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DEVELOPMENT OF WHITE THERMALLY REFLECTIVE RAIN EROSION RESISTANT COATINGS

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FOREWORD

This report was prepared by the Gates Engineering Company under USAF Contract Number AF 33(616)-3027. The contract was initiated under research and development Project No. 4158, "Radome Techniques and Components," Task No. 73494, "White Erosion Coatings". It was monitored under the direction of the Materials Laboratory, Directorate of Laboratories, Wright Air Development Center with Mr. Alex LePera acting as project engineer.

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ABSTRACT

Radomes and other coverings for housing radar antennae exposed to rain during high speed flight require maximum protection against rain erosion. This study is for the development of improved coatings for exterior plastic components, which will be rain erosion resistant, thermally reflective and have satisfactory weatherability.

White coatings formulated from polyacrylic rubber or Kel-F elastomer yield the best overall diffuse reflectances, while Neoprene has the best resistance to rain erosion.

A white Neoprene coating system has been developed which satisfies the major requirements of this program.

Studies are under way to improve the above coating system and to render it anti-static.

PUBLICATION REVIEW

This report has been reviewed and is approved.

FOR THE COMMANDER:

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SECTION I

INTRODUCTION*

The immediate object is to develop light-colored rain erosion resistant coating systems which can be applied to radomes and leading edges of aircraft and missiles traveling at subsonic speeds. A specific objective is to develop coatings possessed of average diffuse reflectance of not less than 85 percent in the wave length of 0.4 to 2.0 microns.

Currently there are available at least two good rain erosion resistant coatings (viz; Goodyear's 23-56 and Gaco's N-79). These coatings resist rain erosion at 500 miles per hour in a simulated rainfall of one inch per hour for an average period of in the neighborhood of sixty (60) minutes. These coatings are rather dark in color and are possessed of a negligible diffuse reflectance and for that reason are not useable in instances where light-colored coatings are required to reflect sunlight and thermal radiations from nuclear explosions.

The first thought that occurs would be to simply add a large quantity of white pigment to either of the currently used rain erosion resistant coatings to upgrade the diffuse reflectance. The addition of a white pigment to these coatings does increase the diffuse reflectance but the best reflectances obtainable from such pigmented coatings is still far under the desired 85 percent figure while, at the same time, the ability to resist rain erosion is substantially decreased. As a result, the development of a white rain erosion resistant coating system, more or less, necessitates starting from scratch.

In the pursuit of our investigations relative to Task No. 73494 (Contract No. A.F. 33(616)-3027), our work entailed an examination of various coatings based upon various elastomer pigments and curing systems applicable for use at room temperatures (or elevated temperatures, but preferably below 150°F). Various combinations, modifying agents and stabilizers were included.

A coating by itself if of no immediate worth - it is only coating systems that are of use. A coating system, as distinct from the rain erosion resistant coating per se, entails (1) the proper surface preparation of the substrate; (2) the use of an appropriate primer; (3) the use of a tie-cement (optional) as well as (4) the white rain erosion resistant body-coating. In some variations one may consider the use of an additional top-coat for the combined purpose of enhancing the overall diffuse reflectance and of protecting the rain erosion resistant body-coat against the deteriorating influences of sunlight, ozone, etc.

Apropos these investigations, hundred of compounds were formulated and examined. In addition, scores of primers and tie-cements were screened. These screenings were of an extensive nature owing to the fact that a primer or tie-cement that is compatible with and gives good results with one particular coating may be very unsuited for use with some other coating.

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In determining the overall worth of a component of a coating system, the following physical criteria were checked:

(1) The suitability of the coating to the production of films approximately ten mils thick (coating applied by brush or spray and cured, either at room temperature for a period of five to ten days or at 150°F for approximately twenty hours).

(2) The tensile strength of the film.

(3) The elongation at break.

(4) The diffuse reflectance.

(5) The peel-pull adhesion (to polyester glass fiber laminates).

In those instances where the coating application qualities, tensile strength, elongation at break, diffuse reflectance, and the peel-pull adhesion were considered satisfactory (coming up to certain minimum target requirements) the coatings were applied to air-foil specimens and submitted to the Cornell Aeronautical Laboratory for a determination of their resistance to rain erosion at 500 miles per hour under a simulated rainfall of one inch per hour.

One of the imporant criteria determining the efficacy of a rain erosion resistant coating has to do with the adhesion between the primer and the laminate, the primer and the body-coat, the primer and the tie-cement or between the tie-cement and the body-coat. These are all of equal importance, inasmuch as the overall adhesion can be no greater than that of the weakest link in the system.

There are many methods that have been used for the purpose of determining the degree of adhesion of elastomeric coatings. For the instant purposes, the various methods were examined and their advantages and disadvantages noted. It was concluded that a peel-pull technique would perhaps be the simplest and most satisfactory. However, to pre-eminently suit this technique to our specific application required a certain amount of research into the various manipulative techniques and variations. This phase of the work culminated in the development of the "Hop-Toad" peel-pull technique which was found to be simple to use in practice and which yielded reasonably consistent results.

As the work progressed it became more and more evident that the forces involved in the mechanism of adhesion as they relate to the execution of the peel-pull technique, involving as they do the slow and leisurely application of tensile pulls, may bear little, if any relation to the forces involved in the adhesion that is effective during the process of "whirling arm" rain erosion tests. This involves subjecting the coating system to a multiplicity of small but intense hammer-like compressual blows engendering impulses characterized by steep wave fronts and very short durations. This circumstance emphasizes the need for the development of a more relevant method for the determination of the effective adhesion so as to permit screening the various coating systems before running them on the costly "whirling arm" test.

There are two important studies being carried out in connection with subject contract (AF 33(616)-3027) viz; the development of a white electrically conductive (anti-static) rain erosion resistant coating and a heat and rain erosion resistant coating (preferably white and, where desired, electrically conductive). Because of the vast array of information that has been compiled, the present Technical Report is confined to the development work carried on under the subject contract as it relates to the development of a light-colored rain erosion resistant coating while the work relating to the development of light-colored electrically conductive coating and heat resistant coatings is presented in WADC TR 57-158, Part II.

SECTION II

GENERAL CHARACTERISTICS OF RAIN EROSION RESISTANT COATINGS

The damaging influences to which rain erosion resistant coatings are subjected appear to be primarily physical rather than chemical in nature. To be effective a rain erosion resistant coating must, in the process of protecting a laminate, shield and cushion it. While so doing the coating must absorb the bulk of the punishment. In absorbing the punishment a portion of the energy involved becomes dissipated as heat through hysteresis, while the bulk of the remaining energy is dissipated more slowly as heat by reflections back and forth. In a rough way the energy may be measured by multiplying the displacement of the affected area by the average stress that it is subjected to, in much the same way that we measure potential energy by measuring the stress by the displacement.

In order to have a measurable and significant displacement potential, a coating on a relatively rigid object must have a depth of thickness that can yield to the impact of impinging droplets of water together with the possibility for a certain lateral displacement. These factors are helpful in explaining why very thin coatings, e.g., of less than three mils, are not very effective and why, as the thickness of the coating increases, the resistance to rain erosion steadily increases. As one increases the coating thickness from say three mils, on upward there is a disproportionate increase in the resistance to rain erosion. As one increases the thickness beyond about twenty mils (in the instance of the usual elastomeric coatings) the rate of increase in the resistance to rain erosion levels off to a more or less straight line function.

The resistance of a given coating to rain erosion appears to be a function of a wide variety of factors which in varying degrees are involved in the mechanism of rain erosion.

Much study and research, largely sponsored by the Wright Air Development Center, has gone into study of the various phenomena involved in the mechanism of rain erosion. Notwithstanding, the detailed mechanics are still imperfectly understood. It is not known why coatings based on one elastomer may give results vastly different from those of coatings based upon other polymers, even though the tensile strength, elongation, modulus, and peel-pull adhesion of the two coatings may not be significantly different, e.g., one can produce coatings based upon natural rubber which are possessed of a higher tensile strength and elongation at break, less permanent set and a much higher resilience than the presently used rain erosion resistant coatings based upon neoprene.

Aside from the ability of the coating to resist rain erosion, the coating under development must also be possessed of a high degree of diffuse reflectance. This requirement of a high degree of diffuse reflectance renders the overall problem much more difficult because to obtain high diffuse reflectance it is necessary to load the composition with substantial quantities of white pigment. The inclusion of such pigment will generally have an adverse effect upon the rain erosion resistant qualities of the coating - perhaps because the coatings become somewhat less resilient and more sluggish as the quantity of resilience and highly compliable elastomer per unit volume is reduced. Numerous other factors are involved, e.g., the usual white pigments, in the quantities in which they must be used, reduce the tear resistanee of the compound.

There is not available, for purposes of guidance, a satisfactory theory which permits one to predict the rain erosion resistant qualities of any given coating. Thus we have no explanation as to why a hard-tempered glass has the limited rain erosion qualities that it has, or why a given plastic has its distinctive rain erosion resistant attributes as against those of some other material. This lack of knowledge, together with a lack of simple procedures to permit the determination of criteria which can be equated in terms of the resistance to rain erosion, constitutes a serious handicap. As a result, the resistance to rain erosion is usually determined via "whirling arm" tests. Only limited facilities are available for this work.

A substantial saving in time and money would result if there were available test procedures which would permit one to determine, in a rapid and inexpensive manner, criteria that would be useful in screening potential rain erosion resistant coatings to a point where only the most promising coatings would be subjected to the "whirling arm" test.

Some tests were carried out for the purpose of determining the effect of intense impulses of short duration upon bond strengths. The method utilized high velocity 22 caliber rifle bullets which were fired against a suitable steel mass resting against a 1/16" strip of neoprene sheetstock which was adhered to the rain erosion resistant coating system on a polyester glass fiber laminate. The results serve to confirm the observations noted in the ensuing Section.

SECTION III

SOME OBSERVATIONS IN CONNECTION WITH THE MECHANISMS INVOLVED IN "WHIRLING ARM" TESTS

The precise mechanics involved in the phenomenon of rain erosion are imperfectly understood. An insight into the causes of the failures as they manifest themselves in the "whirling arm" test might prove helpful. Discounting premature failures due to such obvious defects as defective air-foil laminates and very poor adhesions, there remains a substantial percentage of failures which occur before the normal processes of erosion have an opportunity to erode through the coating. Generally, such premature failures originate with the formation of blisters.

It is not possible to determine with any certainty whether blisters originate because of a loss of bond or because of the disintegration of the laminate or whether both types of failure occured simultaneously. If loss of bond occurs first, the resultant "free play" between the coating system and the laminate would be conducive to an early disintegration of the laminate structure, particularly if it had marginal strength. If the break occurs first in the laminate, then a loss of bond would almost inexorably follow.

An examination of air-foil specimens that have been subjected to the "whirling arm" test disclosed that portions, and frequently the entire underneath sides, of the leading edges of the air-foil specimens have taken on a distinctly white appearance due to a partial breakdown of the structure of the laminate. Evidently the successive hammer-like blows resulting from the impingement of rain drops against the rapidly moving air-foil induce such powerful impulses through the coating onto the comparatively brittle and inelastic laminate as to cause a breakdown of the structure. Repeated examinations have failed to disclose any measurable loss of bond of the coating system immediately above the whitened or injured areas along the leading edge. Microscopic examinations do not show any evidence of blisters or of bubbles about to form over the bulk of the whitened area. Where bubbles have formed, there is invariably a breakdown and pulverization of a portion of the laminate structure immediately beneath the bubble.

It appears that in the initial phases of the "whirling arm" test, it is the laminate that usually first reacts and undergoes failure. It is not so much the top layer of the glass fiber that is first affected as it is the layers deeper within the structure. As the test continues, the failure that has originated within the structure spreads out both in area and depth and makes its way to the surface to which the coating system is adhered. As the failure within the laminate structure (as observed by the progressive whitening of the laminate) spreads out it eventually makes contact with the coating system. When contact is made, it appears that the structural failure within the laminate becomes more severe and entails the pulverization and disintegration of the laminate structure, particularly in the region immediately beneath the coating system. As the pulverization and disintegration of the laminate structure immediately beneath the coating system occurs, a bubble or blister begins to form, due to the breaking of the bond between the coating system and the laminate proper. At the same time gases are liberated and the pressure exerted by the enlarged volume that the pulverized and disintergrated fragments occupy as against their original volume causes bubbles and blisters to be formed.

The minute, perhaps initially imperceptible, blister or bloated area grows to eventually be torn open by the powerful air currents and the continued impingement of rain drops. Once the bubble is broken open, the bulk of the pulverized and disintegrated material is washed out (although not infrequently where the blister has extended over a wide area a certain amount of the fragmented glass and resin may still be found in some recess or pocket of the blister).

While the above events may be occuring, the normal processes of erosion are taking place. When a blister has formed, the erosive processes may quickly puncture it. It is observed that in the case of many of the air-foil specimens that have been returned for examination, very little erosion has had an opportunity to occur due to the premature formation of the blisters that were engendered and broken open. In such situations the results of the "whirling arm" test essentially reflect not the intrinsic rain erosion resistant qualities of the coating system per se, but rather they reflect the qualities of the laminate (assuming that the bond between the coating system and the laminate is adequate).

A study of the results of "whirling arm" tests shows that, on the average, a standard ten mil thick neoprene rain erosion resistant coating, such as Goodyear's 23-56 or Gaco's N-79, resists the effects of rain erosion on the "whirling arm" at 500 miles per hour under a simulated rainfall of one inch per hour for a period of approximately sixty minutes. While a few of the best of the light-colored rain erosion resistant coating systems submitted by the Gates Engineering Company have shown times of 45,47, 50, 52, 57, 60, 66, 70 and 80 minutes, the average time of the best coatings is somewhere in the neighborhood of forty to fifty minutes compared to sixty minutes for a standard rain erosion resistant coating. The majority of coated air-foils failed prematurely owing to the formation and tearing open of blisters before the coating had time to erode through.

The effect of adding substantial quantities of pigments, such as titanium dioxide, to a neoprene coating is to lower the elongation at break, increase the Durometer hardness, and make the stock somewhat less resilient. It appears that such loaded coatings are inherently possessed of a somewhat poorer resistance to rain erosion than a corresponding pure gumstock of the same tensile strength. There is also considerable evidence to indicate that such pigment-filled coatings, perhaps owing to their lesser resilience, are somewhat less able to effectively cushion or shield the substrate and the bonding layer in the faying surface between the laminate and the coating from the effects of impinging rain drops. In short, the stiffer pigment-filled stocks allow more intense shocks or impulses to reach the bond and the laminate beneath. The result is that a laminate structure is more liable to internal injury when it is coated with a pigment-filled elastomer composition as against a pure gumstock coating.

As far as the ability of the coating itself to resist the effects of rain erosion is concerned, there are indications that by formulating the composition so as to yield pigment-filled structures which are physically stronger than the pure gumstock counter-parts, it is possible to increase the rain erosion resistance. It is believed that the rain erosion resistant qualities of some of the better white coatings developed in the present study are on a substantial parody with that of the conventional neoprene rain erosion resistant coatings. A neoprene rain erosion resistant coating such as Gaco N-79 has a minimum 2000 tensile strength and a minimum 750 percent elongation. Some of the newly developed coatings have strength of over 4000 psi and elongations in the neighborhood of 1000 percent. This "extra strength", as compared to that of the Gaco N-79, does not appear to increase the rain erosion resistance of the compound above that of the Gaco N-79, but it does appear to offset, in part, the deleterious effect of the presence of filler.

Because of the extra "stiffness" of the pigment-filled coating as against that of an unfilled composition, the forces that are brought to bear upon the bond between the coating and the substrate are greater than usual and as a result polyester glass fiber air-foils coated with pigment-filled neoprene coatings tend to lose bond more readily than when coated with Gaco N-79. This situation is best overcome by the use of better primers or bonding agents. Tests have shown that a standard rain erosion resistant coating, such as Gaco's N-79 or Goodyears' 23-56, has peel-pull adhesions of in the neighborhood of thirty pounds per inch width (arm moving at the rate of five inches per minute) when Bostik 1007 is used as the primer. Using appropriate primers or primers and tie-cements of the type screened in connection with the present study, it is possible to bond the pigment-filled light-colored neoprene based rain erosion resistant coatings so as to achieve peel-pull adhesions of well in excess of fifty pounds per inch width (some of the better systems give adhesions of between seventy-five and one hundred pounds per inch width) An examination of numerous returned air-foil specimens has given no indications that premature failures are actually attributable to loss of bond where substantial peel-pull adhesions were present. Only where peel-pull adhesions are substantially below fifty pounds per inch width, in the instance of pigment-filled compositions, do failures attributable to loss of bond occur.

Please note that the formation of blisters in general are not interpreted as a "loss of bond". Occasionally a blister may come into being because the adhesion was poor to begin with. However, the majority of blisters examined appeared to have come into being as a result of the afore-elucidated blister forming mechanism.

A white pigment-filled coating which, per se, has an adequate ability to resist rain erosion and an adequate bonding system are not in themselves sufficient to solve the overall problem of producing a coating system that can be applied over glass fiber laminates to protect the latter against rain erosion. This is so because even with a good white coating and a good bonding system, premature failures will still persist, owing to the inability of the polyester glass fiber laminate to withstand and absorb the punishment to which it is subjected by the impulses and shock waves communicated to it through the well bonded white coating system. It would appear that perhaps the best solution to this aspect of the problem would be to use stronger glass fiber laminates. It is known that epoxy glass fiber laminates are physically stronger and seemingly possessed of a better resistance to rain erosion than laminates based upon polyesters. It is therefore suggested that epoxy glass fiber laminates be specified in applications where a white rain erosion resistant coating is required.

The information gathered from a study of the results of the "whirling arm" tests may be summarized as follows:

(1) A standard Neoprene based rain erosion resistant coating of the type currently in use (as exemplified by Gaco N-79 and Goodyear's 23-56) can resist rain erosion under a simulated rainfall of one inch per hour at speeds of 500 miles per hour for approximately sixty minutes.

(2) A Neoprene coating similar to the above but filled with substantial quantities of white pigment, while possessing a tensile strength similar to the above, is much less resilient and does not resist the effects of rain erosion as well as the relatively pure gumstock.

(3) The better of the white colored Neoprene based rain erosion resistant coatings developed, (e.g. KV Nos. 8386-A, 8741, 9433, 8846, 9409, 9431, 9441 and 9443) are per se, possessed of a rain erosion resistance on a substantial parody with that of a conventional Neoprene rain erosion resistant coating (i. e., approximately sixty minutes under a simulated rainfall of one inch per hour at a speed of 500 miles per hour).

(4) The forces brought into play at the bonding line between the laminate and the coating system during the "whirling arm" test appear to be more severe and intense in the case of the pigment-filled less elastic coatings since there is a greater tendency toward loss of bond as against when a pure gum coating is used.

(5) It appears that the "loss of bond" referred to in Paragraph (4) can be eliminated through the use of stronger bonding systems- for glass fiber laminates.

(6) Polyester glass fiber laminated air-foil specimens, even when coated with the best of the white Neoprene coatings systems, usually fail in the "whirling arm" test due to a breakdown of the structure within the laminate which spreads out and results in the pulverization of the structure beneath the coating. This causes a blister to form which is soon torn open by the strong air currents and the continued impingement of rain drops.

