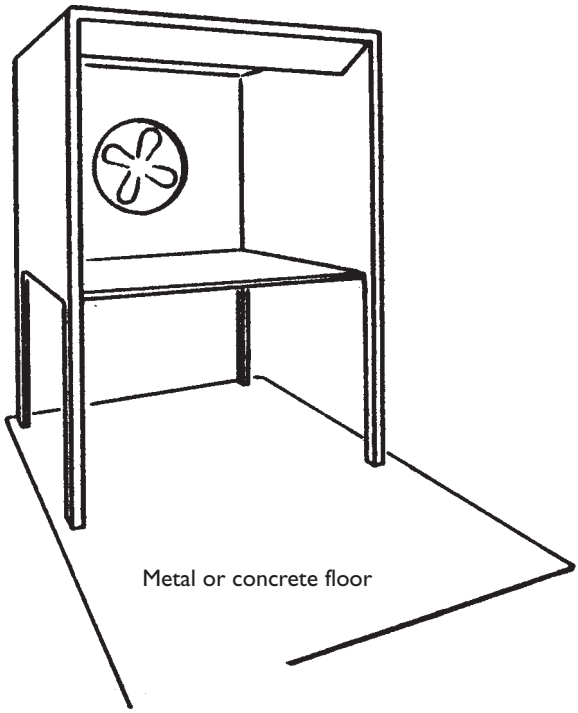

Fig. 2—CABINET BOOTH

room booth (fig. 3), a tunnel booth (fig. 4), and a canopy booth (fig. 5).

The type of booth selected will be determined by the class of work to be performed. In general, cabinet booths are selected for small and medium-sized articles, room booths for large articles and vehicles, tunnel booths and canopy booths for continuous processes.

The materials to be used in the construction of booths and the manner of construction are presented in regulation 8. Booths are to be constructed of metal, reinforced concrete, concrete blocks, brick, or stone. Other materials may be used provided the inside of the booth is lined with sheetmetal, plaster on wire

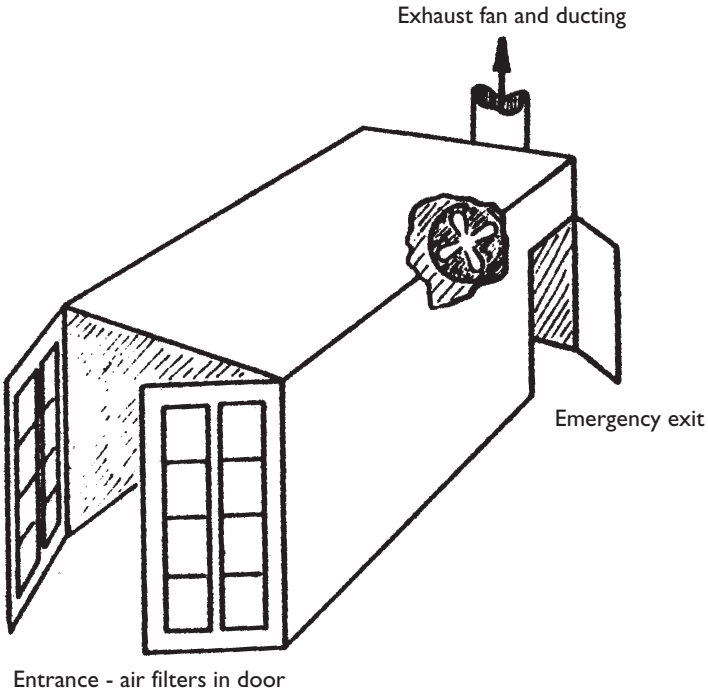

Fig.3 — ROOM BOOTH

netting, or fibrous plaster. Cement asbestos sheet 5 mm thick may also be used for this purpose provided the frame to which it is secured is close-boarded. The unsupported area of any other lining must not exceed 0.5 m^2 (see fig. 6). Plaster board of 10 mm thickness may be used for ceilings.

All joints in linings are to be flush filled or covered with metal strips not less than 38 mm wide and the whole must present a smooth finished surface to facilitate cleaning.

All-metal construction is probably the most suitable for cabinet booths, tunnel booths, and canopy booths.

