

AD-D 429925

PLASTEC SPECIAL REPORT FOURTEEN

REVIEW OF
PLASTIC ACID SPLASH SHIELDS

by

JOHN NARDONE

JANUARY 1, 1977

PLASTICS TECHNICAL EVALUATION CENTER
PICATINNY ARSENAL, DOVER, NEW JERSEY 07801

TABLE OF CONTENTS

	Page
OBJECTIVE	1
BACKGROUND	1
DISCUSSION	1
Commercial Shields	1
Alternate Shield Designs	3
Transparent Materials Review	5
Potential Transparent Shield Configuration	7
CONCLUSIONS	9
REFERENCES	10
LIST OF TABLES	
Table 1. Commercially Available Splash Shields	11
Table 2. Potential Splash Shield Materials	12
Table 3. Chemical Resistance Data	13
APPENDIX 1.	16
APPENDIX 2.	17

PLASTIC ACID SPLASH SHIELDS

OBJECTIVE: To investigate the commercial sources of plastic splash shields for surrounding flanged joints at the sulfuric acid regeneration (SAR) unit planned to be constructed at Sunflower AAP (SAAP). To review the available plastic or composite materials to determine suitability, with a view toward providing transparent shields.

BACKGROUND: Current Army projects dealing with the manufacture of highly concentrated oxidizing acids have considered the need for transparent splash shields, Appendix 1. Transparency is not a mandatory requirement, but is considered to be desirable. This desired feature prompted the review of commercially available products and those transparent plastic materials which could be potentially suitable in specific environments. A scope of work was provided, Appendix 2, which detailed the technical requirements and specific areas of interest.

The intent of this study is to briefly review the state of the art and provide technical guidance useful in determining the shield designs and/or materials for varied plant installations. The technical data provided herein and specific references to sources should result in achieving the best possible shields to meet plant needs.

DISCUSSION: This brief study included the concurrent review of available shields or flange covers and plastic materials, primarily transparent, that would meet the requirements detailed in Appendix 2. The results of this review summarized in the following paragraphs will deal chiefly with plastic type shields.

COMMERCIAL SHIELDS: A search of the Thomas Register, buyers guides published by Chemical Week and Chemical Engineering magazines and personal

contacts, indicate that commercially available splash shields (acid guards, flange covers or spray guards) are available from three companies, Table 1. No other sources could be located. A brief description of each product line is given in Table 1. Splash shields in general are available in both metal and plastic. The metal units are available from only one of the three sources and can generally withstand higher pressures and temperatures. The plastic units are available in a variety of materials and designs, all with some type of "indicating" feature, i.e., a means of detecting acid leakage. Covers are available for valves as well as flanges. Each company provides a full line of covers from 1/4" to 24" pipe, with the exception of the formed covers which are special ordered beyond the 6 in. pipe size. The price picture from the three sources is reflected in the following data for a 3 in. pipe flange cover.

Price Comparison 3 in. Pipe Flange Cover

	Ramco	Slickbar*	Wilmington
Teflon/Fiberglass	\$10.45	\$10.70	--
Polypropylene/Fiberglass	\$ 8.85	--	--
Saran/Fiberglass	\$ 7.35	--	--
Polyvinyl Chloride/Fiberglass	--	\$ 6.60	--
Polyethylene	--	--	\$3.01

*Type 2 design/Teflon guard is non indicating.

Of the commercially available products, the wrap around designs would meet SAAP temperature requirements. The type plastic to use would be dependent on the required chemical resistance and the other requirements which are discussed subsequently. The polyethylene formed cover is also suitable with the exception of outdoor weathering. To overcome this

disadvantage, carbon black would be added, which in turn would remove the visual indicating feature. As a point of information, although termed transparent it is believed that the material is more translucent in the molded form which permits visual leakage indication.

ALTERNATE SHIELD DESIGNS: Since the commercially available splash shields will not provide any degree of transparency, considering that they will be used outdoors, a search was initiated to determine what transparent materials would be potentially suitable.

Fundamentally, chemical glass is an ideal material for splash shields. It is a candidate material and outside of "resistance to breakage" it is desirable in all other respects, with the additional exception of cost. It is believed that the cost picture would not be favorable.

Next to chemical glass, plastic sheeting with a thin glass coating would possibly be suitable. This material has recently been developed, References 1, 2 & 3. Of the two types, the one which utilizes a thin laminate of glass bonded to a plastic (Ref 1) appears to be a more suitable material, but is limited to use in flat sheet or simple formed shapes. The thin glass would provide the chemical resistance while the supporting plastic sheeting would provide the other desirable features. This concept, however, appears to be limited by the cost of the material, which is reported to be expensive, and the cost to fabricate the sections, particularly the hoop form around the flange.

Transparency is next best achieved with a plastic laminate, which would employ a chemically resistant coating or inner liner. This material could be provided in the form of a thin, flexible wrap around plastic or

a rigidly formed plastic as is now commercially available. The wrap around again would be held in place with ties. Although possible, the structural integrity of this design without some form of reinforcement, as is commercially available, is unknown and dependent on the severity of the leak environment.

The foregoing concept of a rigidly formed flange cover appears to be the most favored direction to achieve transparency. Covers made in the form of mirror images manufactured by a molding or forming process could be easily clamped or held in place with mechanical fasteners. The materials used in this concept would consist of (1) a rigid transparent plastic of inherent chemical resistance, (2) a rigid plastic of marginal chemical resistance with a more resistant plastic coating or (3) a laminate of two plastics in which the inner laminate is of a more chemically resistant material.

With each of the above designs, the areas to be addressed are adaptability to the various diameter pipes and other configurations, duration within the chemical environment, desired resistance to chemicals as well as the many specific design details involving attachments, shape, materials and quantities needed. Of these designs the formed unit appears to be the most feasible direction, although it is again highly dependent on the available materials and resultant manufacturing costs when compared to the commercially available units.

The current commercially formed units are made by injection molding and from a polyethylene material which is relatively inexpensive. It is also possible to vacuum form these configurations which would be more

amenable to laminated plastic sheeting. Therefore, to ascertain suitability, a review of materials must be integrated with these design approaches.

TRANSPARENT MATERIALS REVIEW: With the view toward a transparent, plastic splash shield some thirty transparent type materials were reviewed to determine the chemical resistance to nitric and sulfuric acids. The degree of transparency or translucency and the available forms were also assessed as related to the proposed concepts.

From this assessment it is fair to say that no one plastic material will resist the high concentrations of all possible chemicals at the high temperatures for indefinite periods, yet provide transparency, outdoor weathering, low cost, etc. However, a combination of one or more of these materials is believed capable of providing splash protection within the requirements listed in Appendix 2. A review of the requirements reveals that a material to meet the intended environment should have the following characteristics.

- Chemical Resistance
- Outdoor Weathering
- Toughness
- Temperature Resistance
- Low Cost
- Transparency/Translucency

It is with these parameters in mind that available transparent plastic materials were reviewed. These materials were also viewed from the approach of providing a rigid, formed plastic cover as discussed in the previous section.