(7) It is suggested that it may be possible to compose satisfactory coated radomes comprising a glass fiber laminate stronger than that of the Selectron 5003/ glass cloth combination and using the better of the white neoprene rain erosion resistant coatings developed in the present study together with one of the preferred bonding systems.

In the instance of 24 ST Aluminum air-foil specimens, failures frequently are due to a loss of bond. It appears difficult to achieve good bonds with the usual primers and tie-cements. For the reasons mentioned above, it appears that in the instance of pigment-filled coatings, a stronger than normal bond is required to withstand the forces engendered at the bonding interface. Sufficient work has not been conducted to screen out primer systems that are pre-eminently suited to this application.

SECTION IV

NEED FOR PRIMERS AND TIE-CEMENTS

None of the elastomeric solution coatings, of themselves, bond well to polyester glass fiber laminates. It is interesting to note that a coating which originally adheres well, may lose much of its adhesion as the cure progresses and the composition knits itself together more tightly. There are certain exceptions to this, notably where a chemical reaction occurs between the coating or the cross-linking agent and the substrate.

A possible explanation for this phenomenon is that at the start, there are available for purposes of internal or external bonding only a limited number of sites potentially capable of partaking in the mechanisms of adhesion, e.g., secondary valence bonds, hydrogen bonding, etc. As the cure progresses, an ever increasing proportion of these sites of potential bonding are consumed in the process of cross-linking, with the result that a correspondingly decreasing percentage of such sites will be available for adhering to outside materials. At the same time, in the interface between the polmer and substrate, there is usually a profound alteration of the forces involved in surface tension (wetting) phenomena.

It appears desirable that the coating continue to wet and remain in intimate contact with the laminate as the solvent evaporates, and that a continued equalization of internal stresses can occur while changes in the specific gravity and volume are taking place. Such a situation may be anticipated as being conducive to the formation of stronger bonds.

It is sometimes advantageous to utilize solvents or plasticizers that "bite into" the substrate to promote the possibility for a blend or mutual integration of compnents in the interface. It is usually desirable that the coating contain components which are compatible with those in the substrate. Where these relationships cannot be realized, one may be able to synthesize such a situation through the use of a primer or tie-cement specifically formulated to possess the requisite compatibility.

Another means of augmenting adhesion is via chemical bonding. For example, natural rubber compounds containing sulphur or sulphur-liberating materials can usually be made to yield exceptionally good bonds with copper, because some of the sulphur can cross-link a small portion of copper to some of the rubber. In many applications di-isocyanates can be used for such cross-linking. Generally, di-isocyanate primers, such as Gaco N-15, are quite effective in adhering various elastomeric coatings to a wide variety of substrates. The use of strongly polar compounds to promote adhesion through secondary valence forces is often effective. Many of the experimental primers used in the present study contained epoxies for this purpose.

In the light of the above, it becomes increasingly clear why primers or primers plus tie-cement are required. While the use of a primer or primer plus tie-cement may be conducive to the production of strong bonds, such components may also limit the serviceability of a rain erosion resistant coating system.

In the ideal situation the primer would tenaciously adhere to the substrate while the rain erosion resistant coating, in turn, would tenaciously adhere to the primer. In instances where this ideal situation cannot be realized, recourse may necessitate the use of tie-cement which would be used as coupling agents between the primer and the rain erosion resistant coating.

Another important role in which a primer or primer plus tie-cement may be able to function in augmenting the serviceability of a coating system might be conceived as being predicted upon the following considerations:

When a rain drop impinges against the rain erosion resistant coating, a sharp impulse, which may be characterized as a steeply fronted shock wave, passes through the body-coat to the tie-cement (if used), to the primer and, finally to the substrate itself (e.g., polyester glass fiber laminate). It is a well recognized fact that when energy is transmitted through a heterogeneous medium via a wave mechanism "things happen" when the wave reaches the interface between a medium possessing one set of properties and an adjacent medium possessing significantly different properties. In the instance of thermal waves and ordinary acoustic waves such well-known phenomena as reflection, refraction and diffraction may occur. In these transitional changes substantial physical forces are brought into play. If the magnitude of these forces is in excess of the limiting forces that the material at the relevant site can withstand, then a failure of one sort or another will occur.

Where the rain erosion resistant coating and the substrate are possessed of physically divergent qualities, the use of an intermediate cushion-like layer between the coating and the substrate would be advantageous. This would tend to reduce the abruptness of the propagating qualities that the shock wave would have to traverse.

Most of the primers that we have investigated to date which yield a good bond to the substrate, are possessed of more or less hard and brittle characteristics. A number of so-called semi-elastic primers were evaluated. While these yield good peel-pull adhesions and in some instances gave better peel-pull adhesion than the primers formerly used, they in no ways improved the ability of the coating system to withstand rain erosion. Premature failures usually occurred before the coating was eroded through. Similarly, the use of tie-cements that were possessed of propagating properties between those of the coating and the primer did not appear to help the situation. A possible explanation for these results, which offhand appear contrary to expectations, is set forth in Section III.

SECTION V

PRIMERS

Approximately 200 primers were investigated in respect to their efficacy (as based upon peel-pull tests) in adhering tie-cements or rain erosion resistant coatings to polyester glass fiber laminates. No one primer is outstandingly superior for any and every type of coating. Indeed, there is no one primer that is outstandingly superior for any one type of elastomer coating.

In examining the efficacy of primers for the subject application it was found desirable to examine each primer in conjunction with the best of several of the preferred elastomer coating systems. Toward this end, the various primers were examined with respect to the peel-pull adhesions obtained with:

(1) Gaco N-79, a standard dark-colored rain erosion resistant coating

(2) the best Neoprene coatings

(3) Hypalon coating XP-104

(4) the best polyacrylic rubber coatings

(5) the best polyacrylic rubber/Neoprene coatings

(6) the best Kel-F Elastomer coatings.

Upon a statistical basis it appears that the following are the "best" of the primers thus far examined for the coatings of greatest interest:

A. Among the best primers for use with Neoprene top-coatings (or the tie-cements used in conjunction with them) are the following:

Gaco N-15	Gaco KV-8510-D	Gaco KV-8536-D
Gaco KV-6006-N	Gaco KV-8510-E	Gaco KV-8542-J
Gaco KV-8502-C	Gaco KV-8510-G	Gaco KV-8544-J
Gaco KV-8502-K	Gaco KV-8510-K	Gaco KV-8582
Gaco KV-8506-N	Gaco KV-8534-G	Gaco KV-8583
Gaco KV-8510-B		

B. Among the best primers for use with polyacrylic rubber top-coatings are the following:

Gaco N-15	KV-8510-D	KV-8512-B	KV-8542-J
KV-8506-N	KV-8510-E	KV-8534-G	KV-8582
KV-8510-B	KV-8512-A	KV-8536-D	KV-8583

It is interesting to observe that in the case of some polyacrylic rubber top-coatings better results are obtained in the absence of a tie-cement as against when a tie-cement is used. The reverse is true in the case of other coatings based upon polyacrylic rubber while in still other cases it appears to make little difference whether or not a tie-cement is used.

C. Fair to poor peel-pull adhesions are obtained with Bondmaster M-618 as the primer for Kel-F Elastomer coatings. In some instances somewhat better results are obtained if the Bondmaster M-618 is used as the tie-cement and one of the following materials is used as the primer:

Gaco N-15	KV-8534-G	KV-8542-J	KV-8582
KV-8510-K	KV-8536-D	KV-8544-J	KV-8583

One difficulty that has been experienced in the bonding of Kel-F Elastomer coatings resides in the seemingly poor reproducibility factor, e.g., one day good peel-pull adhesions are obtained (using Bondmaster M-618 by itself or with a primer) while a few days later, using the same materials and application technique, the results may be much poorer for no apparent reason.

D. It appears that the primers which have been listed as preferred for use with Neoprene are equally effective for coatings based on Hypalon.

In tests where more than one coat of primer was applied, there usually was no significant difference in the results of the peel-pull adhesions tests. On the other hand, when the overall coating system is to conform to a specific maximum thickness, then it appears preferable to use but one coat of primer because the primers, per se, are possessed of little or no resistance to rain erosion. Any unnecessary thickness of primer reduces thickness of the protective rain erosion resistant coating.

Another consideration that may relate to the efficacy of primers is that it appears desirable that the solvents used are of a type that can bite into the substrate, i.e., be possessed of a good compatibility with the resinous or elastomeric base of the substrate. The same remarks are equally apropos the relationship of the tie-cement to the body-coat or the primer.

It is probably desirable that the primer, aside from serving in the capacity of an adhering aid, should be possessed of physical properties that permit it to function as an intermediary between the substrate and the body-coat. Consequently it should act as a stepping stone that smoothes out the transition in physical properties of the body-coat with those of the substrate. Because the primer is usually applied as a very thin coating, this is perhaps a relatively unimportant attribute and one which can more readily be incorporated into a tie-cement.

For purposes of convenience, it is desirable to have the primer pigmented so that one can more clearly see the areas that have been primed. The distinguishing color of a primer is also helpful in enabling one to identify where the break occurs in peel-pull tests; i.e., one can tell if the colored primer becomes lifted from the substrate, the body-coat becomes lifted from the primer, or the primer itself gives way.

When a tie-cement or body-coat is applied over the usual primers, a certain amount of intermixing of primer and body-coat occurs at the interface. This is particularly true when the coats are applied by brush. When one uses primers and body-coats or tie-cements of different colors and applies the coating system to a transparent or translucent substrate, one easily discerns the rather haphazard manner in which portions of the primer are almost wiped clean from the substrate and intermixed with the body-coat so that the latter is in virtually direct contact with the substrate. In the instance of primers which undergo a cure or which for other reasons are not softened or dissolved by the solvents in the body-coat the primer coat remains intact. In these situations the bond between the body-coat and the primer is often considerably poorer than what it is when a diffuse interlayer forms at the interface. One way to minimize the undesirable tendency of the body-coat to dissolve the primer is to spray apply at least the first coat of body-coat whence, with care, the balance of the coating may be brushed on. The spray technique has the advantage of keeping the diffuse interlayer within limits.

SECTION VI

TIE-CEMENTS

Over 150 tie-cements were investigated with respect to their efficacy in adhering rain erosion resistant coatings to primers on polyester glass fiber laminates. Because of the diversity in composition of the many primers, tie-cements and body-coats, it is an extremely involved task to select the most effective tie-cements. As a matter of fact, there is no "universal" tie-cement that is applicable to all systems. A given tie-cement may adhere tenaciously to one primer but poorly to another. One body-coat may adhere well to a given tie-cement while another does not. As a consequence, it is necessary to list not only the tie-cements but also the primers and the body-coats with which they work best.

The following are among the best tie-cements for use with Neoprene rain erosion resistant coatings (when used with appropriate primers):

Gaco KV-8600	Gaco KV-8374-G
Gaco KV-8366-D	Gaco KV-8718-H
Gaco KV-8704-G	Gaco KV-8722-H

The following are among the best tie-cements for use with polyacrylic rubber/Neoprene coatings or polyacrylic rubber.

Gaco KV-8600	Gaco KV-8736-D
Gaco KV-8366-A	Gaco KV-8826-D
Gaco KV-8704-G	Gaco KV-8506-N
Gaco KV-8502-K	

Of the tie-cement thus far investigated for use with Kel-F Elastomer coatings Bondmaster M-618 appears to give the best results (fair).

In the instance of Hypalon coatings such as Gaco XP-104, it appears that tie-cements are not required, but Gaco KV-8600 could be recommended.

It is only fair to point out that in many instances satisfactory bonds may be procured without the use of a tie-cement. It is suggested that if one has a given primer and rain erosion resistant coating one should run a series of comparative tests side by side, one with the use of a tie-cement and the other without, so as to ascertain whether or not the use of a tie-cement is advantageous. An examination of a few thousand coating systems indicates that in the majority of cases, the use of a tie-cement proved advantageous.

SECTION VII

OBJECTIVES OF HIGH PEEL-PULL ADHESIONS

The average peel-pull adhesions obtained with either Goodyear's 23-56 or Gaco's N-79 neoprene rain erosion resistant coatings are in the neighborhood of thirty pounds per inch width. It will be observed that many of the peel-pull adhesions obtained with the systems under development give values two to three times as great.

There are at least two reasons why it is desirable to obtain high peel-pull adhesions, namely:

(1) The usual rain erosion coatings often fail prematurely due to loss of bond. Seemingly, the bond is at best a borderline nature. Better peel-pull adhesions should permit the coatings to run on the "whirling arm" test until they are actually eroded through. Also, pigment-filled coatings seem to require stronger bonds.

(2) In the development of heat resistant and electrically conductive coatings, it is necessary to modify the coating systems through the incorporation of ionically conductive systems, special fillers, etc. The introduction of such

materials almost invariably lowers the physicals, including the peel-pull adhesions. It follows that if one can procure peel-pull adhesions substantially in excess of the minimums believed desirable, then there will be just that much more leeway with respect to the permissable down-grading of the adhesion that may occur as a result of the addition or alteration that may be called for.

SECTION VIII

ADHESION OF STANDARD RAIN EROSION RESISTANT COATINGS

For a coating to resist rain erosion and to protect the substrate beneath, the coating must be tenaciously adhered to the substrate so that it will not fail prematurely, due to "loss of bond", before it is eroded through. Neoprene-based rain erosion resistant coatings have been successfully used for many years - such coatings are typified by Goodyear's 23-56 and Gaco's N-79.

The afore alluded to neoprene coatings have an average resistance to rain erosion of approximately sixty minutes in a simulated rainfall of one inch per hour at a speed of 500 miles per hour when evaluated on the "whirling arm" of the Cornell Aeronautical Laboratory. In these "whirling arm" tests a variety of failures manifest themselves. Generally, however, the failure is one of true erosion. Occasionally, however, premature failures manifest themselves, at times owing to "loss of bond" and at other times due to failures which appear to originate in the laminate.

In the overall picture, it appears that while "loss of bond" does not appear to be a major factor in the failure of these coatings, the very fact that loss of bond is occasionally observed may be taken as an indication that the bonds are quite close to being on edge of the minimum acceptable value. In the light of this situation and for purposes of comparison, it was deemed desirable to determine the peel-pull adhesion that one procures with these standard Neoprene coatings using Bostik 1007 as primer, and polyester glass fibre laminates as the substrate. The results of numerous tests have shown that the peel-pull adhesion, when determined by the "Hop-Toad" technique, ranges between twenty-five and thirty-five pounds per inch width with the pulling arm moving at the rate of five inches per minute. The average peel-pull adhesion was in the neighborhood of thirty pounds per inch width.

Accordingly it was tentatively assumed, for screening purposes, that no coating systems should have a peel-pull adhesion of less than thirty pounds per inch width. Subsequent work indicated that in the instance of pigment-filled coatings the peel-pull adhesion should be substantially greater than thirty pounds per inch width because there were indications that such coatings, which are less resilient than pure gum coatings, allow more intense forces to be brought to bear upon the bonding line. It appears that peel-pull adhesions of at least fifty pounds per inch width are required in the instance of pigment loaded coatings to preclude or minimize failures due to "loss of bond" as distinct from other causes.

In the instance of metal surfaces it appears that even greater bonds are required. This is perhaps due to the fact that the difference in the structure, density, modulus of the elasticity, etc., between the metal substrate and the organic coating is much greater than the difference between such coatings and polyester glass fibre laminates - the greater the difference, the more intense the forces that can develop at the interface. To date no satisfactory bonding systems have been developed for use with 24 ST Aluminum alloy substrate even when special surface treatments are used. On the other hand, bonds in excess of sixty pounds per inch width are obtainable in the instance of sand-blasted steel, sand-blasted stainless steel, or plain sanded aluminum.

No primers or primer/tie-cement combinations have as yet been uncovered which yield adequate bonds with such materials as the silicone rubbers, and the majority of the fluorine containing elastomers.

SECTION IX

DETERMINATION OF BOND STRENGTHS VIA PEEL-PULL ADHESION TECHNIQUES

A review of the various methods for determining the adhesion of elastomeric coating systems to polyester glass fiber laminates led to the conclusion that some variation of the peel-pull technique would be desirable and satisfactory.

Peel-pull testing techniques are variously described in the literature. Also the Gates Engineering Company has been using such methods for about fifteen years, and upon the basis of this experience, was in an excellent position to work out the details to best adapt this method to the instant application.

There are many ways of carrying out the test. Each method gives somewhat different results and has its advantages and disadvantages. The following methods were investigated:

METHOD I Apply the coating to a thickness such that the tensile strength of the film is approximately twice that of the peel-pull value. Thus if the coating has a tensile strength of 1000 psi and a peel-pull value of in the neighborhood of fifty pounds per inch, a coating thickness of about 100 mils would be needed. The application of such a thick coat from low solid low viscosity solutions presents a difficult problem and may yield misleading results because of the repeated strike-throughs of the solvent and the long time required to assure the elimination of solvent. Accordingly, this method was shelved as impractical.

Instead of building up a thick strong film one may build in a "handle" by imbedding to the coating a piece of suitably woven cloth. A thin, high strength cloth "ribbon" is preferred. An open weave is desired because it permits of a more ready escape of volatiles and permits the film to cling to the cloth by enveloping it. The cloth may be of cellulose, synthetic (nylon, orlon, dacron, etc.) metal or glass fiber. For the purposes of this study, four types of fabric were tried.

METHOD II Aluminum wire screen cut into a one inch wide ribbon, was imbedded into the film. The procedure was to first paint the primed laminate with five, to seven coats of the rain erosion resistant body-coat. Then while the body-coat was still wet, to gently press into it the wire screen and to then apply three to four additional coats of body-coat. The drying and the curing was carried out in the usual manner.

The thickness of the wire screening necessitates building up a total coating thickness of at least thirty mils. It was difficult to get the wire to lay perfectly flat which results in an unevenness that promoted a variation in the measured adhesion. Because of this coating thickness it required a longer than normal drying period. The result was considered moderately satisfactory. If a less stiff and more conformable wire screening was used, it is probable that the method would be viewed with more favor.

METHOD III The procedure was the same as that outlined in Method II with the difference that a saran screen was substituted for the aluminum screen. The results are substantially a duplicate of Method II. The open structure of a screen is highly desirable and it is possible that if a softer and more pliable fibre were used, e.g., a soft grade of nylon, more satisfactory results could be obtained.

METHOD IV Glass fiber cloth was used in lieu of the aluminum or saran screenings used in Methods II and III. The results appeared less satisfactory owing to the fact that in the course of the peel-pull test, the glass cloth usually broke thread by thread.

METHOD V Nylon cloth in the form of a one inch wide ribbon with a fairly tight weave was used in the manner for the preceding three methods. The results were unsatisfactory because the weave was too close to permit the coating to adequately impregnate the ribbon and envelop the individual strands. However an eminently satisfactory bond between the pull tape "handle" and the body-coat in which it was imbedded was secured by first coating the ribbon with a primer and following this with one coat of an appropriate body-coat or tie-cement.