Floors in booths and 914 mm beyond the entrance to cabinet booths, tunnel booths, and canopy

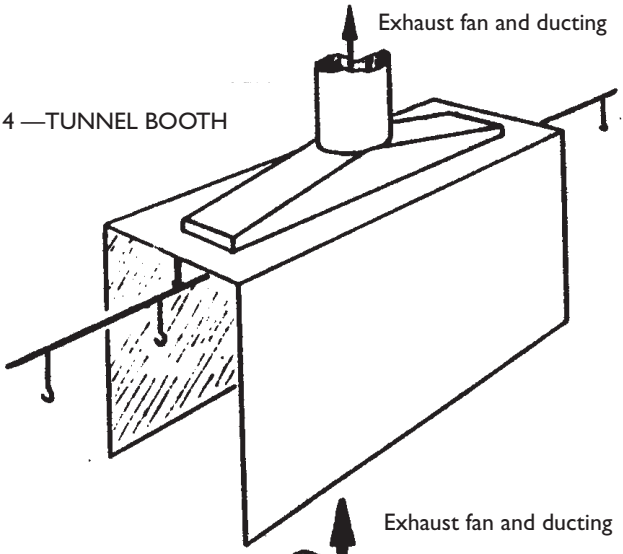

Fig. 4 —TUNNEL BOOTH

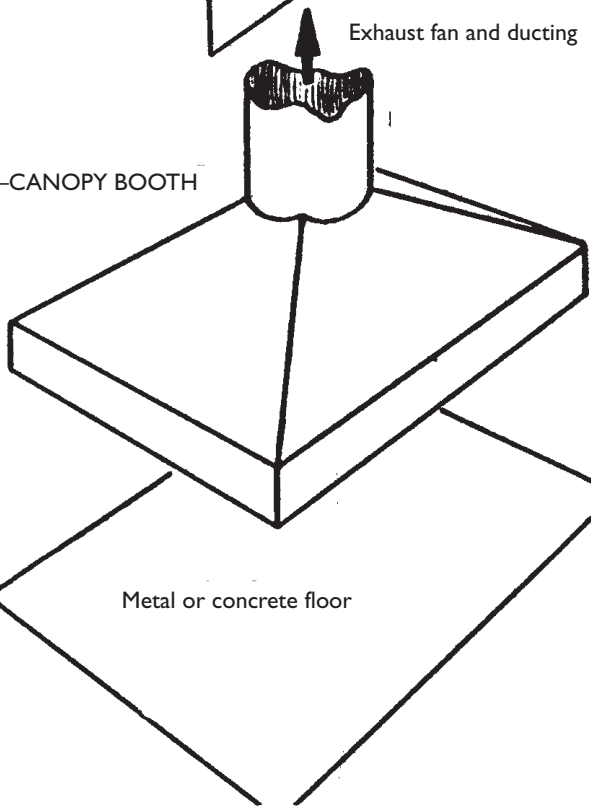

Fig. 5—CANOPY BOOTH

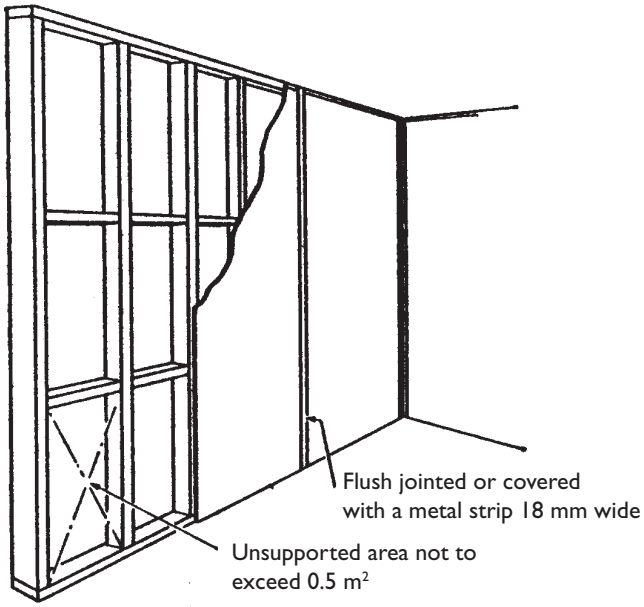

Fig.6—DETAIL OF LINING FOR BOOTH

booths are to be constructed of similar material to that prescribed for booths, or where other material is used it must be covered with sheetmetal.

