Spray.

This is due to the fact that spray technology makes the most of the unique process-ability of PUR and combines this with outstanding thermal insulation properties of these products. moreover information is now available relating to applications carried out several years ago which proves the reliability and effectiveness of the technique.

PUR chemicals are delivered as Two liquids [ISOCYANATE - A Component & POLYOL BLEND - B Component], which are metered and mixed in POLYCRAFT FOAMING MACHINE and then sprayed onto the surface to be insulated. The chemicals react [a few seconds] allows the technique through to vertical.

Hence, Tanks, Walls & Roofs of varying slops can be effectively insulated in this manner.

However, the insulation of roofs is an area where the use of spray applied PUR is growing very rapidly and it is this application that this note is primarily concerned.

Spray applied PUR show several characteristics of particular interest for this application.

- Light weight because foam density usually is in the region of 30-50 Kg./cubic meter.
- Suitable mechanical characteristics in particular, a compressive resistance greater than 280 K Pa [40-PSI] for foams in the density range of 40-55Kg./cubic meter.
- Good adhesive to all types of roof decks.
- Adaptability to irregular roof surfaces allowing complete filling and sealing.
- Thickness can be varied to give the most suitable roof slope.
- Elimination of joints because of the monolithic [seamless] nature of the foam
- Easy maintenance and repair.

In order to obtain the full benefit from the use of PUR spray from it is important to select chemicals to apply them correctly and to maintain a valid quality control procedure.

This write-up gives important information on:-

A	**Substrate Preparation.**	**B**	**Foam Quality and Foam Application Condition.**
C	**Coatings.**		

Substrate Preparation.

As already mentioned, spray applied PUR adheres well to a wide variety of substrates.

Moreover, in order to obtain the best results, it is important that the substrates are clean, dry & free of crease, oil, rust, loose seal etc. In addition, the surface into which the foam is to be sprayed must have sufficient mechanical strength and be adequately fastened to the structure to preclude tear off or wind uplift.
By observing these precautions and by taking into consideration some specific recommendations for the most critical applications, good results are obtained with the various substrates discussed below [if, there are doubts about PU adhesion to a particular substrate, it is recommended to carryout a preliminary evaluation by spraying a sample at least 50 x 50 cm. (2 Ft. X 2 Ft.) and measuring adhesive after 18 H Curing]

CONCRETE	:	It is strongly recommended that moisture content be less that 10% to be checked through a moisture meter; criminate eventual possible excessive salt precipitation by cleaning concrete with hydrochloric acid. Alternatively, the surface can be cleaned by sand blasting or wire brushing and afterwards watched with a washing primer and sealed with a "Penetrating Primer" [usually an epoxy type].
GALVANIZED STEEL	:	New galvanized steel to be washed a solvent or acid, then with water and finally primed; use of solvent or acid not in general necessary for "weathered" galvanized steel. [priming is not always required depending on the age and exposure of the metal and use].
PRE PAINTED SUBSTRATES	:	In general surface will be too smooth; mechanical score or sandblast the paint to increase the surface area and consequently strength of adhesion.
BARE STEEL	:	Removal of any loose scale and rust; for tanks it is important to sandblast and prime the steel.
STAINLESS STEEL	:	Clean with xylem or mineral spirits and prime; it may necessary to sandblast.
COPPER	:	Usual cleaning only.
ALUMINUM	:	Clean with solvent, never use a caustic solution and prime. This also prevents corrosion of the aluminum.
WOOD, GYPSUM BOARD AND FIBERBOARD	:	Maximum moisture content 10% attention to possible presence of surface treatment which may adversely affect adhesion.

Surface texture and quality of the foam is mainly controlled by following variables

Equipment Adjustment

System Election

Application Conditions

Applicator skill

1. EQUIPMENT ADJUSTMENT :- Temperature and pressure of the components have to be controlled because these parameters significantly affect the spray pattern. Materials which are too cold will cause a narrow pattern which create holes, dimples or roughness. Consequently a popcorn or oven a tree bark surface is obtained. If the temperature is only slightly lower than that recommended, the spray pattern can be modified, in the "airless" spraying machines, by adjusting the pressure of the components or the spray gun valuing rod.

With material, which are too hot the sprayed blend will react too fast to permit adequate leveling and a verge of popcorn texture will be produced, even though the spray pattern is correct.

The ISOCYANATE ['A' Component] / Polyol ['B' Component] ratio has to be adjusted and controlled to the recommended valve and must remain constant during the whole application. Utilization foams with abnormal physical properties.

In addition, an excess of ISOCYANATE will give friable or brittle foams, dark in color, with smooth hard and glassy cellular structure.

Soft and spongy foams, light in color, with coarse orange peel surface texture and blow holes or pinholes are obtained with an excess of Polyol.

[It is off course assumed that equipment is operating properly, i.e. it is capable of providing adequate metering and good mixing to produce foams of good quality].

2. SYSTEM SELECTION :- PUR Systems for spray application have to be tailored to provide;

- **Reaction times [mainly cream time] adequate for the available spraying machine and for the environmental and application conditions.**
- **Foams with the required physical characteristics.**

If the cream time is too short [due to improper system selection in relation, for example, to too warm environmental conditions] the foam texture will trend to be "coarse orange peel" OR worse in texture.
Skin densification [with consequent foam density in crease] may be noticed with too long a cream time, although in this case foam surface texture may be "smooth". in additions, systems

with too long a cream time will create problems with too long a cream time will create problems when foam is prayed into vertical surfaces, "tree bark" surface texture in extreme cases. Finally such a system will also have a higher

3. APPLICATION CONDITIONS :-

Attention has to be paid to the following points:

A. WIND :- Use of winds-screens is strongly recommended when wind speed are over 19-24 KM / hour [12-15 miles /hour]. In addition it is recommended not to spray at all when wind speed is over 10Km /hour [25 miles /hour].

B. MOISTURE / HUMIDITY :- It is essential that PU foam is prayed on a dry surface. In fact water can react with the ISOCYANATE component with the formation, mainly at the foam / surface interface, of brittle, friable foams having low adhesion strength.

Further, in extreme cases, water reaction with ISOCYANATE can produce On/Off ratio foam in favor of excess Polyol resulting in poor foam physical properties. These Two factors could cause blister formation. Finally, CO_2 gas formation [form water / ISOCYANATE reaction] may cause foam porosity.

FOR THIS REASON :-

Spraying should not be performed in presence of rainfall, mist OR visible moisture; care should be taken whenever relative humidity rises above 90%.

Foam application should not be carried out if the dew point is less than 3ºC. (5ºF) above the temperature of the surface to be sprayed.

Foam application has to be carried out when surface moisture controlled with the moisture meter is higher than 10%.

C. SURFACE TEMPERATURE:- When PUR foam is applied on cold substrates (below 10-50ºF-5-10ºC) the cold surface can act as a heat sink absorbing part of the heat necessary for the compete vaporization of R 11 blowing agent and reducing polymerization/reaction rate. Consequently a thick skin of friable/brittle foam will form at the application surface, with adhesive problems and subsequent foam blistering.

However, special systems have been developed (such as those marketed by CIL Canada) for utilization in deep winter (indicated temperature range: 5-35ºF - about - 15-0º C.).

When PUR foam is applied on hot surfaces, an increase in foam density (due to R 11 loss) and blow holes or pin holes in the foam can occur)