Through the proper choice of primer and tie-cement and with due regard to the timing, the above "processed ribbons" could be firmly stitched onto and adhered to the body-coat. Peel-pull tests via this method are fairly reproducible and easy to carry out.

Two major disadvantages of this method are (1) the necessity of preprocessing the ribbon, preferably not more than a few days before use and (2) the limited elasticity or stretchability of the nylon cloth "handle".

A variation of the peel-pull procedure that gives more consistant results and which it is reasonably easy to carry out, is based upon the use of an elastomeric "handle" made from Neoprene sheet stock. This method has the disadvantage that it requires several hours to a day longer than the foregoing methods, but this disadvantage outweighs the other Methods.

METHOD VI The laminate is primed and cured in the normal manner. The coating is then allowed to cure. Although the curing can be satisfactorily carried out at room temperatures in about seven days, it is more convenient to place the coated panel in an air-circulating oven, maintained at 150°F, for a period of ten to twenty hours.

A coat of Gaco N-29 tie-cement is applied to both the coating on the laminate as well as to a buffed side of a one inch wide Neoprene strip (about eight and one-half inches long and 1/16" thick). After an appropriate open assembly time usually requiring between one and two hours, the tie-cement coated Neoprene "handle" is firmly pressed (lengthwise, centrally located) on to the tie-cement coated laminate. To secure a firm and uniform bonding, a small roller (a so-called "stitching tool") is used.

The above is placed in an oven at 150°F for a period of eight to sixteen hours so as to firmly bond the rubber "handle" to the top of the body-coat. Tests have shown that this additional curing has a negligible effect upon the already cured rain erosion resistant coating. The cured assembly is removed from the oven and allowed to cool to room temperature. Before placing the test assembly into the Scott Tester, one runs a sharp knife or razor blade lengthwise down along each edge of the Neoprene "handle", cutting through the coating and masking tape down to the laminate.

To facilitate the placement of the test assembly into the Scott Tester, a simple jig was designed for this purpose. (Please see Figure 1 for a sketch of the jig). The frame is made from one-half inch angle iron. The inside dimensions of the holder are two and one-eighth inches by six and one-eighth inches). The jig is secured to the moving arm of the Scott Tester. The test assembly is placed into the holder with the rubber "handle" pulled up between the frame of the jig. The "handle" is placed into the jaws of the upper fixture of the Tester. It has been found convenient to have the moving arm of the Scott Tester move at a rate of five inches per minute - the actual rate of peel is very slow as the bulk of the motion is consumed in stretching the rubber strip.

It has been observed that the effort required to effect the first substantial peeling is often much greater than what is subsequently required. In the initial stages of our investigations, the initial abnormally high peel-pull readings were disregarded. However, further investigations disclosed that the initial values were more significant than the values obtained after the peeling had started.

The method just described is easily carried out and is characterized by an unusually good constancy and ready reproducibility. For these reasons, the method has tentatively been adopted by our laboratory for determining the bond strength of inter-coat and system adhesions to polyester glass laminate and other substrates.

SECTION X

IMPROVED PEEL-PULL ADHESION TECHNIQUE - "HOP-TOAD" VARIATION

An examination of the mechanics involved in the peel-pull test discloses that the initial peel-pull value is generally substantially higher than the values subsequently registered. The explanation appears to reside in the fact that initially a very considerable pull is applied to the "handle" right on through to the weakest link in the coating system. As the pull increases however, a break eventually occurs and the "handle" with adherent material peels away.

Once a "peel-line" has been established it usually persists and acts like a plane of cleavage. As the peel progresses, the line of peel may not transfer itself to the waker section, because to do so would necessitate breaking and tearing apart the intervening layers. The result is that the readings do not necessarily reflect the value of the weakest link in the coating system.

In order to obtain a more meaningful average value, it is necessary to run peel-pull adhesions on at least five specimens. This would be unduly time consuming and costly, as it would involve an unnecessarily large amount of work and tie up the equipment for extended periods of time. To circumvent these difficulties, the following variation of the peel-pull technique referred to under "Method VI" was evolved.

The two inch by six inch panels of polyester glass fiber laminate (or other substrates) are first banded with five or six strips of one half inch wide masking tape. The strips are applied at right angles to the length, allowing about one half inch to three fourth of an inch between the strips. The coating system is then applied over the stripped panels, i.e., over both the masking tape as well as the exposed areas between the strips of masking tape. From here on, the procedure of adhering the neoprene peel-pull "handle" is similar to that set forth in connection with Method VI.

After cure, one runs a sharp knife or razor blade lengthwise down alongside each edge of the neoprene "handle" cutting through the coating and masking tape down to the laminate. The peel-pull "handle" is peeled back manually for a distance of about one fourth of an inch and the panel is then placed into the jig in the manner already described.

In the process of pulling, the reading obtained is a measure of the actual adhesion of the coating system or of the inter-coat adhesion at that point. As the peeling progresses, it soon advances to a strip of masking tape, which has a very poor adhesion to the laminate, with the result that the masking tape lets go of the laminate and the "handle", together with the adherent coating and masking tape, leaps or "hops" to the next bonded area, at which time the Scott Tester is re-zeroed. As the pull continues, the new adhesion area comes into play and we again obtain a relevant reading reflecting the weakest point of the system in that particular region. This process is continued until four or five successive readings have been taken.

It has been found desirable to average out the three highest of the five readings and to record the results as representing the average peel-pull adhesion of the coating system under test.

This "Hop-Toad" variation of the peel-pull technique is easy to carry out and is characterized by a high degree of reproducibility. It is believed to reflect a truer picture of the actual adhesion than any of the other methods we have described.

The method is applicable to a wide variety of coating systems. It fails only in those cases where there is no suitable means of adhering a peel-pull "handle" to the coating system. In the case elastomeric coatings other than Neoprene, which may be more difficult to adhere; good results can frequently be obtained with the following modification.

A coat of an appropriate tie-cement (Gaco N-29 is recommended as being suitable for use where the coatings are based upon Neoprene, Hypalon, Polyacrylic rubber or Buna N) is applied over the last coat of body-coat that has been applied before the latter has had a chance to dry too far. In this manner, the tie-cement tends to "bite" into the body-coat. The coated panel is then cured as usual. After curing, a coat of tie-cement is applied both to the Neoprene "handle" as well as to the cured coat of tie-cement on the panel. After an appropriate open assembly time, one proceeds in the manner previously outlined in connection with the "Hop-Toad" variation.

Presently this technique is not applicable to coatings based upon silicones and fluorine containing elastomers, owing to the absence of suitable tie-cements.

SECTION XI

PEEL-PULL ADHESIONS OF WHITE RAIN EROSION RESISTANT COATINGS

The hundreds of coatings, primers, and tie-cements screened in the present study were examined for their peel-pull adhesion to polyester glass fiber laminate, as well as to certain other selected metal substrates.

Because of the large amount of data amassed, only somewhat over half of the relevent portions of this study have been included in the tabulation. The results of the peel-pull values over polyester glass fiber laminates are set forth in Table IV, while the results obtained over metal substrates are set forth in Table V.

A study of the results has disclosed many interesting features much too numerous to elaborate here. However a few generalizations may appropriately be touched upon which are set forth below:

(1) Neoprene based coatings appear to be more easily bonded than any other type of elastomer thus far examined. A host of suitable primers is available. Usual tie-cements are not required, but in many instances their use does give slightly better results.

(2) Neoprene coatings can be firmly bonded to sand-blasted steel, sand-blasted stainless steel, brass, copper, commercial aluminum, and probably many other metals. It cannot be bonded as firmly to magnesium, magnesium alloys, or aluminum alloys such as 24 ST with the primers or tie-cements presently available.

(3) Hypalon coatings will adhere moderately to both polyester glass fiber

laminates and to various metals. Peel-pull adhesions however, are only about half of what can be obtained with Neoprene.

(4) Polyacrylic rubber coatings are more difficult to adhere than Neoprene. However, some of the later white Polyacrylic rubber coatings give good to excellent adhesions with certain primers. Often the adhesion is better in the absence of a tie-cement which is contrary to earlier indications.

(5) Other elastomers, such as those based upon brominated Butyl rubber, Buna-N and Thiokol, and the many combinations of two or more such polymers can be bonded with fair to good results. In general with any given coating of this type, it is just a matter of running adhesions with a number of selected primers/tie-cement to ferret out a good bonding system.

(6) To date, no satisfactory means have been found of firmly bonding liquid coatings based upon Silicon rubbers or fluorine containing rubbers, such as Kel-F Elastomer, Fluoro Rubber 1F4 or Viton A.

(7) Certain Polyacrylic rubber coatings, when applied to aluminum and heated to 400°F, tend to flux down and become exceptionally well bonded to the substrate.

(8) The introduction of ionically conductive systems into elastomeric combinations has a tendency to reduce the adhesion slightly.

(9) The introduction of fillers into an elastomeric coating generally has an effect upon the adhesion. This varies from filler to filler as well as upon the amount of filler incorporated into the coating. The incorporation of large quantities of most fillers adversely affects the adhesion.

(10) In the instance of white rain erosion resistant coatings based upon Neoprene, Polyacrylic rubber, or combinations of the two, it is generally possible to procure a high degree of adhesion.

(11) Standard Neoprene rain erosion resistant coatings, such as Goodyear's 23-56 and Gaco's N-79, show a peel-pull adhesion of twenty-five to thirty-five pounds per inch width when Bostic 1007 is used as the primer.

(12) The two coatings referred to above give peel-pull adhesions of sixty to eighty pounds per inch width when used in conjunction with superior primers such as di-isocyanate or epoxy modified primers.

(13) In "whirling arm" tests, if the peel-pull adhesion of a coating to polyester glass fiber laminate is less than about thirty pounds per inch width, one is apt to encounter premature failures that may be attributed to "loss of bond".

(14) In the instance of a coating such as Gaco N-79 and Goodyear's 23-56, as the peel-pull adhesion is raised substantially above thirty pounds per inch width, there is no increase in the resistance to rain erosion, presumably because the coating is eroded through and the "extra" bond is of no value. There are indications that the thirty pounds per inch width peel-pull bond is on edge, as occasionally even these coating systems fail in the "whirling arm" test due to apparent "loss of bond".

(15) It appears that in the instance of white rain erosion resistant coatings a better bond is required to minimize premature failure in the "whirling arm" test due to loss of bond. This is due to firmer, less elastic, pigment-filled coatings where greater forces are communicated to the coating and brought to bear upon the adhesion line. In the instance of light-colored Neoprene rain erosion resistant coatings, it is believed that the requisite high order of bond is available.

SECTION XII

ELASTOMERS AND ELASTOMER COMBINATIONS SCREENED AS REGARDS THEIR UTILITY IN THE PRODUCTION OF WHITE RAIN EROSION RESISTANT COATINGS

Elastomeric polymers thought to be of interest in connection with the present study were investigated and subjected to a preliminary screening as regards to the following criteria:

(A) (1) Ease with which the polymers could be brought into a state of solution

(2) Ease with which the polymer solution could be brushed or sprayed

(3) Facility with which the coatings could be cured at room or at slightly elevated temperatures

(4) Shelf and pot lifes

(5) Tensile strength

(6) Elongation at break

(7) Diffuse reflectance

(8) Compatibility and ease with which the coating solutions could be applied over primers or tie-cements

(9) Adhesion to polyester glass fiber laminates, aluminum, 24 ST aluminum, steel.

(10) Rain erosion resistance in conjunction with appropriate tie-cements.

In many instances it was necessary to examine various manipulative techniques and comparative methods so as to optimize the inherent attributes of a particular polymer to effect maximum solution stability, etc.

In all, 846 formulations were compounded and screened in the aforeindicated manner. Over 10,000 peel-pull specimens, involving 50,000 readings, were taken. The following twenty elastomers were screened in regards to the above criteria;

(B) (1) Brominated Butyl Rubber (Goodrich)

(2) Buna-N

(3) Chlorinated Rubber (Parlon, twenty seconds)

(4) GR-S Rubber

(5) Hypalon 20

(6) Kel-F Elastomer 3700

(7) Kel-F Elastomer 5500

(8) Natural Rubber (Smoked Sheet)

(9) Neoprene AC

(10) Neoprene GN

(11) Neoprene GN-A

(12) Neoprene GRT

(13) Neoprene KNR

(14) Neoprene W

(15) Neoprene WRT

(16) Polyacrylic Rubber (Hycar 4021)

(17) Polyisobutylene (Vistanex L-100)

(18) Thiokol LP-2

(19) Thiokol LP-3

(20) Thiokol LP-8

The following formulations, based upon the indicated elastomer combinations, were investigated;

(C) (1) Brominated Butyl Rubber/Neoprene AC

(2) Buna-N/Hypalon

(3) Buna-N/Natural Rubber

(4) Buna-N/Neoprene AC

(5) Buna-N/Polyacrylic Rubber

(6) Chlorinated Rubber/Neoprene

(7) GR-S Rubber/Neoprene AC

(8) Hypalon/Natural Rubber

(9) Hypalon/Neoprene AC

(10) Hypalon/Neoprene GRT

(11) Hypalon/Polyacrylic Rubber

(12) Kel-F Elastomer/Neoprene AC

(13) Natural Rubber/Neoprene AC

(14) Natural Rubber/Polyacrylic

(15) Neoprene AC/Neoprene GN

(16) Polyacrylic Rubber/Neoprene AC

(17) Polyacrylic Rubber/Neoprene GNA

(18) Polyisobutylene/Neoprene AC

(19) Thiokol LP-2/Neoprene AC

(20) Thiokol LP-3/Neoprene AC

(21) Thiokol LP-8/Neoprene AC

(D) No work has as yet been carried out with the following polymers. However, work with some of these polymers has been scheduled or is just getting underway;

(1) Silicone Rubbers

(2) Fluoro-Rubber 1F4 (formerly Poly-FBA)

(3) Fluoro-Rubber - Blends

(4) Fluoro-Rubber - DuPont's Viton A

(5) Polyurethane Rubber (Adiprene "L")

SECTION XIII

QUANTITY AND TYPE OF WHITE PIGMENT REQUIRED TO PRODUCE COATINGS POSSESSED OF A HIGH DIFFUSE REFLECTANCE

The many white pigments that are commercially available differ from one another in composition, whiteness, brightness, opacity, hiding power, tinting strength, mineral hardness, chalkings, refractive index, oil absorption, chemical reactivity, specific gravity, crystal type, crystal form, particle size, bulking value, etc. The majority of the available white pigments are not capable of yielding elastomeric rain erosion resistant coatings possessed of an average diffuse reflectance of not less than 85 percent in the wave length range of 0.4 to 2.0 microns.

It appears that only the commercially available pigment grades of titanium dioxide are satisfactory for use in the subject coatings. Even then meticulous care as to cleanliness and composition must be exercised to obtain the maximum diffuse reflectance.

Titanium dioxide is available in three different crystalline modifications which are identified as anatase, rutile and brookide. The anatase and rutile are the usual forms of the commercially available titanium pigments.

The quantity of white pigment required to achieve a given degree of whiteness is dependent upon a variety of factors, including the reflective index of the pigment as compared to the color of the matrix, etc. A major controlling factor is the quantity of pigment that can be tolerated in the coating from the standpoint of electrical transmission characteristics, the physical strength and the resistance to rain erosion. If the minimum amount of pigment that is required to achieve the minimum acceptable diffuse reflectance is in excess of the maximum amount of pigment that the coating can tolerate from the standpoint of resistance to rain erosion or the electrical transmission qualities, then the problem has no practical solution with the pigment in question. Fortunately, it appears that the solution to the immediate problem is just within the realm of the practical.

In most of the coatings that have been prepared, the rutile type of titanium dioxide was used because it offers a greater hiding economy and is "whiter" than the anatase type. However, it is to be observed that in the wave lengths region between 0.375 and 0.425 the anatase variety has a significantly higher diffuse reflectance, which one may be able to capitalize upon so as to bring up the diffuse reflectance in the blue region of the spectrum, where most of the coatings have shown a comparatively poor diffuse reflectance. A combination of anatase with rutile pigment may offer interesting possibilities.

It has been ascertained that the optimum amount of titanium dioxide to use, from the combined standpoints of the diffuse reflectance and the minimum deterioration of the physicals of the coatings, is in the vicinity of fifty parts by weight of pigments per 100 parts of elastomers. Larger and smaller quantities of pigments were tried.

For purposes of study, pigments with both lower and higher specific gravities than that of titanium dioxide were investigated to see if there were any significant relationship between the density of the cured films and their resistance to rain erosion. No significant relationship was found.

In general, as the pigment loading is increased the tensile strength, and more particularly the elongation at break, is diminished. At the same time a reduction in the resilience or snappiness of the stock is noted. This deterioration in the physicals of the coating can be offset to some extent via the use of improved curing systems. Through the use of such improved curing systems, it is possible to produce elastomeric coatings possessed of a diffuse reflectance close to the minimum desired value while retaining tensile strengths comparable to, or in excess of, those of unpigmented pure gumstocks.

White Neoprene coatings loaded with appropriate quantities of white pigment are inherently possessed of a poorer resistance to rain erosion than corresponding pure gumstock coatings. It appears that a resistance to rain erosion comparable to that obtainable with a pure gumstock can be obtained by substantially strengthening the coating through the use of appropriate curatives.

White coatings which are intrinsically, per se, possessed of a rain erosion resistance comparable to that of a pure gumstock, when applied over a polyester glass fiber laminate do not show a resistance to rain erosion as good as that of the pure gumstock. The explanation for this resides in the fact that the <u>highly loaded coatings require both a better bonding system as well as a stronger laminate than what the pure gum coatings require</u>. It appears that when the coating is highly loaded with pigment, it becomes less elastic and has a reduced ability to shield or cushion both the bond and the laminate beneath. Evidently, when the pigment loaded coating on a laminate is subjected to the "whirling arm" test, more intense impulses or steeply fronted shock waves are transmitted through the coating to the laminate and the bond, with the result that greater forces are brought to bear upon both the bond and the laminate. To cope with these increased forces requires a stronger bond and laminate.

It is believed that the better of the bonding systems available for use with white Neoprene rain erosion resistant coatings are adequate. What is still needed is a laminate stronger and more resistant. Perhaps epoxy bonded laminate will fulfill this requirement.

The formulation of the various white coatings that have been prepared are set forth in Table I; while the diffuse reflectance, the resistance to rain erosion, and the peel-pull adhesions are set forth in Tables II, III, IV and V respectively. Data relative to pigmented coatings modified with ionic agents and data relative to heat resistance is presented under separate cover in Part II of the present report.

SECTION XIV

COATINGS PREPARED FROM VARIOUS ELASTOMERS AND ELASTOMER COMBINATIONS

For convenience, the 846 coating formulations prepared in connection with the present study have been catalogued so as to simplify the task of finding formulations made with a given elastomer or combination of elastomers. The identifying numbers of the coatings are listed alongside the polymers used. The formulations are presented in a more or less chronological order, which closely parallels the identifying number. This should aid in finding specific coatings in terms of their identifying number.

The formulations are presented in Table I. The diffuse reflectances, resistances to rain erosion, peel-pull adhesions to polyester laminates and peel-pull adhesions to metallic substrates are set forth in Tables II, III, IV and V respectively.