Concrete is the most suitable material for the floors of room booths, canopy booths, and some tunnel booths. Where sheetmetal is used, some form of non-slip surfacing may be necessary.

Windows in booths are to be of wired or reinforced glass, fitted in metal frames.

Filters are also required to be secured in metal or metal-covered frames and where of combustible material enclosed in wire gauze.

Doors fitted to room booths must not open inwards and every room booth must also have an emergency door with the exit kept clear.

Electrical Installations

(The information in the original booklet has been superseded. New Codes, Regulations and Standards apply. The following information is current as at April 2000)

Explosions and fires have been caused by unapproved or faulty electrical appliances or installations at or near places where flammable materials are sprayed or stored.

The electrical Codes and Regulations require electrical appliances, installations and wiring to be suitable for such places.

Spraybooths require zoning for hazardous locations, to ensure that all electrical appliances, installations and wiring, associated with the booth are suitable for the purpose or of an approved type. The standard for determining the hazardous zone(s) is AS/NZS 2430.3:1997, Classification of Hazardous Areas.

However, the zoning according to this standard, only applies if the booth complies with AS/NZS 4114.1. This standard requires the doors of room booths, to be interlocked with the spray gun.

Apparently, New Zealand operators do not like this arrangement and therefore it is believed that no booths in New Zealand would comply with AS/NZS 4114.1.

Therefore, the Zone1 hazardous area still extends 2 metres in any direction form any opening of the booth.

The Energy Safety Service of the Ministry of Consumer Affairs, (formerly the Office of the Chief Electrical Engineer, Ministry of Commerce), have published an information sheet EPA - 3 Hazardous Areas which provides further information on electrical work in hazardous areas. This information sheet is now requiring update. Their website is

www.ess.moc.govt.nz
email to Colin.Murphy@moc.govt.nz

An electrical inspector, experienced in work in hazardous areas, will be able to advise on what needs to be done, to ensure compliance with the relevant Codes, Regulations and Standards. They should be contacted early in the planning stages of a new booth installation, to ensure that the work is done properly first time, and no expensive re-work is required.

Once the work is completed, the Certificate of Compliance is signed by the electrician and the inspector, who inspected the work.

Ventilation

Good ventilation is essential in controlling the hazards of spray coating. It has two main functions: (a) to carry off and disperse the solids and solvents, and (b) to reduce by dilution to below the explosive level concentrations of flammable solvents in the air.

An air velocity of 0.5 m/s is recognised by authorities as being the minimum necessary to carry away the solids normally found in overspray. Velocities of 0.8m/s are common overseas and higher velocities are not unknown.

0.5 m/s is just over 1 km/h —a little over one-third of a normal walking pace.

Booths are required by the regulations to be so constructed that air can enter and the air must be reasonably pure, fresh, and clean. In addition one or more exhaust fans are to be fitted in such a manner as to produce and maintain an air movement past the operator of not less than 0.5 m/s.

Although this requirement is primarily in the interests of the health of the operator, it is usually demanded by the process in order to prevent sprayed surfaces from being spoilt by air-borne dust. For the same reason, air exhausted from a booth must not be recirculated unless it is effectively filtered.

Where a filtering system is being provided,

care must be taken to see that the filters are properly sited and are of adequate size, otherwise the flow of air may be impeded and the effectiveness of the fan diminished.

Exhaust ductings are to be made of metal, any joints being made airtight and secured by means other than solder. Covered cleaning openings are to be provided at suitable positions.

Ductings for the removal of air containing flammable solvents are to be insulated or separated by a distance of 229 mm from any woodwork. A number of fires have been caused in the past through faulty ducting construction.

(See also regulation 6 concerning the ventilation or places other than booths.)

Disposal of Overspray

The proper disposal of overspray is necessary to prevent accumulations of flammable solids and solvents, and also to safeguard contamination and damage to adjacent properties. This requires some means of trapping the solids and dispersing the vapours.

By far the best method so far devised is the use of a water wash. A well-designed water wash will not only trap the overspray but will reduce the amount of cleaning required in ductings.

The regulations require the provision of a suitable water wash or similar efficient device for trapping contaminants. Alternatively, the onus is on the occupier to dispose of the overspray in such a manner that it does not re-enter the factory or cause damage or nuisance. In such circumstances, however, he must exhaust any flammable solvent at a point not less than 3 m above ground level.

Drying

A variety of methods involving the use of heat are now used to speed-dry or to bake-finish articles that have been spray coated.

The risk involved in such a process has already been referred to. The need for care in the selection of a suitable heating medium, its control during use and the early removal or dilution of flammable vapours, cannot be overstressed. Several serious fires have occurred where there has been failure to observe these common sense rules.

Regulation 16 requires that drying by the application of heat of articles that have been spray coated with a flammable material shall be done in a drying room cabinet, or oven reserved exclusively for the purpose. The drying room, etc., is to be constructed of specified materials or lined with sheetmetal, and ventilated so that the products of the drying are delivered directly to the open air.

Regulation 17 permits drying to be done in a workroom, provided the area in which the drying is done is reserved for the purpose and the air in the workroom is changed not less than 15 times per hour.

Regulation 18 similarly permits drying to be done in a room booth. However, no spraying is to be carried on while drying is in progress and the ventilation system must have been in operation for at least 5 minutes after the last spraying was done and before any heating is turned on.

Materials or flammable substances, other than those being dried, are not permitted in drying areas or booths during drying operations.

Regulations 19 and 20 require that the source of heating will not cause ignition of any of the products of drying. They prohibit, in particular, the use of a naked flame, red-hot element, or any source likely to produce sparks within 6 m of any drying process, unless separated by what is termed a "screen wall" (see fig. 7).

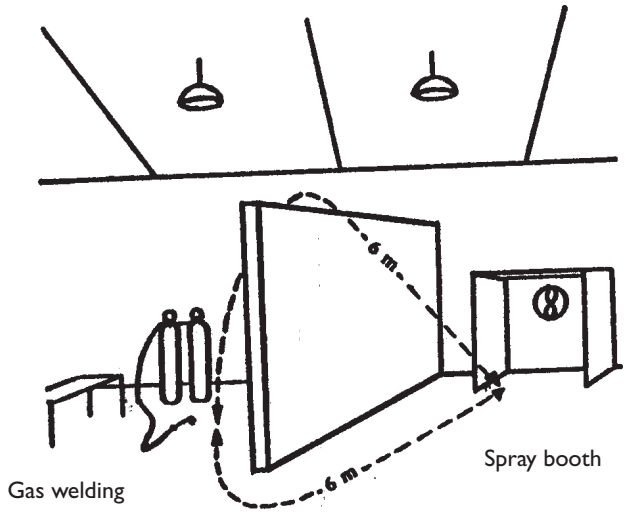

Fig. 7—SCREEN WALL

A screen wall is merely a physical separation of a source of ignition from a source of flammability constructed of specified materials in such a manner that the distance between the sources measured through uninterrupted air space is not less than 6m. For example the separation may be the wall between two rooms or a special wall erected for the purpose.

It is likely that ovens or enclosures will be used where heating is by convection. In single convection or direct-fired ovens, care should be taken in the selection of the heating medium to ensure compliance with regulation 19. A double convection or indirectly fired oven is safer and has the added advantage that forms of heating such as gas or oil can be used with relative safety. Wherever ovens or similar enclosures are used, an adequate vent must be provided to allow the products of the drying process to reach the open air. A suitable damper can be fitted to regulate the loss of heat.

Drying by means of radiant heat is now becoming very common in industry. It is simple and less costly —elaborate ovens are not necessary — and the heat can be concentrated at points where it is required. Here again it is essential that there is adequate ventilation, preferably by mechanical means, to remove the vapours and that the source of heat is such that ignition of the vapours cannot occur.

Storage of Flammable Materials

There are few things which will feed a fire better than open tins of paint and solvents. In recent years several factory occupiers have discovered this to their sorrow (see the report on page 23 of this booklet). A golden rule should be keep these materials in proper storage and only remove what is necessary for immediate use.