ELASTOMER (S)	FORMULATION NUMBER (S)
Brominated Butyl Rubber/Neoprene AC	KV-8326-A to F
Buna-N/Hypalon	KV-8382-A to C
Buna-N/Natural Rubber	KV-8344-A to F
Buna-N/Neoprene AC	KV-6958-P KV-6978-P KV-8332-A to F
Buna-S/Neoprene AC	KV-6958-Q
Hypalon - 20	KV-8391 GACO XP-104
Hypalon/Natural Rubber	KV-8346-A to F
Hypalon/Neoprene AC	KV-6858-N KV-8324-A to F
Hypalon/Neoprene GRT	KV-8702-A to H
Kel-F Elastomer	KV-8304-A KV-8382-D,F,G,H KV-8720-A to F KV-8882-A to C KV-9316-A to E KV-9362-A to F KV-9384-A to H
Natural Rubber	KV-7008

Natural Rubber/Neoprene AC

KV-6958-S	KV-6988-W	KV-8328-A to F
KV-6986-2-P	KV-7011-A	KV-8780-A to D
KV-6988-R	KV-8315	

ELASTOMER(S) | **FORMULATION(S)**

Neoprene AC

KV-6906-F
KV-6928-B-2
KV-6934-J
KV-6934-Q
KV-6940-C
KV-6942
KV-6950-B
KV-6978-T
KV-6978-V
KV-6986-2-K

KV-8780-E to F
KV-8782-A to D
KV-8824-B to D
KV-8824-E to G
KV-8830-A to C
KV-8830-D to F
KV-8830-G to H
KV-8838-A to H
KV-8840-A to H
KV-8842-A to H
KV-8844-A to H
KV-8846

KV-7007-A
KV-8303-B
KV-8303-C
KV-8358
KV-8359
KV-8360
KV-8368-A
KV-8368-B
KV-8376-A to H
KV-8384-A & F
KV-8386-A to D
KV-8864-A to H
KV-8868-A to F
KV-9318-A to H
KV-9320-A to H
KV-9322-A to H
KV-9324-A to H
KV-9326-A to H
KV-9332-A to D
KV-9338-A to H
KV-9394-A to H
KV-9409
KV-9412-A to H
KV-9414-A to H

KV-8386-E to H
KV-8394
KV-8732-A to H
KV-8734-A to H
KV-8758-A to H
KV-8760-A to H
KV-8762-A to H
KV-8770-A to H
KV-8772-A to H
KV-8774-A to H

KV-9428
KV-9429
KV-9431
KV-9433
KV-9434
KV-9435
KV-9436
KV-9472-A to H
KV-10702-A to H
KV-10704-A to H
KV-10710-A to H
KV-10721

Neoprene AC - Conductive Coatings

KV-6955-B
KV-8778-A to D
KV-8778-E to H
KV-8874-A to H
KV-8876-A to H

KV-8878-A to H
KV-8880-A to H
KV-9474-A to H
KV-9478-A to H

Neoprene AC/Neoprene GN

KV-9476-A to H

Neoprene GN

KV-9354-A to H
KV-9356-A to H
KV-9386-A to H
KV-9416-A to H

KV-9418-A to H
KV-9441
KV-9443
KV-10706-A to H

Neoprene GN-A

KV-6916-A
KV-7007-E

Neoprene GN-A - Conductive

KV-9480-A to H

Neoprene GRT

KV-6974-J
KV-8780-G & H

ELASTOMER(S)	FORMULATION NUMBER(S)
Neoprene KNR	KV-7007-F
Neoprene W	KV-7007-C
Neoprene WRT	KV-7007-D KV-6982-2-B

Polyacrylic Rubber

KV-8310-A	KV-9306-A to H	KV-9380-A to H
KV-8310-B	KV-9310-A to H	KV-9396-A to H
KV-8310-C	KV-9328-A to H	KV-9398-A to H
KV-8310-D	KV-9336-A to D	KV-9420-A to H
KV-8318-A to H	KV-9340-A to F	KV-9425
KV-9304-A to H	KV-9352-A to G	KV-9427
KV-9449	KV-9455	KV-9466-A to H
	KV-10708-A to H	

Polyacrylic Rubber/Buna-N	KV-8340-A to F
Polyacrylic Rubber/Hypalon	KV-8330-A to F
Polyacrylic Rubber/Natural Rubber	KV-8342-A to F

Polyacrylic Rubber/Neoprene AC

KV-6978-Q	KV-8784-E to H	KV-9437
KV-8310-E	KV-8832-A to E	KV-9438
KV-8320-A to H	KV-8870-A to H	KV-9450
KV-8361	KV-8872-A to H	KV-9451
KV-8362	KV-9302-A to H	KV-9452
KV-8378-A to H	KV-9330-A to H	KV-9453
KV-8748-A to H	KV-9334-C,D,G,H	KV-9456
KV-8754-A to H	KV-9390-A to H	KV-9457
KV-8766-A to H	KV-9392-A to H	KV-9458
KV-8782-E to H	KV-9407	KV-9459

Polyacrylic Rubber/Neoprene GN-A	KV-8750-A to J KV-8768 KV-8776-A to G KV-8784-A to D
Polyisobutylene (Vistanex L100/Neoprene AC	KV-6958-R
Thiokol/Neoprene AC	KV-7010-A to E KV-8313

Brominated Butyl Rubber - It was not found possible to prepare liquid coatings from this polymer which could be cured at room temperatures or below 150°F to yield films possessed of substantial strength. However, some combinations with Neoprene yielded more satisfactory results.

GR-S Rubber - It was not found possible to prepare liquid coatings from this polymer which could be cured at room temperatures or below 150°F to yield films possessed of substantial strength. However, some combinations with Neoprene yielded more satisfactory results.

Thiokols LP-2, LP-3 and LP-8 - It was not found possible to prepare practical, light-colored, readily cured coatings from these polymers which yielded films possessed of adequate physicals. However, coatings prepared from combimations of Thiokol with Neoprene AC showed some improvement. The Thiokol warrant further investigation (information from the field indicates that one firm has prepared experimental Thiokol coatings which look quite promising, in spite of their softness and seemingly low strength).

Polyisobutylene - It was not found possible to prepare air curing light-colored coatings from this polymer. Combinations with Neoprene are of possible interest.

Chlorinated Rubber - Chlorinated rubber yields strong, hard films possessed of insufficient rubbery elasticity to warrant their consideration as elastic rain erosion resistance coatings. Chlorinated rubber is of interest as a modifying agent for other elastomers.

SECTION XV

EFFECT OF FILLERS OF DIFFERENT SPECIFIC GRAVITIES UPON THE PHYSICAL PROPERTIES OF NEOPRENE VULCANIZATES

There is much about the mechanism of rain erosion that remains shrouded in mystery. A question that often comes to the fore is why is it that neoprene coatings are distinctly superior to most other coatings even though the other coatings may be just as good or better as regards such criteria as tensile strength, modulus, elongation at break, resilience, resistance to weathering, etc. One may theorize that the fact that Neoprene contains within its polymeric structure a substantial percentage of chloric atoms, weighing more than carbon atoms or hydrogen. This condition may have something to do with its good performance, in that it may have a bearing upon the ease and the manner in which energy impinging upon such a coating is distributed and dissipated.

It would be of interest to know the effect, of substantially loading the Neoprene, on a constant volume basis, with fillers of varying specific gravities.

The immediate effect of varying the specific gravity of the filler is to bring about a corresponding variation in the specific gravity of the ultimately cured film. The velocity of propagation of mechanical or acoustic waves is influenced by the density of the compound.

The following fillers were evaluated in Neoprene coatings for convenience, the specific gravities and the tensile strengths and elongation at break are listed:

Filler	Specific Gravity	Tensile Strength psi	Elongation at Break %
Thermax (Carbon Black)	1.80	3751	807
Silene EF	2.10	3214	773
Titanium Dioxide	4.26	3525	847
Zinc Oxide	5.60	3761	827
Zirconium Oxide	5.71	3402	793
Basic Lead Phosphite	6.94	3357	667
Thorium Oxide	9.69	Oxide Not Available	

The peel-pull adhesions obtained with the above coatings were uniformly good. The resistance to rain erosion did not show any significant difference between the various fillers.

SECTION XVI

HYPALON COATINGS

Hypalon is a chloro-sulfonated polyethylene elastomer whose vulcanizates are possessed of distinctly rubbery attributes. This elastomer is of interest because it is light in color, has a heat resistance slightly superior to that of conventional Neoprene-based compounds and is substantially immune to the effects of ozone. On the basis of numerous coatings based upon this elastomer, prepared by various concerns and subjected to the "whirling arm" test, it would appear that the rain erosion resistance coatings based on this polymer is in the order of between three and fifteen minutes. While the indicated resistance to rain erosion is much poorer than that of good Neoprene coatings it is of interest because it permits the production of white coatings possessed of a good resistance to discoloration.

Many of the "whirling arm" failures appear to be due to "loss of bond" and, accordingly, a major effort was made to screen various primers as well as primer/tie-cement combinations with a view of improving the bond. The usual Bostik 1007 primer yields peel-pull adhesions of less than ten pounds per inch width. As a result of the screening tests carried out in connection with the present project, various primers and primer/tie-cement combinations were found which gave greatly improved peel-pull adhesions.

Little time was spent with this elastomer or with combinations of this elastomer with Natural Rubber, Neoprene, Polyacrylic Rubber or Buna-N because (1) the rain erosion resistance of such coatings appears poor as compared to that of Neoprene and (2) the maximum average diffuse reflectance obtainable with this polymer falls short of the desired 85 percent and is inferior to that of the initial reflectance of light-colored coatings based upon Polyacrylic Rubber, Kel-F Elastomer or Neoprene AC.

For convenience, the following numbers identify the Hypalon containing coatings that were prepared:

Buna-N/Hypalon	KV-8382-A
	KV-8382-B
	KV-8382-C

Hypalon/Natural Rubber

KV-8346-A	KV-8346-D
KV-8346-B	KV-8346-E
KV-8346-C	KV-8346-F

Hypalon/Neoprene AC

KV-6885-N	KV-8324-D
KV-8324-A	KV-8324-E
KV-8324-B	KV-8324-F
KV-8324-C	

Hypalon/Neoprene GRT

KV-8702-A	KV-8702-E
KV-8702-B	KV-8702-F
KV-8702-C	KV-8702-G
KV-8702-D	KV-8702-H

Polyacrylic Rubber/Hypalon

KV-8330-A	KV-8330-D
KV-8330-B	KV-8330-E
KV-8330-C	KV-8330-F

Hypalon - 20

KV-8391
XP-104

Most of the work was done with the Hypalon coating "XP-104", inasmuch as this is a commercially available material whose physicals were equal to or superior to most of the other Hypalon coatings prepared.

Data with respect to the peel-pull adhesions are listed in Table IV. For convenience, the pages upon which peel-pull data relating to Hypalon coatings appear, are listed below:

K-107	K-116	K-135	K-158	K-183	K-625
K-108	K-120	K-138	K-161	K-184	K-626
K-109	K-121	K-141	K-164	K-188	K-842
K-110	K-124	K-143	K-166	K-215	K-856
K-111	K-127	K-146	K-168	K-216	K-857
K-112	K-130	K-149	K-171	K-217	K-879
K-113	K-133	K-152	K-173	K-221	K-880
K-114	K-134	K-155	K-177	K-233	

The results of the "whirling arm" tests, carried out by the Cornell Aeronautical Laboratory, are contained in Table III.

SECTION XVII

KEL-F ELASTOMER COATINGS

Forty coating compositions were prepared from Kel-F Elastomers 3700 and 5500. The formulations differed from one another in the type of polymer, filler, solvents and curing agents used.

Coatings were brush applied in the usual manner and subjected to cure at various temperatures. Room temperature cures were not very effective. Cures at 150°F and more particularly, at 225°F, gave close to optimum results, while the use of still higher temperatures, e.g., 300°F or 400°F yielded somewhat poorer results. Kel-F Elastomer coatings have a good diffuse reflectance and resistance to discoloration.

The rubbery vulcanizates that can be prepared from Kel-F Elastomer are possessed of good heat resistance and are of interest in connection with the development of white rain erosion resistant coatings capable of withstanding elevated temperatures.

One of the major difficulties centering around the use of Kel-F Elastomer solution coatings stems from the fact that it is difficult to firmly bond them to any of the usual substrates. Many peel-pull adhesions have been run using most of the common primers and tie-cements - the results have all been uniformly unsatisfactory.

However, during the later phases of these investigations, somewhat improved bonds have been obtained through the use of a primer known to the trade as Bondmaster M-618. Further slight improvements have been made by using various of the better primers that have been used with the other elastomers and using the Bondmaster M-618 as a tie-cement. In this manner it has been possible to occasionally obtain peel-pull adhesions of in the neighborhood of twenty-five to thirty pounds per inch width as against the three to ten pounds values that have hithertofore been obtained. The reproducibility factor is poor.

One of the apparent shortcomings of the Kel-F Elastomer coatings thus far prepared resides in their comparatively poor elongations at break and lack of snappy resilience. The tensile strengths of the better of the fully cured coatings appear adequate in comparison with those of standard Neoprene rain erosion resistant coatings. The elongations at break of the coatings possessing the better tensile strengths may be anywhere from two-thirds to as little as one-seventh of what one obtains with Neoprene coatings. For these reasons, no air-foils have been coated for submission to the Cornell Aeronautical Laboratory for "whirling arm" tests. More recent coatings have been developed that may possess adequate adhesion, tensile strength and a fair elongation at break, and warrant coating air-foils for submission to the Cornell Aeronautical Laboratory.

Kel-F Elastomer coatings have shown a better resistance to dry heat (400°F) than any of the other coatings examined to date. This superiority has reference to both the retention of strength as well as the resistance to discoloration.

For convenience, the following table lists the forty Kel-F Elastomer coatings that were made, together with their respective gumstock solutions.

Coating Solution KV#	Gumstock Solution KV#	Coating Solution KV#	Gumstock Solution KV#
8304A	8304	9316C	9345
8382D	8400	9316D	9364
8382E	8400	9316E	9364
8382F	8400	9316F	8896A
8382G	8400	9316G	8896A
8382H	8400	9384A	9345
8720A	8401	9384B	9345
8720B	8401	9384B	9464
8720C	8401	9384C	9464
8720D	8401	9384E	8896A
8720E	8401	9384F	8896A
8720F	8401	9384G	9365
8882A	8896A	9384H	9365
8882B	8896	9362A	9378
8882C	8745	9362B	9378
8882D	8745	9362C	9378
8882E	8745	9362D	9379
9316A	9345	9362E	9379
9316B	9345	9362F	9379
		10726A	8896A
		10726B	9345

The tensile strengths and elongations at break are listed in Table I, entitled "Formulations and Physical Properties", while the peel-pull adhesions and the diffuse reflectances are listed in Table IV and II, respectively.

SECTION XVIII

NEED FOR CARE IN SELECTING CURING TEMPERATURES

In the instance of ordinary room temperature coating systems, seven to ten days or longer may be required (at about 70°F) to effect a substantial cure. It is a common practice to expedite the cure through the use of elevated temperatures, using a time-temperature schedule, such that one effects, in a convenient period of time, a degree of cure which is the substantially equivalent to what is obtained with the drawnout room temperature cure.

On the basis of scores of tests run with coating solution based upon Neoprene it appears that a cure of between twelve and twenty hours at 150°F substantially duplicates the physicals procured when curing between ten and fifteen days at room temperatures. When Neoprene is cured at a higher temperature, e.g. 200°F the equivalent degree of cure is achieved in a much shorter period of time, but cognizance should be taken of the fact that the tensile strengths procurable at 200°F are generally somewhat higher than those procurable at room temperatures, irrespective of how long one waits.

In the instance of polymers other than Neoprene, the above relationship does not necessarily apply. It has been found that in the instance of Neoprene/Polyacrylic Rubber co-vulcanizates (when using the new curing systems) requires between twenty and thirty hours or the use of a higher temperature, e.g., 175°F, to simulate the degree of cure obtained with an air temperature cure. This particular combination often cures faster at room temperature than does straight Neoprene.

On the other hand, in the instance of many Hypalon coatings, the use of elevated temperatures is a matter which requires very careful consideration. Temperatures of 200°F produce tensile strengths of in the neighborhood of 2000 psi whereas, when using temperatures of 150°F the maximum tensile strengths that one procures in a reasonable period of time are only in the order of 1500 psi. Curing at room temperatures for seven days yields tensile strengths of about 1000 psi (after twenty-two days of cure, strengths of around 1200 psi are obtained). Even in six months the tensile strength increases slightly, with no indication that it will ever reach the 1500 psi mark. In the instance of a typical coating such as XP-104, it appears that a cure of about twenty hours at 150°F simulates a room temperature cure of between twenty and twenty-five days. Cure temperatures in excess of 150°F should be avoided because the ultimate tensile strengths obtainable at such elevated temperatures are in excess to the strengths obtainable at room temperature. If the manufacturing operation be one where the cure is to be effected at room temperatures without the use of heat, one would not be justified (when using Hypalon) in accelerating curing schedules that call for a time-temperature schedule in excess of twenty hours at 150°F.

Kel-F Elastomer coatings require the use of heat to realize the optimum physicals. Numerous other polymers and polymer combinations, which while not requiring the use of elevated temperatures, do give significantly greater ultimate physicals when temperatures of 150°F or higher are used. Almost without exception, cures at elevated temperatures lead to lowered diffuse reflectances while peel-pull adhesions are usually improved.

SECTION XIX

SEMI-ELASTIC VERSUS HARD AND BRITTLE PRIMERS

It has been observed that many of the failures occuring during the "whirling arm" test appear to be associated with the destruction or disintegration of the laminate immediately beneath the coating.

This is particularly true of the more rain resistant coatings. It has been further observed that when the laminate beneath the coating begins to disintegrate and pulverizes, the resultant powdery material is tinted pink by the red colored primer. The disintegration and pulverization of the laminate has to start somewhere. The following possibilities present themselves:

(1) The glass fiber laminate below the surface starts to disintegrate.

(2) The glass fiber laminate in immediate contact with the primer starts to disintegrate.

(3) The primer starts to disintegrate.

Virtually all the primers used in the early phases of the study yielded films which were hard and brittle as against the highly flexible and resilient nature of the tie-cements of body-coats. Most of the primers had a hardness comparable to that of the Selectron 5003 polyester resin used in the laminates.

Inasmuch as there is a distinct possibility that the hard and brittle primers may contribute to early failure in the "whirling arm" test, by the succession of hammer-like blows that are communicated to it through the body-coat by the impinging rain drops. Should the primer start to disintegrate, then the bond in the immediate area would automatically be lost and there would come into being a region between the laminate and the body-coat where there would be enough free play to lead to the early disintegration of the adjacent laminate. This is evident by the formation of blisters or bubbles.

Accordingly, an investigation was made of primers which were somewhat more flexible and elastic than those hithertofore used.

Many of these semi-elastic primers gave very good bonds when measured by the peel-pull technique.

However, on the basis of "whirling arm" tests, it appears that such semi-elastic primers were little, if any, better than the hard and brittle primers. A possible explanation for this may be that the primers referred to as semi-elastic were not sufficiently more elastic than the original hard and brittle primers and that to be effective one should use primers that are much more flexible and rubber-like.

Another possible explanation might be that while a primer referred to as semi-elastic may, in fact, be more flexible and elastic than a hard and brittle primer when the determination is made in the usual manner of bending the coating over a small diameter mandrel or when bending it sharply upon itself, it may in fact, be no more flexible if the flexibility were measured in a manner involving very high speeds or intensive impulses of short duration. It may be that when subjected to short time impulses (resulting from individual rain drops impinging against the coating) the molecules of the primer do not have time to orientate and align themselves in a manner calculated to best take in the deformations. This situation points up the desirability of a measuring technique using impulses of high intensity but short duration.

It has been observed that the semi-elastic primers are quite selective in their efficacy in the sense that while the majority are very effective when used with Neoprene top-coatings, only a few are effective with top-coatings based upon other polymers, and vise versa.

Among the semi-elastic primers that have shown themselves quite effective in yielding good peel-pull values are the following:

Gaco KV-8532-D
Gaco KV-8532-H
Gaco KV-8534-D
Gaco KV-8534-G
Gaco KV-8536-D
Gaco KV-8536-E
Gaco KV-8536-F
Gaco KV-8538-E
Gaco KV-8538-F
Gaco KV-8542-J
Gaco KV-8544-A
Gaco KV-8544-F
Gaco KV-8544-J
Gaco KV-8583

SECTION XX

STUDIES OF VARIABLES AS THEY RELATE TO REPRODUCIBILITY

Frequently it has been found difficult, perhaps even impossible, to obtain reproducible results. Fortunately, the degree of reproducibility, insofar as it relates to the results of peel-pull adhesion tests, is reasonably satisfactory with most coating systems.

Occasionally a whole series of tests conducted upon a particular day may give good peel-pull adhesions while the same materials, applied in the same manner by the same operator, may give vastly different results the following day. There are some coating systems that consistently give reproducible results. There are other coating systems which are consistent only in the sense that the results are consistently inconsistent. In short, there are certain coating systems that consistently give reproducible results irrespective of the batch of the material, the operator, the date of application, or the temperature, humidity, and drafts (within reasonable limits). Such coating systems may be described as being possessed of a high reproducibility factor.

An examination of the peel-pull data that has been amassed and is set forth in Tables IV and V indicates that each primer, tie-cement and body-coat may be said to be possessed of some inherent "reproducibility factor". These same remarks appear applicable to coating systems in that some systems (using specific components) are possessed of a good reproducibility factor whereas others are not.

An interesting observation is the fact that where all the components are individually rated as being possessed of a good reproducibility factor then the resultant coating system in its entirety is almost invariably possessed of a good reproducibility factor. How general this observation is, is not presently known. If it is applicable, it should prove of considerable help in eliminating the need for testing out countless combinations.

It is important in this connection to point out that the terms good reproducibility factor and bad reproducibility factor bear no relationship to the quality of the components or the results that the components, per se, yield. In other words, a primer that consistently yields good bonds would be classed as being possessed of a good reproducibility factor but a primer which consistently yields poor bonds would also be classed as having a good reproducibility factor.

The existence of a reproducibility factor brings up the point that the efficacy of a given coating component or coating system can only be established if the work is repeated a considerable munber of times. A component or coating system is good only if it consistently gives good results; and vise versa, a component or coating system which only occasionally gives good results cannot be considered as desirable.

It would appear that components or coating systems that are possessed of a good reproducibility factor are relatively insensitive to moderate changes in (1) temperature at time of application (2) humidity at time of application (3) temperature during cure (4) drafts and air currents prevailing during the various operations (5) length of time that the primer dries (6) length of time that the tie-cement dries (7) length of time required to apply top-coats(8) time involved in bonding the Neoprene "handle" used in the peel-pull technique

(9) number of coats used in the body-coat and (10) the exact manner in which the operator makes the application. In some cases where poor reproducibility factors are the rule (e.g., Kel-F Elastomer coating systems thus far investigated), the variations in results persist in spite of all pains to assure duplicate conditions and components - in such cases the variable is probably of some subtle nature that escapes attention.

SECTION XXI

RAIN EROSION RESISTANCE

Four hundred and ninety coating systems were applied to polyester glass fiber laminates or 24 ST aluminum alloy air-foil specimens (usually two specimens per coating) for a determination of their resistance to rain erosion on the Cornell Aeronautical Laboratory's "whirling arm". Most of the coating systems were submitted solely for the purpose of study.

Among the variations submitted to test were the following:

(1) Polyester glass fiber versus 24 ST aluminum air-foils

(2) Same top-coat but different types of primers

(3) Same top-coat and primer, with and without the use of a tie-cement

(4) Same top-coat and primer, but with different types of tie-cement

(5) Top-coats, otherwise identical, and differing only in the specific gravity of the filler used, on a constant volume basis

(6) Effect of the introduction of ionically conductive systems into the coating

(7) Effect of using electron conductive coatings as tie-cements

(8) Effect of changing the polymer in the top-coat

(9) Effect of using polymer combinations in the top-coat

(10) Effect of variations in the application technique

(11) Use of semi-elastic primers versus more hard and brittle primers

(12) Di-isocyanate primers versus Bostik 1007

(13) Overcoating the rain erosion resistant body-coat with a thin layer of a less rain erosion resistant top-coat which is possessed of a higher diffuse reflectance and capable of protecting the Neoprene.

For convenience, the twenty-six white rain erosion resistant coating systems that gave the best results are enumerated below:

RAIN EROSION RESISTANCE OF THE 26 BEST WHITE RADOME COATING SYSTEMS

C.A.L. No.	K-No.	Primer	Tie-Cement(s)	Top-Coat	Time to Erode Through (min.)
1483 A,B	223-A	6006-N	8366-D	8386-A	60-80
1484 A,B	223-B	"	8374-G	"	35-66
1492 A,B	223-K	6006-G	None	"	22-32
1601 A,B	276-B	8502-C	8704-G	"	40-51
1602 A,B	276-C	"	"	"	35-52
1609 A	276-K	"	"	"	24-57
1646 A,B	277-C	8506-N	8722-H	8741	30-33
1698 A,B	410-E	8510-E	8746-B	8760-B	35-37
1730 A,B	455-E	"	8746	8774-A	7-37
1732 A,B	455-J	"	"	8846	6-33
1733 A,B	455-K	"	None	"	55-70
1818 A,B	751-D	8542-J	8746-B	8774-A	15-32
1807 A,B	740-H	"	8846/8756-B	8754-B	19-33
1810 A,B	741-A	N-15	8746-B	8732-B	31-37
1811 A,B	741-B	"	8746	8741	37-47
1813 A,B	741-D	"	8846/8756-B	8870-F	32-34
1952 A,B	912-C	8512-A	8587	9409	8-32
1965 A,B	913-F	"	"	9431	18-35
1966 A,B	913-G	"	"	"	28-33
2203 A	960-D	8582	None	9433	13-40
2205 A	960-F	8582	8589	9443	26-31
1984 B	961-F	"	"	9441	13-43
1985 A	961-G	"	"	9443	27-47
1986 A	961-J	"	None	9441	15-50
1986 B	961-K	"	"	9443	34-45
2262 A,B	1046-E-F	"	8600/9443	9431	28-36

For comparison, Gaco N-79 gave the following results:

1853,4,5	822-A-F	N-15	None	N-79	Avg. 61

Of the rain erosion resistant coating systems in the above list, two (KV-8754-B and KV-8870-F) are based on polyacrylic rubber/Neoprene AC (50/50) coatings, while the remaining coatings are based on Neoprene.

Two specimens were prepared and tested for each coating system. In every instance, of the coatings enumerated in the above list, at least one of the two specimens required not less than thirty minutes to erode through. It will be observed that in many cases there was a considerable difference between the two specimens. It is believed that these differences can usually be attributed to defective laminates or poor application. The highest erosion figures were 45, 47, 51, 52, 66, 70 and 80 minutes. The white Neoprene coating systems that gave the highest resistance to rain erosion were not those possessed of the highest diffuse reflectance. Vice versa, the coatings giving the best diffuse reflectance were possessed of a somewhat poorer resistance to rain erosion.

As is mentioned elsewhere, the resistance to rain erosion of selected white coatings is somewhat better when applied over 24 ST aluminum air-foil specimens as against when applied over polyester glass fiber air-foils. Where the bond is adequate, unpigmented coatings, such as Gaco N-79, do not show much difference when applied over 24 ST aluminum as against polyester. The difference is most marked in the case of pigmented coatings which are adequately bonded, because there is a tendency for the glass fiber laminate to undergo deterioration under the successive hammer-like blows of impinging rain drops, which reflects itself in earlier failures. It would appear that glass fiber laminates that are stronger and tougher than those based upon polyester Selectron 5003 would be highly desirable.

Of the polymers examined, it appears that Neoprene GNA (or GN) is slightly better than Neoprene AC in the matter of the resistance to rain erosion. On the other hand, the diffuse reflectance of coatings prepared from Neoprene GN or GNA is definitely inferior to that of coatings prepared from the AC type. The other types of Neoprene appear to yield solution coatings whose films are possessed of somewhat poorer physicals from the standpoint of tensile strength, elongation at break, and resistance to rain erosion.

Aside from the Neoprene coatings thus far investigated, Polyacrylic rubber shows up best since it has a better diffuse reflectance and a much better resistance to discoloration than Neoprene. The combinations of Neoprene and Polyacrylic rubber yield results intermediate between those of the straight Neoprene and Polyacrylic rubber coatings. Of the other coatings investigated, but not subjected to "whirling arm" tests, Kel-F Elastomer is perhaps of the greatest potential interest. Of coatings relative to which little or no work has thus far been done, polyurethane rubbers and fluoro-rubbers, such as Viton A, hold much promise.

SECTION XXII

PHYSICAL (TENSILE STRENGTH AND ELONGATION) VERSUS RESISTANCE TO RAIN EROSION

If a coating has virtually no strength, as determined by a measurement of its tensile strength and elongation at break, then little or no energy would be required to disintegrate or tear apart such a coating. At the other extreme, if the coating were phenomenally strong in terms of both its tensile strength and the elongation at break, then one might reasonably expect that its resistance to rain erosion would be correspondingly great.

A standard Neoprene rain erosion resistant coating such as Gaco N-79 has a resistance to rain erosion in the neighborhood of sixty minutes as determined by the Cornell Aeronautical Laboratory's "whirling arm." Such a coating has an average elongation at break and tensile strength of approximately 750 percent and 2000 psi respectively. One might anticipate that a coating with an 800 percent elongation at break and a 3000 psi tensile strength, would show a higher resistance to rain erosion. Going a step further, one might assume that a coating with an 850 percent elongation at break and a tensile strength of around 4000 psi would give still better results.

Contrary to these expectations, a study of the physicals versus the rain erosion resistance of the various coatings prepared in the present study discloses that as one goes beyond 2000 psi in tensile strength and goes over 750 percent in ultimate elongation the resistance to rain erosion is not increased. There are several possible explanations for this situation. In the first place, a large percentage of all the "whirling arm" tests on the better coatings failed not so much because of erosion but failed prematurely for other reasons. Another possibility is that most of these coatings were rather highly pigmented and were not as "snappy" as unfilled compositions. This feature may have reduced their ability to absorb the hammer-like impacts resulting from the impingement of rain drops. Another factor may be that while the tensile strength and the elongation at break were substantially greater than that of a standard coating, it may be that if the tensile strength and elongation were measured via equipment that would permit an extremely rapid determination of these criteria; i.e., in less time than what it takes the elastomeric structure to undergo re-orientation and re-alignment, then the physicals may not show up higher and may, indeed prove to be lower.

Another important factor that enters the picture has to do with our present inadequacy of knowledge relating to the mechanism of erosion. If this mechanism were better understood and one had the test equipment necessary to determine the criteria, then one might be able to utilize that information as a guide in developing improved products.

SECTION XXIII

DIFFUSE REFLECTANCES

One of the prime objectives of the present study is the development of rain erosion resistant coatings possessed of a diffuse reflectance of not less than 85 percent in the wave length range of 0.4 to 2.0 microns. The diffuse reflectances of several hundred coatings have been measured with a Gardner M-1 Reflectometer. The readings cover the blue, green, amber and near infra red regions of the spectrum corresponding to a wave length of from approximately 0.42 to 0.7 microns. Diffuse reflectances of some of the more promising coatings were also measured by the Wright Air Development Center, which extended the measurements out to a wave length of 2.0 microns.

Top-coats were brushed onto aluminum panels, to a thickness of approximately ten mils. With reasonable concentrations of pigments of good hiding power, a ten mil thickness was generally sufficient to give readings uninfluenced by the background. Additional details are set forth to the introduction to Table II.

The results of the diffuse reflectance measurements for 1215 coatings are set forth in Table II. The readings are recorded for the blue, green, amber and near infra red regions of the spectrum.

Additional information touching on the subject of diffuse reflectance is set forth in Sections XXIV and XXV.

When using the very best of the commerically available titanium dioxide and an elastomer possessed of little inherent color (e.g., Polyacrylic Rubber or Kel-F Elastomer) and paying meticulous attention to cleanliness, it was possible to produce coatings which yielded dried films that were possessed of initial diffuse reflectances of not less than 85 percent in the wave length range of 0.4 to 0.7 microns. It is possible that some of these coatings are possessed of an average diffuse reflectance of very close to 85 percentage throughout the wave length range of 0.4 to 2.0 microns.

Although it is possible to produce elastomeric coatings possessed of an average diffuse reflectance of not less than 85 percent, the particular elastomeric coatings Polyacrylic Rubber and Kel-F Elastomer are not the ones that show the best resistance to rain erosion. Of the various elastomeric coatings thus far examined, only Neoprene appears to show promise of yielding an adequate resistance to rain erosion. However, the best white Neoprene rain erosion resistant coatings have an average diffuse reflectance of about 78 percent in the wave length range of 0.4 to 0.7 microns as against a desired minimum of 85 percent.

The usual unpigmented coatings are possessed of a low diffuse reflectance. To render such coatings lighter in color and to increase the diffuse reflectance to in the neighborhood of 85 pereent, it is necessary to incorporate substantial quantities of the very best of available white pigments. In so doing, the resistance to rain erosion appears to be measurably impaired. The deterioration in physical strength and resistance to rain erosion can be offset somewhat through the use of superior curing systems, so that the pigmented coatings will have tensile strength in excess of those of unpigmented Neoprene coatings.

It is thus possible to produce Neoprene coatings that are possessed of an average diffuse reflectance of somewhere between 75 and 85 percent and possessed of an intrinsic resistance to rain erosion, as far as the coating per se is concerned, that is but slightly below that of a good unpigmented rain erosion resistant coating. However, such coatings are not quite as resilient and do not offer as much protection or cushioning to a polyester glass fiber laminate as do unpigmented Neoprene coatings.

As a result the laminate may undergo disintegration and pulverization in the "whirling arm" test due to the multiplicity of hammer-like blows communicated to it through the coating by the impinging rain drops. To offset this it is suggested that a better grade of glass fiber laminate to be used. Using a superior glass fiber laminate it should be possible to realize rain erosion resistances very close to those presently obtained with unpigmented Neoprene coatings while at the same time have initial average diffuse reflectances of close to 85 percent in the wave length range of 0.4 to 2.0 microns.

A progressive lowering in the reflectance occurs as a result of discoloration attributable to weathering. Neoprene coatings undergo substantial discoloration or darkening upon exposure. The lesser rain erosion resistant coatings, such as those based upon Polyacrylic rubber and Kel-F Elastomer, and to a lesser extent Hypalon, are much more resistant to discoloration.

It is possible that overall coating systems can be prepared which consist of a thin coat of a non-discoloring coating (such as one based upon Polyacrylic rubber) over a comparatively thick coating of a more rain erosion resistant product (e.g., based upon Neoprene). A Polyacrylic rubber coating would enhance the diffuse reflectance and protect the Neoprene coating beneath from the effects of weathering. During the process of rain erosion the thin discoloration resistant coating would quickly be eroded off and the Neoprene coating would then provide the resistance to rain erosion.

SECTION XXIV

RADIATION VERSUS WAVE LENGTH AND THE DIFFUSE REFLECTANCE OF VARIOUS PIGMENTS

The following data is of general interest:

RADIATION	WAVE LENGTH IN MICRONS		
Visible Spectrum	0.4	to	0.7
Violet	.4	to	.424
Blue	.424	to	.491
Green	.491	to	.575
Maximum Visibility		.556	
Yellow	.575	to	.585
Orange	.585	to	.647
Red	.647	to	.700
Infra Red		over .700	

It will be observed that the wave length range of 0.4 to 2.0 microns, with which we are concerned, covers the whole of the visible spectrum and a portion of the infra red.

The following information, relative to the diffuse reflectance of various pigments, is of interest. (Most of the figures were taken from publications of the National Bureau of Standards).

Pigment	Diffuse Reflectance, % — Wave Length in Microns (Maximum Energy) (Blue) .4	(Green) .54	(Orange) .60	(IR) .95	(IR) 4.4
Lead Oxide, PbO			51.8		50.6
Yttrium Oxide			73.8		34.4
Lead Chromate		61.2	70.2		41.2
Aluminum Oxide			84.1	87.7	20.8
Thorium Oxide			86.0		46.9
Zinc Oxide			82.2	86.4	8.5
Magnesium Oxide			86.3		16.0
Zirconium Oxide		82.2	85.2	84.1	23.2
Lead Carbonate			86.8	90.8	29.2
Magnesium Carbonate			85.2	89.4	10.8
Titanium Dioxide (Rutile)	36.0	94.0	93.0		
Titanium Dioxide (Anatase)	82.0	92.0	90.0		

Of the white pigments examined, it appears that pigment grades of titanium dioxide are by far the best. It is possible that combinations of titanium dioxide with zirconium or thorium dioxide may be of interest.

It is not certain that any known material has a diffuse reflectance of not less than 85 percent throughout the entire range of from 0.4 to 2.0 microns. However, a coating with an average diffuse reflectance of 85 percent over the range of 0.4 to 2.0 microns should be possible.

The diffuse reflectance of commercial pigment grades of anatase and rutile titanium dioxide are as follows:

	Diffuse Reflectance, % Wave Length in Microns (Maximum Energy)							
	0.375	0.87	0.4	0.425	0.45	0.5	0.6	0.7
Anatase Titanium Dioxide	50	71	83	93	93.5	93	90	93
Rutile Titanium Dioxide	18	15	36.5	93	95.5	94.5	93	95

The diffuse reflectance of a coating, particularly one based upon a vehicle that has a certain inherent color will not be as high as that of the pure concentrated pigment. As practically all elastomeric rain erosion resistant coatings tend to discolor upon weathering, the original diffuse reflectance may be expected to decrease as time goes on.

SECTION XXV

DIFFUSE REFLECTANCE OF WHITE COATINGS AS A FUNCTION OF THE ELASTOMER

The following listing summarizes the best of the diffuse reflectances obtained with various of the more promising elastomer and elastomer combination coating systems that have been studied.