Regulation 38 prohibits the storage of flammable paints and solvents in a booth, except that contained in the spraying apparatus or wanted for immediate use. In the latter case, the quantity is limited to 4.5 litres in covered containers.

Where a licence is required under the Dangerous Goods Act 1957, bulk supplies of flammable paints and solvents must be stored in accordance with the Dangerous Goods Regulations 1958. In other cases, storage must be in a metal cabinet provided with close fitting doors.

In some cases it may be desirable to have both types of storage, particularly where the bulk store is some distance from the spray booth. In such cases a cabinet associated with the bench on which the paints are mixed, situated near the booth, is not only convenient but encourages good housekeeping (see fig. 8).

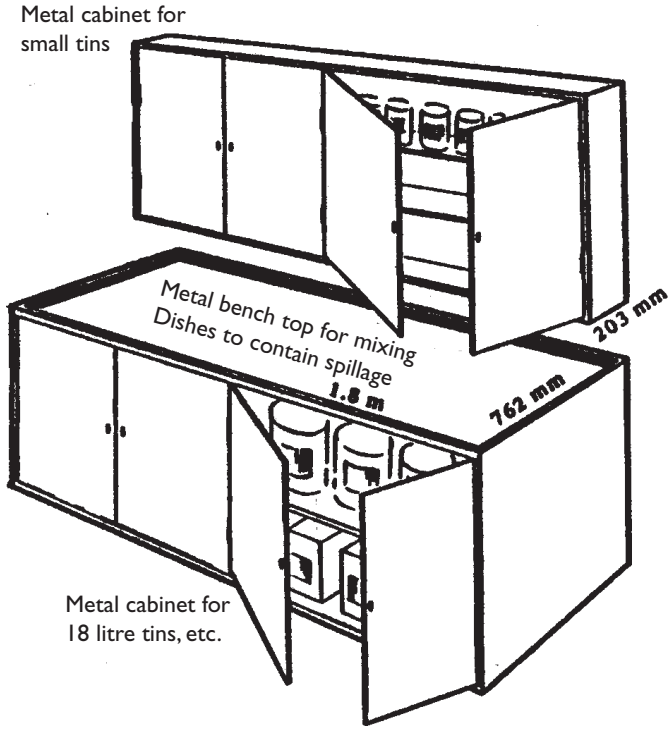

Fig. 8—PAINT STORAGE

Use of Booths

To obtain the full benefit of a booth in the control of a spray-coating process, it must be used in the proper manner.

Regulations 25 to 28 prescribe certain rules which in general are as follows:

(1) Wherever possible the article being sprayed should be placed between the operator and the exhaust fan. This will help to keep overspray away from the operator's face and body.

(2) The ventilating system should be kept in operation during the whole of the spraying time and for 5 minutes after spraying is finished to ensure that all overspray is removed from the booth.

(3) Spraying should not be done indiscriminately, nor should overspray be allowed to accumulate on the interior surface of the booth.

(4) Booths should be cleaned regularly and this includes, in particular, fan blades and exhaust ducting. A fan will lose efficiency very rapidly if overspray is allowed to accumulate on the blades.

(5) A suitable covered metal bin should be kept handy to the booth for the reception of old cleaning rags, etc., and be emptied regularly. Oily or solvent-saturated rags left lying about are not only untidy but readily become fire hazards.

(6) No smoking or naked lights — and this includes electric radiators — are permitted in a booth. A suitable fire extinguisher should be kept adjacent to the booth. Fire extinguishers should be checked at appropriate intervals to ensure that they are always in working order. There is nothing so disconcerting or tragic as trying to put out a fire with an extinguisher that does not work.

Personal Protection and Amenities

Unless using isocyanates, where spray coating is undertaken in a properly constructed and ventilated booth there should be little risk to the health of the operator. However, in situations prescribed by the regulations where spraying is done elsewhere than in a booth, some protection may be necessary to prevent inhalation of the overspray. Further, even in a booth where recessed or hollow objects are being sprayed and "blow back" occurs, protection is desirable.