DIFFUSE REFLECTANCES
Percent

Polymer(s) in Coating	Infra Red (2)	Amber (1)	Green (1)	Blue (1)	Average
Buna N/Neoprene AC	85-90	76-81	73-76	55-61	75%
Hypalon	68-81	63-72	62-70	51-56	65%
Kel-F Elastomer	90-95	87-90	85-89	79-81	87%
Neoprene AC (3)	90-92	81-83	77-79	60-62	78%
Polyacrylic Rubber	95-97	90-92	88-90	77-80	89%
Polyacrylic Rubber/ Buna N	90-93	73-83	75-79	62-70	78%
Polyacrylic Rubber/ Hypalon	87-88	84-87	84-86	76-27	77%
Polyacrylic Rubber/ Neoprene AC	91-95	85-89	83-86	71-76	84%

The coatings listed in the above table are all pigmented with fifty parts by weight of rutile titanium dioxide per 100 parts of elastomer. The Hypalon coating is an exception in that it contains a higher percentage of pigment (a mixture of the titanium dioxide with a lead compound).

NOTE: (1) Blue, green and amber tristimulus filters giving approximately the spectral responses of the C.I.E. standard colorimetric observer.

(2) Wratten 87 filter for infa red.

(3) Neoprene AC gives reflectances of 72-73 percent in the blue when anatase TiO_2 is used in lieu of the rutile type.

SECTION XXVI

POOR QUALITY POLYESTER GLASS FIBER FLAT AND AIR-FOIL LAMINATED SPECIMENS

The bulk of the polyester glass fiber laminates (whether flat or in the form of air-foil specimens) used in connection with the present studies, appears to be of "poor" quality. There is much non-uniformity between panels, or even sections of one and the same panel (or of air-foil specimens) and, in many instances, readily visible defects are discernible.

This lack of uniformity is unfortunate in that it introduces an uncontrolled variable into the studies. Often times the results obtained on either peel-pull tests or on the costly "whirling arm" tests reflect the quality of the laminate rather than that of the primer, tie-cement, or coating, as the case may be.

Flat polyester glass fiber laminate panels are used in determining the electrical charateristics of coatings as well as peel-pull adhesions. Among the things that may manifest themselves in the instance of polyester glass fiber laminates used in determinimg peel-pull adhesions are the following:

(1) Small pieces of polyester resin are pulled out of the surface of the laminate during the process of the peel-pull test.

(2) Delamination occurs; e.g., the outermost layers of glass cloth peels off.

(3) Laminates are not uniform in the sense that some small panels can be used over and over again whereas other panels can be used but once, owing to delamination or other defects.

(4) The following observations also point up the nonuniformity of the polyester glass fiber laminate panels. Ordinarily, the two inch by six inch panels used in carrying out peel-pull adhesions are used over and over. The procedure is to immerse the coated panels in a stripping agent and to then clean them. Some specimens appear to be wholly unaffected by this treatment whereas other laminates are quickly impaired to a point where they are unsuited for further use.

(5) The physical properties of polyester glass fiber laminates purchased from different sources appear to differ from one another in both appearance and strength, even though they are all specified as conforming to specifications Mil-C-7439B and Mil-P-8013 (using Selectron 5003 as resin).

(6) Different manufacturers appear to use different mold release agents. Some panels require a much more severe surface treatment than others to assure good adhesions.

(7) All of the above remarks are equally apropos in the instance of polyester glass fiber air-foil specimens manufactured to conform to Figure I of specification Mil-C-7439B. The air-foil specimens appear to be even more non-uniform than the flat panels - probably because of their shape and the tendency for resin to be squeezed out from one region to another. The non-uniformity of polyester glass fiber laminate air-foil specimens is particularly unfortunate in that the defects present are reflected in the "whirling arm" tests.

SECTION XXVII

24 ST ALUMINUM AIR-FOIL SPECIMENS VERSUS POLYESTER GLASS FIBER LAMINATE AIR-FOIL SPECIMENS

Since there has been observed a non-uniformity in the polyester laminated test specimens, it was agreed that studies be made on 24 ST aluminum air-foil specimens for better reproducibility. The most promising coatings will in turn be tested on polyester laminates of good quality, for comparative results. For convenience, we list below the identifying "K" numbers for individual or series of 24 ST aluminum alloy coated air-foils coated and evaluated as regards their peel-pull adhesions (please see Table V).

K-711	K-771	K-825	K-961	K-1010	K-1037
K-712	K-779	K-861	K-976	K-1011	K-1038
K-713	K-800	K-861-A	K-977	K-1012	K-1039
K-714	K-801	K-862	K-978	K-1017	K-1040
K-715	K-802	K-862-A	K-979	K-1018-A	K-1044
K-740	K-803	K-898	K-989	K-1019	K-1051
K-741	K-804	K-899	K-990	K-1025	K-1061
K-768	K-805	K-913	K-991	K-1026	K-1065
K-769	K-824	K-960	K-1009		

Listed below are the identifying "K" numbers for individual or series of 24 ST aluminum air-foils coated and subjected to the "whirling arm" test.

K-740	K-825	K-1009	K-1017
K-741	K-913	K-1010	K-1025
K-768	K-960	K-1011	K-1061
K-824	K-961	K-1012	K-1065

The results of a comparision between the rain erosion resistance of selected coatings applied over polyester glass fiber laminates as against the same coatings applied over 24 ST aluminum air-foil specimens indicates the following:

(1) The resistance to rain erosion of the better of the white coatings, where a satisfactory degree of bond was obtained, appears to be better over aluminum as against polyester air-foil specimens.

(2) Where the bond was inadequate, blisters generally formed and premature failures occurred due to "loss of bond".

(3) For the best results over 24 ST aluminum, an appropriate surface treatment should be used (Alodine 1200 or Alodine 1200 followed by an application of wash primer appeared suitable).

(4) It is more difficult to obtain a good bond over 24 ST aluminum air-foil specimens than over polyester glass fiber laminates. This matter would be resolved with the finding of a better surface treatment or a better primer.

(5) It appears that when one has an adequate bond, the better of the white rain erosion resistant coatings require, on the average, between forty-five and sixty minutes to erode through.

SECTION XXVIII

PREMATURE GELATION OF COATING SOLUTIONS

Starting with about May, 1956, we continued to run into difficulties stemming from the premature gelation of many of the coating solutions. Prior to that time this difficulty was rarely experienced and indeed, many of the original coating solutions, then about a year old, were still in good useable condition whereas starting with the aforeindicated date, gelation has often occurred within a matter of days. Both Neoprene and Polyacrylic Rubber based solutions were undergoing premature gelation.

The Gates Engineering Company has been engaged in the manufacturing of elastomeric coating solutions for a period of perhaps fifteen years and during this time, at fairly regular intervals, particularly during the summer months, it has experienced a similar difficulty in connection with its Neoprene coatings. As a result of that situation, the Company inaugurated a comprehensive testing program with the view of determining the cause of this premature gelation and the means of preventing it. In brief, the trouble appears to originate with the raw elastomer as purchased from the manufacturer. The manufacturer of the raw polymer (Neoprene) did not appear to be in a position to do anything to remedy the situation. Thereupon the Gates Engineering Company initiated a program looking into agents that would inhibit premature gelation, These efforts led to the development of "stabilizers".

The addition of Gaco stabilizers to the Neoprene coatings currently being produced appears to give a good shelf life.

In the instance of the Polyacrylic Rubber coatings it appears that the fact that the premature gelations coincided with the premature gelations of the Neoprene coatings was purely coincidental. The B. F. Goodrich Company, which manufactures the raw Polyacrylic Rubber, has advised us that they feel the difficulty stems from the fact that the particular batches of Polyacrylic Rubber that we started using in May had too high a gell content or intrinsic viscosity. They believe that if they furnished us with a lower viscosity grade of elastomer, we would again get stable coatings. During December of 1956, we again received low viscosity grades of Polyacrylic Rubber and preliminary tests indicate that the gelation difficulty may be over.

Premature gelation and shelf life are influenced by the original viscosity of the coating solutions. Most of the coating solutions prepared in the earlier phases of our investigations were actually too thick for good brushing.. Accordingly, most subsequent solutions have been prepared with lower viscosities - lower viscosities being generally conducive to an improved shelf life.

SECTION XXIX

DIFFICULTY IN MAINTAINING WHITE ELASTOMERIC RAIN EROSION RESISTANT COATINGS CLEAN

White elastomeric rain erosion resistant coatings show a marked tendency toward becoming soiled. It appears that these coatings, because of their softness, become soiled much more readily than the white sidewalls of an automobile tire.

Carbon black, dust, etc., that float in the air settles onto the white coating without showing too much effect, but the moment such a coating is contacted and rubbed, as with the finger, the dirt becomes smeared out and smudged, engendering a profound discoloration.

When one writes upon glass or a hard enameled surface with a ball-point pen, the ink does not take hold and, when it does, it may readily be rubbed off, because there is only a negligible tendency for the ink to penetrate into the substrate. When one writes on the white erosion resistant coatings the ink immediately penetrates and cannot be rubbed off with the fingers and no amount of erasing will remove the stains. It appears that oily and greasy things, including materials such as soot, tend to cling and affix themselves very tenaciously and it is conceivable that in a smoke or smog laden atmosphere, considerable permant dirtying up could occur, particularly in the initial stages of a light rainfall before the atmosphere has had a chance to clear.

This situation is mentioned only in passing. It may or may not have serious implications - no doubt, no matter how bad the dirtying up may become, such a soiled coating would still be much more effective in reflecting relevant radiations than a dark or black coating.

There are indications that the different polymers differ somewhat in their tendency toward becoming soiled. The smoother, somewhat glossier and firmer compositions, are usually slightly more resistant to soilage. In some cases, oily and greasy materials penetrate and soil the coatings with considerable rapidity. It is known that some silicone compositions (which we have not yet investigated for the instant application) have less tendency to become soiled.

Simple washing with water is not effective in removing oily material from these white coatings. Alcohol or aqueous alcohol containing a small amount of detergent is a fairly effective cleansing agent.

SECTION XXX

EFFECT OF HEAT

The effect of moderately elevated temperatures, e.g., up to about 200°F, upon coatings that have not been cured or that have been but partially cured is to expedite the rate of cure and to engender a good, strong and complete cure. To this extent the use of a moderately controlled heat is beneficial.

The use of more elevated temperatures, e.g., 300°F to 400°F or above, must be regarded as subjecting the coating to severe conditions which have the effect of degrading the coating.

In the instance of elastomers such as Brominated Butyl Rubber, Buna-N, Chlorinated Rubber, GR-S, Natural Rubber, Neoprene, Polyisobutylene and Thiokol, the use of temperatures in the neighborhood of 150°F is to darken white coatings, concomitant with a reduction in the diffuse reflectance and an increase in the Shore Durometer hardness. In most cases the tensile strength goes up somewhat and the elongation at break is diminished. The peel-pull adhesion is usually improved.

In the instance of elastomers such as Hypalon 20, Kel-F Elastomers, Polyacrylic Rubber, Silicone Rubbers, and presumably most of the Fluoro-Rubbers, the use of temperatures of in the neighborhood of 200°F is to darken the coating, increase the hardness and tensile strength, and reduce the extensibility. Polyacrylic Rubber stands up better than Hypalon 20; most of the Fluoro-Rubbers (e.g., Kel-F Elastomer) stand up better than Polyacrylic Rubber while various of the Silicone Rubbers stand up better than the Fluoro-Rubbers from the standpoint of resistance to discoloration.

In one series of tests, primers only were applied to the polyester glass fiber laminate which was then first heated to 150°F, then at 200°F for fifteen minutes, followed by thirty minutes at 300°F and finally thirty minutes at 400°F. The effect of baking on the primers at elevated temperatures, in the instance of most of the primers examined in this manner, was to bond the primers to the glass fiber laminate so firmly that they could not be removed from the laminate without actually abrading them off with sandpaper. While primers that are baked on at elevated temperatures become bonded very tenaciously to the laminate, it generally becomes more difficult to bond to the primer. Where the primer is baked on at 400°F for prolonged periods of time, e.g., twenty hours, the primer turns more or less black in color but appears to be exceedingly well bonded to the laminate while at the same time it is no longer possible to tenaciously bond to the primer via the usual tie-cements.

The subject of the heat resistance to rain erosion resistant coatings and of coatings particularly designed for improved heat resistance will not be further commented upon at this point as it is covered in greater detail under separate cover in Part II of the present report.

An interesting observation was made in connection with Polyacrylic Rubber. It was found that when free films of white Polyacrylic Rubber coatings were laid upon aluminum panels and subjected to a bake for twenty hours at 400°F, the coatings seemed to partially fuse down and wet the aluminum and became so firmly bonded to the aluminum that they could not be removed other than by abrading or shaving them off with a razor. This unanticipated adhesion should be kept in mind as of possible interest in other connections.

In a series of tests where aluminum panels were first coated with a thin film of a silicon parting medium, prior to painting on a Polyacrylic Rubber coating solution, and then curing followed by a bake at 400°F for twenty hours, the Polyacrylic Rubber appeared to become integrally bonded to the metal. These coatings could not conveniently be removed, even with a knife.

SECTION XXXI

VINYLIDENE CHLORIDE COPOLYMER RESIN COATING AS A BARRIER TO MINIMIZE THE TRANSMISSION OF MOISTURE

Materials Laboratory of WADC brought to our attention the fact that difficulties have been encountered with certain radomes in which water vapor condensed within the honeycomb structures. The presence of such condensed water is objectionable from the standpoint of the radome's radar transmitting qualities. A possible solution to the problem would be to coat the radomes, both inside and outside, with a barrier coat which would minimize the transmission of both moisture through the outer shell into the honeycomb structure.

For this purpose, the Gates Engineering Company recommended the use of a specifically compounded vinylidene chloride copolymer resin coating, Gaco XX-5. A quantity of this material was forwarded to the WADC.

Published information indicates that the water vapor transmission of vinylidene chloride copolymer resin films is less than 0.15 grams/100 sq. inches per twenty-four hours at 100°F at a 90 percent differential for unsupported films one mil thick. The following specific data may be of interest:

Dielectric Strength - over 1700 volts/mil
Surface resistivity - greater than 1013 ohms

Dielectric Constant 100,000 cps.	Percent Power Factor 100,000 cps.	Low Temp. Brittle Point	Water Absorption of film 2 week immersion @ 25°C
2.3	1.4	0°F	Negligible

Gaco XX-5 by itself cannot be securely bonded to polyester glass fiber laminates nor can the usual rain erosion resistant coatings be readily adhered to it. However, upon the basis of preliminary tests, it appears that good adhesions of Gaco XX-5 to polyester glass fiber laminates and excellent adhesions of Neoprene rain erosion resistant coatings to the Gaco XX-5, can be achieved through the use of the di-isocyanate primer, Gaco N-15. Peel-pull adhesions of in the neighborhood of fifty pounds/in. width are obtainable. The results of the peel-pull adhesion tests are included in Table IV (the material coded KV-6759 is Gaco XX-5).

SECTION XXXII

STUDY OF THE EFFECT OF INTENSE IMPULSES OF SHORT DURATION UPON COATED POLYESTER GLASS FIBER LAMINATES

As noted elsewhere, a substantial percentage of premature failures encountered in "whirling arm" tests of the better of the white rain erosion resistant coatings, originated with the formation of blisters or bubbles.

The leading edges of air-foil specimens that have been subjected to "whirling arm" tests are usually whitened to a considerable extent, indicating a breakdown of the internal structure of the laminate. An important question in connection with the mechanism involved in such premature failures has to do with whether the failure originates in the laminate, the primer, or whether both types of failure occur together.

An examination of the "whirling arm" tests versus peel-pull adhesions discloses that there is little coalition between the two. For one and the same coating, a bonding system that gives a peel-pull adhesion of eighty pounds per inch width may fail due to the information of blisters just as quickly as a coating that has a peel-pull adhesion of twenty-five pounds per inch width. Alternatively, a coating that has a peel-pull adhesion of thirty pounds per inch width may show a resistance to rain erosion far in excess of the same coating but bonded with a tenacity of seventy-five pounds per inch width.

This situation may be due to the fact that in the peel-pull adhesion technique the test is carried out in a slow and leisurely fashion, involving largely the slow application of tensile pulls; whereas in the "whirling arm" test impinging rain drops subject both the coating and the bond to a succession of small hammer like blows which may involve an adhesion mechanism of a quite different nature.

On the basis of the thoughts set forth in Section III, the failure may reside entirely with a breakdown of the laminate structure. Such an explanation would be in keeping with the observed facts and would indicate that the peel-pull technique for determining adhesion is valid and adequate for most, if not all of the present purposes.

To throw additional light upon the question of whether the formation of blisters originates with a breakdown of the bond or with a breakdown of the laminate structure, the following test apparatus was set up (on the author's estate, at no cost to the W.A.D.C.). A four inch by eight inch beam of hard wood about eight inches long was used as a base. Heavy wide boards were secured to one end and a rifle was then cradled and made secure, with provisions for aiming the gun and fixing it in position. At the other end of the beam, a heavy wooden block was secured with heavy boards on each side. The rifle was fired a number of times to make sure that the bullets always fell in the same place. A spring clasp arrangement was then provided so that coated two inch by six inch polyester glass fiber laminate panels could be positioned in the target area. Proper safeguards were provided.

Previous tests indicated that high velocity twenty-two gauge rifle bullets would readily go through four inches of semi-hard wood and would severely dent one-eighth inch thick cold rolled steel. Three-sixteenth inch thick cold rolled steel was slightly dented under the impact of the bullet, while one-fourth inch thick steel was not perceptibly bent although the side struck by the bullet had an indentation. The bullet burst and spattered on striking the metal target. The spatter was kept confined.

When a piece of three-sixteenth inch thick steel three-fourth inch wide and one inch in length was placed over the coated laminate and a bullet was fired into the center of the steel target, an undue shattering of the laminate occured (laminate was cushioned against Neoprene sheetstock secured to the wooden block). It was observed that the Neoprene rain erosion resistant coating appeared intact as far as could be visually ascertained. In order to lessen the impact a one-sixteenth inch thick strip of Neoprene sheetstock (c. f. peel-pull handle) was bonded to the coating on the laminate. This appeared to be an ideal procedure because it would permit one to run peel-pull adhesion tests in the normal manner and would permit one to ascertain what the effect of the high-intensity short-time impact was while at the same time it would permit one, on the immediately adjacent area, to determine the peel-pull adhesion on the unmolested section.

Using the above setup with a one inch wide strip of one-sixteenth inch thick Neoprene sheetstock adhered lengthwise along the center of the two inch by six inch coated panel (regular peel-pull test specimen) and placing a piece of cold rolled steel three-fourth inch by one inch by three-sixteenth inch upon the Neoprene sheetstock the firing of a bullet point blank into the center of the metal target, in all cases led to the following results:

The region of the polyester glass fiber laminate immediately behind the rectangular metal target was whitened - the whitening was most intense near the central region and became less intense toward the edges. The whitening appeared identical with that observed when coated air-foil specimens are subjected to a few minutes on the "whirling arm" under a simulated rainfall of one inch per hour at a speed of 500 miles per hour.

Both the one-sixteenth inch thick strip of Neoprene sheetstock and the Neoprene coating appeared to be entirely intact - not the slightest visible effect could be observed, even with the aid of a magniying glass. When peel-pull adhesion tests were run, no significant difference could be observed between the unmolested portions of the specimens as against the region that had been subjected to the aforedescribed intense impulse of short duration. Further, on picking at the bond with a sharp knife, no difference could be observed between the portions of the specimens unmolested as against those subjected to the impact treatment.

The above preliminary tests indicate that the intense impacts, which were severe enough to partly breakdown the laminate and give a whitening similar to thet observed in the case of "whirling arm" tests, appear to have little, if any, effect upon the coating or the bond per se. These preliminary findings may be taken as confirming the observations set forth in Section III.

Additional tests with the above equipment are scheduled to be carried out as time permits; e.g.,

(1) Repeated firings at the same target (specimen in place) to see if the pulverization of the laminate can be simulated.

(2) Speed at which the impact is transmitted through the system - this can probably most conveniently be ascertained by placing magnetic reluctance pick-ups near the metal target and a metal backing plate between the Neoprene sheet and the wooden target backing structure. The electrical impulses generated in the pick-ups could be led to an oscilloscope and, with the aid of a suitable timing wave somewhere between 10 KC and one MC, the maximum time required to transmit the pulse through the coating system, including the Neoprene sheetstock, could be measured. For greater accuracy, the test would be repeated without a coated panel in place and with just the Neoprene strips in place. The difference in time between the two sets would be an indication of the time the impulse required to pass through the coating system and the laminate. Because of the non-recurrent nature of the phenomena, the pattern on the oscilloscope screen would probably have to be photographed.

(3) By way of comparision, it would be well to repeat the above tests using epoxy laminates.

SECTION XXXIII

SUMMARY AND CONCLUSION

There is no one coating which is superior with respect to all the relevant criteria.

The twenty-six best white rain erosion resistant coating systems that have been developed to December 31, 1956 are listed in Section XXI. Although twenty-six coating systems are listed, only thirteen distinct rain erosion resistant coatings are involved.

Of the thirteen coatings listed, two (KV-8774-A and 8732-B) are possessed of only a moderately light color and may be excluded for purposes of the present comparison. Two coatings, viz., KV-8754-B and KV-8870-F, are based upon Polyacrylic/Neoprene combinations which, while possessed of a higher diffuse reflectance, have generally shown a poorer resistance to rain erosion and may be excluded from immediate consideration. This leaves nine coatings that may be referred to as the "preferred" of the best white rain erosion resistant coatings. Further analysis shows that this list can be reduced to four groups.

BEST WHITE NEOPRENE COATINGS

Coating Solutions KV#	Gum-stock Solution KV#	Gum-stock KV#	Type of Neoprene	Di-basic Lead Phosphite & Zinc Oxide	Remarks
8386-A	8402	8196	AC	No	Coatings equivalent to one another.
8741	8740	8909	AC	No	
9433	9432	8909	AC	No	
8760-B	8789	8938	AC	Yes	Coatings equivalent to one another.
8846	8789	8938	AC	Yes	
9409	9408	8938	AC	Yes	
9431	9430	8938	AC	Yes	
9441	9440	9089	GN	No	
9443	9442	9090	GN	Yes	

One may select the preferred coating from each of the above four groups. Body-Coats KV-9431, 9433, 9441 and 9443 are the "best" of the coatings thus far developed. On the basis of the many formulations that have been examined, it appears that no very substantial further improvement can be made with the presently available neoprenes. However, one should attempt to optimize the above four best coatings to ascertain the possibility of effecting further slight improvements.

It appears just within the realm of the practical to attain the desired average diffuse reflectance of 85% in the wave length range of 0.4 to 2.0 microns, using approximately fifty parts by weight of the best available white pigments (rutile and perhaps anatase titanium dioxide) per one hundred parts of elastomer. Polyacrylic rubber coatings show the best diffuse reflectance, permitting the attainment of average diffuse reflectance of in excess of 85%. Kel-F Elastomer (of interest from the standpoint of heat resistance) shows the next best diffuse reflectance. Of the most rain erosion resistant coatings, Neoprene AC yields average initial diffuse reflectances of 75 to 80%.

Loading the coating with pigment to bring up the diffuse reflectance lowers the strength, resilience and resistance to rain erosion. These reductions can be offset, in part, through the use of superior curing systems. The pigmented coatings, because of their reduced resilience, are less able to cushion and protect the bond and laminate against impinging rain drops which transmit more intense impulses or steeply fronted shock waves through the coating to the bond and laminate, resulting in the pulverization and disintegration of the laminate and the formation of blisters and bubbles.

Various bonding systems have been developed which appear adequate to withstand the severe force to which the bond and laminate are subjected.

The better of the white neoprene coatings developed (neoprene Body Coats KV-9431, 9433, 9441 and 9443), used in conjunction with selected bonding systems (e.g. Primer KV-6006-N), provide (1) an average initial diffuse reflectance of 75 to 80% in the wave length of 0.4 to 2.0 microns; (2) adequate adherence to glass fiber laminates; (3) electrical transmission qualities (8500 to 10,000 mc/s) of in the neighborhood of 93%; and (4) a resistance to rain erosion in the range of 45 to 60 minutes. A slightly higher diffuse reflectance and a substantially greater resistance to discoloration can be achieved by top-coating (to a thickness of about 2 mils) the above neoprene coatings with a polyacrylic rubber composition (e.g. KV-9455). White rain erosion coatings applied over epoxy glass fiber laminates hold up appreciably better than when applied over polyester glass fiber laminates.

FORMULATIONS AND PHYSICAL PROPERTIES OF COATING SOLUTIONS - INTRODUCTION

The gumstocks were prepared by compounding the various ingredients upon a twelve inch laboratory rubber mill. The mill-operator followed the conventional milling practice for each polymer. In some cases it was necessary to try different techniques as regards the rate and order of addition of ingredients, the breakdown of the gumstock, roll temperatures, etc. In many cases the gumstock was milled one day and re-milled a day later prior to use.

The gumstocks were then dispersed in appropriate solvents to yield solution coatings of brushing consistency. The solid content of the solution were kept as high as practical from the combined standpoint of ease of brushability and shelf life. The solutions were prepared in either one quart or approximately five gallon quantities, using conventional stirring equipment. Usually a portion of the solvent was first added followed by the addition of gumstock over a period of time, to yield a heavy bodied composition (in order to obtain maximum shearing action). The balance of the solvent was then added and the churning continued until a smooth textured composition was obtained.

To the above solutions or appropriate aliquots thereof the various curing agents were added to produce the finished coating solutions.

In some instances where indicated, the whole or a portion of the accelerator was added on the mill. In other instances, coating solutions or their respective gumstock solutions were blended together to produce a combination elastomers type of coating solution, while in other cases, the diverse polymers were milled together on the rolls.

The completed coating solutions were painted out onto glass plates, cured either at room temperature over a period of days or for sixteen to twenty hours at 150°F. The resultant films were stripped from the plates and the tensile strengths and elongations at break determined in the usual manner on a Scott Tester.

Diffuse reflectances were obtained by painting a ten mil thickness out on aluminum panels (please see the Section and Table on Diffuse Reflectances).

Peel-Pull adhesions were obtained by painting coatings over primed or primed and tie-cemented polyester glass fiber laminates (or other substrates) and the adhesions determined via the "Hop-Toad" variations of the peel-pull technique (please see the Section and Table on Peel-Pull Adhesions).

The rain erosion resistance of the more interesting coatings were determined by coating the system onto polyester glass fiber (or aluminum) air-foil specimens, which were tested by the Cornell Aeronautical Laboratories, Inc., (please see the Section and Table on Rain Erosion Resistance).

Over 180 different formulations were evolved during the course of these investigations. Various of the formulations were repeated many times so as to procure additional quantities of material for testing purposes. In the interest of brevity, only the more interesting or promising formulations, numbering 122, are listed in the Table.

TABLE I

FORMULATIONS AND PHYSICAL PROPERTIES

KV-6906-F, NEOPRENE AC COATING SOLUTION, UNPIGMENTED

Coating Solution KV-6906-F	GRAMS	PHYSICALS
Neoprene AC	100	Tensile Strength, psi = 3,830
Toluene	400	Elongation at Break, % = 920
MEK	100	
Stab. Ag. Gaco KV-5502-G	6	
Vulc. Ag. Gaco KV-7102-A	5	

KV-6916-A, NEOPRENE GN-A COATING SOLUTION, UNPIGMENTED

Coating Solution KV-6916-A	GRAMS	PHYSICALS
Neoprene GN-A	100	Tensile Strength, psi = 3431
Toluene	400	Elongation at Break, % = 906
MEK	100	
Stab. Ag. Gaco KV-5502-A	6	
Stab. Ag. Gaco KV-5502-G	6	
Vulc. Ag. Gaco KV-7102-A	6.12	

KV-6928-B-2, NEOPRENE AC COATING SOLUTION CONTAINING ZINC OXIDE

Coating Solution KV-6928-B-2	GRAMS	PHYSICALS
Neoprene AC	100	Tensile Strength, psi = 3625
Toluene	400	Elongation at Break, % = 900
MEK	100	
Stab. Ag. Gaco KV-5502-G	6	
Zinc Oxide	6	
Vulc. Ag. Gaco KV-7102-A	30	

KV-6934-J, NEOPRENE COATING SOLUTION WITHOUT LITHARGE

Gumstock KV-6936-B	GRAMS	Coating Solution KV-6934-J	GRAMS
Neoprene AC	350	Gumstock KV-6936-B	108.6
Zinc Oxide	10	Toluene	485.4
Magnesia	10	Stab. Ag. Gaco KV-5502-G	6
Santowhite Crystals	10	Vulc. Ag. Gaco KV-7103-A	30

PHYSICALS

Tensile Strength, psi = 3380; Elong. at Break, % = 660.

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

KV-6934-Q, NEOPRENE COATING SOLUTION CONTAINING LITHARGE

Gumstock KV-6936-B	GRAMS	Coating Solution KV-6934-Q	GRAMS
Neoprene AC	350	Gumstock KV-6936-B	108.6
Zinc Oxide	10	Toluene	485.4
Magnesia	10	Stab. Ag. Gaco KV-5502-G	6
Santowhite Crystals	10	Litharge	30
		Vulc. Ag. Gaco KV-7103-A	30

PHYSICALS

Tensile Strength, psi = 3208; Elong. at Break, % = 673

KV-6940-C, NEOPRENE COATING SOLUTION WITH LITHARGE MILLED INTO THE GUMSTOCK.

Gumstock KV-6938-C	GRAMS	Coating Solution KV-6940-C	GRAMS
Neoprene AC	350	Gumstock KV-6938-C	108
Litharge	17.5	Toluene	486
Santowhite Crystals	10	Stab. Ag. Gaco KV-5502-G	6
		Vulc. Ag. Gaco KV-7103-A	30

PHYSICALS

Tensile Strength, psi = 3946; Elong. at Break, % = 793
Accel. Shelf Aging (prior to the addition of the vulcanizing agent) at 150°F. 13 days

KV-6942-SERIES, EFFECT OF LEAD COMPOUND UPON NEOPRENE COATING SOLUTION

Gumstock	GRAMS	Coating Solution Series KV-6942	GRAMS
Neoprene AC	200	Gumstock	107.4
Santowhite Crystals	5	Toluene	486.6
Lead Compound (see below)	10	Stab. Gaco KV-5502-G	6
		Vulc. Ag. Gaco KV-7103-A	30

Coating Sol. Gaco KV-	Lead Compound	Tensile Strength, psi	Elong. at Break, %	Shelf Life @ 150°F., days
6942-D	Dythal	3310	900	37
6942-F	Dyphos	3715	840	30
6942-H	Normasal	3866	886	9
6942-J	Lead Linoleate	3818	946	52
6942-P	#1 Eagle Sublimed blue lead	4000	806	16

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

KV-6950-B, NEOPRENE COATING SOLUTION, PIGMENTED GREEN

Gumstock KV-7335	GRAMS
Neoprene AC	350
Santowhite Crystals	10
Chromium Oxide, X-1134	15
Monastral Green	15
Thermax	3
#1 Eagle Sublimed Blue Lead	17.5
Titanium Dioxide, R-610	17.5

Coating Solution KV-6950-B	GRAMS
Gumstock KV-7335	122.2
Toluene	471.8
Stabilizer-Gaco KV-5508	6
Vulc. AG. Gaco KV-7103-A	30

PHYSICALS

Tensile Strength, psi = 2999; Elong. at Break, % = 960
Shelf Life at 175°F, days = 18

KV-6955-B, ELECTRICALLY CONDUCTIVE NEOPRENE COATING SOLUTION

Gumstock KV-7343	GRAMS
Neoprene AC	350
Santowhite Crystals	10
#1 Eagle Sublimed Blue Lead	17.5
Acetylene Black	175

Coating Solution KV-6955-B	GRAMS
Gumstock KV-7343	157.8
Toluene	534.2
Stabilizer-Gaco KV-5508	6
Vulc. Ag. Gaco KV-7103-A	30

PHYSICALS

Tensile Strength, psi = 3227; Elong. at Break, % = 500
Shelf Life at 150°F, days = 49

KV-6558-N, HYPALON/NEOPRENE COATING SOLUTION

Gumstock KV-7348-B	GRAMS
Neoprene AC	233
Hypalon	117
Santowhite Crystals	10
Eagle Sublimed Blue Lead	17.5

Coating Solution KV-6558-N	GRAMS
Gumstock KV-7348-B	107.7
Toluene	486.3
Stabilizer-Gaco KV-5508	6
Vulc. Ag. Gaco KV-7103-A	30

PHYSICALS

Tensile Strength, psi = 2085; Elong. at Break, % = 700
Shelf Life @ 150°F, days = 17

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

KV-6958-P, BUNA-N/NEOPRENE COATING SOLUTION

Gumstock KV-7348-C	GRAMS	Coating Solution KV-6958-P	GRAMS
Neoprene AC	233	Gumstock KV-7348-C	107.7
Hycar OR-15	117	Toluene	243
Santowhite Crystals	10	Ethylene Dichloride	244
Eagle Sublimed Blue Lead	17.5	Stabilizer-Gaco KV-5508	6
		Vulc. Ag. Gaco KV-7103-A	30

PHYSICALS

Tensile Strength, psi = 1695; Elong. at Break, % = 830
Shelf Life @ 150°F, days = 17

KV-6958-Q, BUNA-S (GRS-1000)/NEOPRENE COATING

Gumstock KV-7348-D	GRAMS	Coating Solution KV-6958-Q	GRAMS
Neoprene AC	233	Gumstock KV-7348-D	107.7
Buna S (GRS-1000)	117	Toluene	324
Santowhite Crystals	10	Mineral Spirits	162
Eagle Sublimed Blue Lead	17.5	Stabilizer-Gaco KV-5508	6
		Vulc. Ag. Gaco KV-7103-A	30

PHYSICALS

Tensile Strength, psi = 1575; Elong. at Break, % = 806
Shelf Life @ 150°F, days = 19

KV-6958-R, POLYISOBUTYLENE (VISTANEX L-100)/NEOPRENE COATING

Gumstock KV-7348-E	GRAMS	Coating Solution KV-6958-R	GRAMS
Neoprene AC	233	Gumstock KV-7348-E	107.7
Vistanex L-100	177	Toluene	324
Santowhite Crystals	10	Mineral Spirits	162
Eagle Sublimed Blue Lead	17.5	Stabilizer-Gaco KV-5508	6
		Vulc. Ag. Gaco KV-7103-A	30

PHYSICALS

Tensile Strength, psi = 1566; Elong. at Break, % = 620
Shelf Life @ 150°F, days = 18; Better than normal adhesion to glass

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

KV-6958-S, NATURAL RUBBER/NEOPRENE COATING

Gumstock KV-7348-F	GRAMS	Coating Solution KV-6958-S	GRAMS
Neoprene AC	233	Gumstock KV-7348-F	107.7
Smoked Sheet	117	Toluene	324
Santowhite Crystals	10	Mineral Spirits	162
#1 Eagle Sublimed Blue Lead	17.5	Stabilizer-Gaco KV-5508	6
		Vulc. Ag. Gaco KV-7103-A	30

PHYSICALS

Tensile Strength, psi = 2999; Elong. at Break, % = 633

SERIES KV-6974, NEOPRENE GRT COATING SOLUTIONS

Gumstock KV-7332-B	GRAMS	Gumstock Solution	GRAMS
Neoprene GRT	350	Gumstock KV-7332-B	102.8
Santowhite Crystals	10	Stabilizer-Gaco MB-845	6
		Toluene	491.2

Coating Solution	Accelerator 30 Grams Type	Physicals: Tensile Strength psi	Elongation at Break %
KV-6974-A	KV-7108-A	1256	860
KV-6974-B	KV-7108-B	1317	913
KV-6974-C	KV-7108-C	704	1100
KV-6974-D	KV-7108-D	704	1200
KV-6974-J	KV-7108-J	2384	1166
KV-6974-Q	KV-7108-R	1655	1400
KV-6974-R	KV-7108-S	1071	1400

KV-6978-P, BUNA-N/NEOPRENE COATING

Gumstock KV-7354-C	GRAMS	Coating Solution KV-6978-P	GRAMS
Neoprene AC	175	Gumstock KV-7354-C	107.8
Buna N (Hycar OR-15)	175	Toluene	486.2
Ionol, Antioxidant	10	Stabilizer- Gaco KV-5508	6
Eagle Sublimed Blue Lead	17.5	Vulc. Ag. Gaco KV-7103-A	30

PHYSICALS

Tensile Strength, psi = 2259; Elong. at Break, % = 800
Shelf Life @ 150°F, days = 7

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

KV-6978-Q, POLYACRYLIC RUBBER/NEOPRENE COATING

Gumstock KV-7354-D	GRAMS	Coating Solution KV-6978-Q	GRAMS
Neoprene AC	175	Gumstock KV-7354-D	107.8
Hycar PA-21	175	Toluene	486.2
Ionol, Antioxidant	10	Stabilizer-Gaco KV-5508	6
Eagle Sublimed Blue Lead	17.5	Vulc. Ag. Gaco KV-7103-A	30

PHYSICALS

Tensile Strength, psi = 2005; Elong. at Break, % = 866
Shelf Life @ 150°F, days = 49

KV-6978-T, NEOPRENE COATING SOLUTION, CURING AGENT ADDED ON THE RUBBER MILL

Gumstock KV-7254-G	GRAMS	Coating Solution KV-6978-T	GRAMS
Neoprene AC	350	Gumstock KV-7354-G	129.2
Ionol, Antioxidant	10	Toluene	46.48
Eagle Sublimed Blue Lead	17.5	Stabilizer-Gaco KV-5508	6
Vulc. Ag. Gaco KV-7103-A	75		

PHYSICALS

Tensile Strength, psi = 4407; Elong. at Break, % = 940
Shelf Life at 150°F, days = 33

KV-6978-V, NEOPRENE COATING CONTAINING MICA

Gumstock KV-7354-J	GRAMS	Coating Solution KV-6978-V	GRAMS
Neoprene AC	350	Gumstock KV-7354-J	210.8
Ionol, Antioxidant	10	Toluene	483.2
Micro-Mica C-3000	264	Stabilizer-Gaco KV-5508	6
Vulc. Ag. Gaco KV-7103-A	100		

PHYSICALS

Tensile Strength, psi = 2091; Elong. at Break, % = 360
Shelf Life @ 150°F, days = 12, Moderately good adhesion to glass.