Apart from suitable overalls, and in some cases gloves, a face mask is the minimum protection expected. Face masks and respirators are made in a variety of forms and types, from the simple face mask

An operator wearing an air-fed respirator and protective clothing suitable for use with isocyanate-containing paints.

to an air-fed helmet. While the former type may be quite satisfactory to prevent overspray entering the lungs, it will not prevent solvent fumes from doing so. It is recommended that a mask be obtained which fits snugly over the mouth and nose and which can be fitted with a replaceable chemical cartridge to absorb the solvent vapours. Where there is doubt concerning the correct type of cartridge required, the local medical officer of health should be consulted.

Many of the paints and solvents used in spray coating can readily cause dermatitis if they get on the skin. Good personal hygiene is therefore essential.

Regulation 39 requires the provision of washing facilities which include hot running water, soap, and provision for drying. It is not intended that these facilities be in addition to the normal facilities provided in the factory but it is recommended that they be situated handy to the spray-coating process.

There are three specific duties imposed by the regulations on users of booths. Briefly they are:

(1) Do not keep or eat food within a booth or in any room in which a booth is used.

(2) Do not test the spray gun by spraying indiscriminately.

(3) Do use the protective clothing, masks, or respirators provided for your protection.

CONSTRUCTION OF BOOTHS

Parts 1 and 2 of the First Schedule to the Spray Coating Regulations provide the following lists of materials for construction and types of lining.

Forms of Construction

Metal, reinforced concrete, concrete blocks, brick, stone.

Types of Lining

The undermentioned linings shall be secured to timber or other suitable framing in such a manner as to ensure that no unsupported surface exceeds 0.5 m2:

(a) Sheetmetal of not less than 0.45 mm thickness.

(b) Plaster of not less than 19mm thickness reinforced with 13 mm wire netting.

(c) Fibrous plaster of not less thickness than 13 mm.

(d) Cement asbestos sheets of not less thickness than 5 mm may be used provided the framing is first close-boarded or the sheets secured to equivalent solid backing.

(e) Plaster board of not less thickness than 10 mm may be used for ceilings only.

(f) All joints in linings shall be flush filled with plaster, filler, or covered with metal strips not less than 38 mm wide.

While the Regulations specify the materials to be used, they do not take account of the latest materials and the latest Building Codes and legislation. For example, cement asbestos sheets would not be available nowadays. New booths will be covered by the Building Code.

The *Approved Code of Practice for the Safe Use of Isocyanates*, March 1994, (Appendix 8) states that "The construction of any spray booth may be varied

from the requirements of the Spray Coating Regulations 1962, provided that any alternative construction of lining materials are not ignitable when tested for flammability by AS 1530 Part 3:1989. In addition, the smoke index obtained shall not exceed 5, and the linings must have smooth, easily cleaned surfaces."

(Please Note: AS 1530 Part 3 was amended in 1992, and is now a joint standard AS/NZS 1530.3:1999).

The local authority should be contacted for advice on how to comply with the requirements of the latest Building Codes and legislation.

SOME COMMON SOLVENTS

Solvent	*Closed Cup Flash Point*	*Remarks*
Acetone	-17°C	Miscible in water, strong solvent for nitro cellulose and most natural and synthetic resins.
Amyl Acetate	23°C	Nitro cellulose solvent.
n-Butanol	32°C	Used in nitro cellulose thinners to prevent blushing and as a component of thinners for amino resin enamels.
Ethyl Acetate	-5°C	Nitro cellulose solvent.
Ethyleneglycol Monoethyl Ether (Cellosolve) J	40°C	High boiling solvent for nitrocellulose.
Ethyl Lactate	54°C	Miscible with water. Used to prevent pinholing.
Methyl Ethyl Ketone (MEK)	-6°C	A solvent of generally similar properties to ethyl acetate.
Methyl Iso Butyl	27°C	A good solvent for nitro cellulose and synthetic resins. May be used when a higher boiler than MEK is required.
Xylol	24°C	A good solvent for most synthetic paints. Especially used in amino resin enamel thinners with butanol.

Further Information

Other relevant publications that may be obtained from your local OSH office are:

- *Approved Code of Practice for the Safe Use of Isocyanates*
- *Approved Code of Practice for the Management of Substances Hazardous to Health*
- *A Guide to Respirators and Breathing Apparatus*