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

KV-6986-2-K, WHITE NEOPRENE COATING SOLUTION

Gumstock KV-7388	GRAMS	Coating Solution KV-6986-2-K	GRAMS
Neoprene AC	425	Gumstock KV-7388	175
HiSil	42.5	Toluene	535
Titanium Dioxide, R-610	227.0	Stabilizer-Gaco MB-845	6
Neozone D	21.2	Vulc. Ag. Gaco KV-7103-A	30
Ionol, Antioxidant	7		

PHYSICALS

Tensile Strength, psi = 2211; Elong. at Break, % = 1033
Color: Cream

KV-6986-2-P, NATURAL RUBBER/NEOPRENE COATING

Gumstock KV-7395	GRAMS	Coating Solution KV-6986-2-P	GRAMS
Neoprene AC	70	Gumstock KV-7395	108
Smoked Sheet	280	Xylene	486
Ionol, Antioxidant	10	Stabilizer Gaco KV-5508	6
Eagle Sublimed Blue Lead	17.5	Vulc. Ag. Gaco KV-7103-A	40

PHYSICALS

Tensile Strength, psi = 3283; Elong. at Break, % = 893
Shelf Life @ 150°F, days = over 40

KV-6988-R, NATURAL RUBBER/NEOPRENE COATING

Gumstock KV-7393	GRAMS	Coating Solution KV-6988-R	GRAMS
Neoprene AC	175	Gumstock KV-7393	108
Smoked Sheet	175	Toluene	486
Ionol, Antioxidant	10	Stabilizer KV-5508	6
Eagle Sublimed Blue Lead	17.5	Vulc. Ag. Gaco KV-7103-A	30

PHYSICALS

Tensile Strength, psi = 3553; Elong. at Break, % = 820

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

KV-6988-W, NATURAL RUBBER/NEOPRENE COATING

Gumstock KV-7394	GRAMS	Coating Solution KV-6988-W	GRAMS
Neoprene AC	125	Gumstock KV-7394	108
Smoked Sheet	225	Xylene	486
Ionol, Antioxidant	10	Stabilizer-Gaco KV-5508	6
Eagle Sublimed Blue Lead	17.5	Vulc. Ag. Gaco KV-7103-A	30

PHYSICALS

Tensile Strength, psi = 3747; Elong. at Break, % = 786

KV-7007-A, NEOPRENE AC, PIGMENTED WITH TITANIUM DIOXIDE

Gumstock KV-7404	GRAMS	Coating Solution KV-7007-A	GRAMS
Neoprene AC	350	Gumstock KV-7404	131.4
Ionol, Antioxidant	10	Xylene	426.6
Titanium Dioxide, R-610	100	Stabilizer-Gaco MB-845	6
		Vulc. Ag. Gaco KV-7103-A	30

PHYSICALS

Tensile Strength, psi = 3140; Elong. at Break, % = 1193
Color; Cream

SERIES KV-7007, COMPARISON OF COATINGS BASED ON VARIOUS TYPES OF NEOPRENE

Gumstock KV-7404	GRAMS	Gumstock#	Type of Neoprene
Neoprene (Page 65 for type)	350	7404-A	GN-A
Ionol	10	7404-B	GRT
TiO_2 R-610	100	7404-C	W
		7404-D	WRT
		7404-E	AC
		7404-F	KNR

Coating Solutions, Series KV-7007	GRAMS
Gumstock, see Page 65 for type	131.4
Stabilizer, Gaco MB-845	6
Xylene	462.6
Accelerator Gaco KV-7103-A	30

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-7007, COMPARISON OF COATINGS BASED ON VARIOUS TYPES OF NEOPRENE (continued)

PHYSICALS VERSUS TYPE OF NEOPRENE

Coating Solution KV#	Gumstock Solution KV #	Neoprene Type	Physicals Tensile Strength psi	Elongation at Break %
7007-A	7404-A	GN-A	3140	1193
7007-B	7404-B	GRT	1713	1220
7007-C	7404-C	W	1420	1300
7007-D	7404-D	WRT	1794	1320
7007-E	7404-E	AC	3817	1000
7007-F	7404-F	KNR	1694	753

KV-7007-C gave the lightest color followed by B, D, E, A and F in that order. It will be observed that Neoprenes AC and GN-A gave the strongest products (Neoprene GN-A gives a poorer color than Neoprene AC).

KV-7008, NATURAL RUBBER COATING SOLUTION

Gumstock KV-7410	GRAMS	Gumstock Solution	GRAMS
Smoked Sheet	350	Gumstock KV-7410	107.7
Ionol	10	Stabilizer Gaco MB-845	6.0
Eagle Sublimed Blue Lead	17.5	Xylene	486.3

Coating Solution KV-7008-A

Gumstock KV-7008	600	Accel. Gaco KV-7103-A	40

Tensile Strength, psi cured at room temperature = 1542
Elongation at Break, %, cured at room temperature = 1120

Tensile Strength, psi cured at 150°F. = 1554
Elongation at Break, %, cured at 150°F. = 1006

KV-7007-E, NEOPRENE GNA COATING, PIGMENTED WITH TITANIUM DIOXIDE

Gumstock KV-7404-E	GRAMS	Coating Solution KV-7007-E	GRAMS
Neoprene AC	350	Gumstock KV-7404-E	131.4
Ionol, Antioxidant	10	Xylene	462.6
Titanium Dioxide, R-610	100	Stabilizer-Gaco MB-845	6
		Vulc. Ag. Gaco KV-7103-A	30

PHYSICALS

Tensile Strength, psi = 3817; Elong. at Break, % = 1000
Color: Tannish-Cream

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-7010 A-E VARIOUS THIOKOL/NEOPRENE COATING SOLUTIONS

Gumstock KV-7402	GRAMS	Base Formulation-Incorporation of Thiokol	GRAMS
Neoprene AC	350	Gumstock KV-7402	51.4
Ionol	10	Stabilizer Gaco MB-845	6.0
		Xylene	492.6
		Thiokol, see Page 66 for type	50.0

PHYSICALS VERSUS TYPE OF THIOKOL

Accelerated Coating Solution	Thiokol Type	Accelerator KV-7103-A Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-7010-A	LP-2		Not run,	Thiokol incompatible
KV-7010-B	LP-3	30	1307	1420
KV-7010-C	LP-8	30	1120	1346
KV-7010-D*	LP-3	30	634	1700
KV-7010-E*	LP-8	30	195	870

* Used 102.8 grams of neoprene Gumstock KV-7402 and only 392.6 grams of Xylene.

KV-7011-A, NATURAL RUBBER NEOPRENE COATING, PIGMENTED WITH TITANIUM DIOXIDE

Gumstock KV-7411	GRAMS	Coating Solution KV-7011-A	GRAMS
Neoprene AC	125	Gumstock KV-7411	136.3
Smoked Sheet	225	Xylene	452.7
Ionol, Antioxidant	10	Stabilizer-Gaco MB-845	6
Eagle Sublimed Blue Lead	17.5	Vulc. Ag. Gaco KV-7103-A	30
Titanium Dioxide, R-610	100		

PHYSICALS - Tensile Strength, psi = 3137; Elong. at Break, % = 786
Color: Tannish-Cream

KV-8303-B, NEOPRENE AC COATING, PIGMENTED WITH TITANIUM DIOXIDE

Gumstock KV-7405-B	GRAMS	Coating Solution KV-8303-B	GRAMS
Neoprene AC	350	Gumstock KV-7405-B	152.7
Ionol, Antioxidant	10	Xylene	441.3
Titanium Dioxide, R-610	175	Stabilizer-Gaco MB-845	6
		Vulc. Ag. Gaco KV-7103-A	30

PHYSICALS - Tensile Strength, psi = 3236; Elong. at Break, % = 1093
Color: Cream

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

KV-8303-C, NEOPRENE AC COATING, PIGMENTED WITH TITANIUM DIOXIDE AND MICA

Gumstock KV-7405-C	GRAMS	Coating Solution KV-8303-C	GRAMS
Neoprene AC	350	Gumstock KV-7405-C	160
Ionol, Antioxidant	10	Xylene	434
Titanium Dioxide, R-610	150	Stabilizer-Gaco MB-845	6
Micro Mica C-3000	50	Vulc. Ag. Gaco KV-7103-A	30

PHYSICALS

Tensile Strength, psi = 3049; Elong. at Break, % = 860
Color: Cream

KV-8304-A, KEL-F ELASTOMER COATING, UNPIGMENTED

Coating Solution KV-8304-A	GRAMS
Kel-F Elastomer	50
Methyl-Isobutyl Ketone	135
Amyl Acetate	135
Toluene	45
Isopropanol-anhy.	135
Vulc. Ag. Gaco KV-7103-A	20

PHYSICALS

Tensile Strength, psi = 1169
Elong. at Break, % = 2000

KV-8310-A, POLYACRYLIC RUBBER COATING, UNPIGMENTED

Gumstock KV-8108	GRAMS	Coating Solution KV-8310-A	GRAMS
Hycar 4021 well milled and sheeted off as thin as possible		Gumstock KV-8108	75
		Xylene	525
		Vulc. Ag. Gaco KV-7103-A	22.50

PHYSICALS

Tensile Strength, psi = 689; Elong. at Break, % = 1426

KV-8310-B, POLYACRYLIC RUBBER COATING, PIGMENTED WITH TITANIUM DIOXIDE

Gumstock KV-8109	GRAMS	Coating Solution KV-8310-B	GRAMS
Hycar 4021	350	Gumstock KV-8109	112.5
Titanium Dioxide, R-610	175	Xylene	487.5
		Vulc. Ag. Gaco KV-7103-A	22.5

PHYSICALS

Tensile Strength, psi = 751; Elong. at Break, % = 1500

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

KV-8310-C, POLYACRYLIC RUBBER COATING UNPIGMENTED

Gumstock KV-8110	GRAMS	Coating Solution KV-8310-C	GRAMS
Hycar 4021	175	Gumstock KV-8110	100
Neoprene AC	175	Stabilizer-Gaco MB-845	3
		Xylene	497
		Vulc. Ag. Gaco KV-7103-A	30

PHYSICALS

Tensile Strength, psi = 1839; Elong. at Break, % = 1033

KV-8310-D, POLYACRYLIC RUBBER COATING, PIGMENTED WITH TITANIUM DIOXIDE

Gumstock KV-8111	GRAMS	Coating Solution KV-8310-D	GRAMS
Hycar 4021	175	Gumstock KV-8111	150
Neoprene AC	175	Stabilizer-Gaco MB-845	3
Titanium Dioxide, R-610	175	Xyleme	447
		Vulc. Ag. Gaco KV-7103-A	30

PHYSICALS

Tensile Strength, psi = 1491; Elong. at Break, % = 913

KV-8315, NATURAL RUBBER/NEOPRENE COATING SOLUTION, PIGMENTED

Gumstock KV-8115	GRAMS	Coating Solution KV-8315	GRAMS
Smoked Sheet	225	Gumstock KV-8115	120.7
Neoprene AC	125	Stabilizer-Gaco MB-845	4
Ionol, Antioxidant	5	Xylene	475.3
Dyphos	20	Vulc. Ag. Gaco KV-7103-A	30.0

PHYSICALS

Tensile Strength, psi = 2700; Elong. at Break, % = 900

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-8320, POLYACRYLIC RUBBER/NEOPRENE COATING SOLUTIONS, PIGMENTED

Gumstock KV-8111	GRAMS	Coating Solution KV-8320	GRAMS
Hycar 4021	175	Gumstock KV-8111	150
Neoprene AC	175	Stabilizer-Gaco MB-845	3
Titanium Dioxide, R-610	175	Xylene	447

PHYSICALS versus ACCELERATION

Coating Sol. KV-	Gaco Accelerator Type	Gaco Accelerator Grams	Physicals Tensile Strength, psi	Physicals Elong. at Break
8320-A	KV-7103-A	30	1597	906
8320-B	KV-7103-A	40	1401	846
8320-C	KV-7103-A	50	1143	653
8320-D	KV-7108-D	30	1185	966
8320-E	KV-7108-G	30	665	1153
8320-F	KV-7108-J	30	311	over 2000
8320-G	KV-7108-U	30	246	1786
8320-H	None	None	241	over 2000

SERIES KV-8324, HYPALON/NEOPRENE CO-VULCANIZATES

Gumstock KV-8117	GRAMS	Coating Solution	GRAMS
Hypalon	175	Above Gumstock	156.4
Neoprene AC	175	Stabilizer Gaco MB-845	4.0
Titanium Dioxide	175	Xylene	339.6
Ionol, Antioxidant	5		
Plumb-O-Sil B	17.5		

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals Tensile Strength psi	Physicals Elongation at Break %
KV-8324-A	KV-7103-A	30	1327	813
KV-8324-B	KV-7103-A	40	1165	820
KV-8324-C	KV-7103-A	50	1297	646
KV-8324-D	KV-7108-F	30	679	1213
KV-8324-E	KV-7108-G	30	977	1046
KV-8324-F	KV-7108-J	30	323	2000

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-8326, BROMATED BUTYL RUBBER/NEOPRENE CO-VULCANIZATES

Gumstock KV-8118	GRAMS	Coating Solution	GRAMS
Hycar 2202	175	Above Gumstock	156.4
Neoprene AC	175	Stabilizer Gaco MB-845	4
Ionol, Antioxidant	5	Xylene	439.6
Dyphos	17.5		
Titanium Dioxide	175		

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator		Physicals	
	Type	Weight Grams	Tensile Strength psi	Elongation at Break %
KV-8326-A	KV-7103-A	30	837	920
KV-8326-B	KV-7103-A	40	870	630
KV-8326-C	KV-7103-A	50	565	400
KV-8326-D	KV-7108-F	30	466	1500
KV-8326-E	KV-7108-G	30	Adherent, weak,	unstrippable.
KV-8326-F	KV-7108-J	30	343	2000

SERIES KV-8328, RUBBER/NEOPRENE CO-VULCANIZATES

Gumstock KV-8119	GRAMS	Coating Solution	GRAMS
Smoke Sheet	175	Above Gumstock	156.4
Neoprene AC	175	Stabilizer Gaco MB-845	4.0
Ionol	5	Xylene	339.6
Dyphos	17.5		
Titanium Dioxide	175		

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator		Physicals	
	Type	Weight Grams	Tensile Strength psi	Elongation at Break %
KV-8328-A	KV-7103-A	30	2324	886
KV-8328-B	KV-7103-A	40	2392	746
KV-8328-C	KV-7103-A	50	1722	613
KV-8328-D	KV-7108-F	30	1511	760
KV-8328-E	KV-7108-G	30	1875	660
KV-8328-F	KV-7108-J	30	479	1800

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-8332, BUNA-N NEOPRENE CO-VULCANIZATES

Gumstock KV-8121	GRAMS	Coating Solution	GRAMS
Hycar OR-15	175	Above Gumstock	156.4
Neoprene AC	175	Stabilizer Gaco MB-845	4.0
Ionol	5	Xylene	339.6
Dyphos	17.5		
Titanium Dioxide	175		

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-8332-A	KV-7103-A	30	1545	833
KV-8332-B	KV-7103-A	40	1733	706
KV-8332-C	KV-7103-A	50	1636	630
KV-8332-D	KV-7108-F	30	1364	913
KV-8332-E	KV-7108-G	30	1269	900
KV-8332-F	KV-7108-J	30	933	960

SERIES KV-8340, POLYACRYLIC RUBBER/BUNA-N CO-VULCANIZATES

Gumstock KV-8124	GRAMS	Coating Solution	GRAMS
Hycar OR-15	175	Above Gumstock	156.4
Hycar 4021	175	Stabilizer Gaco MB-845	4.0
Ionol	5	Xylene	339.6
Dyphos	17.5		
Titanium Dioxide	175		

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-8340-A	KV-7103-A	30	932	853
KV-8340-B	KV-7103-A	40	1193	806
KV-8340-C	KV-7103-A	50	816	573
KV-8340-D	KV-7108-F	30	too weak to test	
KV-8340-E	KV-7108-G	30	too weak to test	
KV-8340-F	KV-7108-J	30	too weak to test	

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-8342, POLYACRYLIC RUBBER/NATURAL RUBBER CO-VULCANIZATES

Gumstock KV-8125	GRAMS	Coating Solution	GRAMS
Hycar 4021	175	Above Gumstock	156.4
Smoke Sheet	175	Stabilizer Gaco MB-845	4.0
Ionol	5	Xylene	339.6
Dyphos	17.5		
Titanium Dioxide	175		

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals Tensile Strength psi	Physicals Elongation at Break %
KV-8342-A	KV-7103-A	30	2322	743
KV-8342-B	KV-7103-A	40	2466	666
KV-8342-C	KV-7103-A	50	2111	593
KV-8342-D	KV-7108-F	30	1500	813
KV-8342-E	KV-7108-G	30	2178	680
KV-8342-F	KV-7108-J	30	too weak to test	

SERIES KV-8344, BUNA-N/NATURAL RUBBER CO-VULCANIZATES

Gumstock KV-8126	GRAMS	Coating Solution	GRAMS
Smoke Sheet	175	Above Gumstock	156.4
Hycar OR-15	175	Stabilizer Gaco MB-845	4.0
Ionol	5	Xylene	339.6
Dyphos	17.5		
Titanium Dioxide	175		

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals Tensile Strength psi	Physicals Elongation at Break %
KV-8344-A	KV-7103-A	30	2000	633
KV-8344-B	KV-7103-A	40	1847	580
KV-8344-C	KV-7103-A	50	1812	560
KV-8344-D	KV-7108-F	30	1277	620
KV-8344-E	KV-7108-G	30	1755	540
KV-8344-F	KV-7108-J	30	too weak to test	

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-8346, HYPALON/NATURAL RUBBER CO-VULCANIZATES

Gumstock KV-8123	GRAMS	Coating Solution	GRAMS
Hypalon	175	Above Gumstock	156.6
Smoke Sheet	175	Stabilizer Gaco MB-845	4.0
Ionol	5	Xylene	339.6
Dyphos	17.5		
Titanium Dioxide	175		

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals Tensile Strength psi	Physicals Elongation at Break %
KV-8346-A	KV-7103-A	30	1622	833
KV-8346-B	KV-7103-A	40	1248	686
KV-8346-C	KV-7103-A	50	977	653
KV-8346-D		30	910	853
KV-8346-E		30	1978	680
KV-8346-F		30	190	900

SERIES KV-8360, NEOPRENE COATING SOLUTION, PIGMENTED WITH TITANIUM DIOXIDE

Gumstock KV-8330	GRAMS	Coating Solution	GRAMS
Neoprene AC	350	Gumstock KV-8330	152.7
Ionol	10	Stabilizer Gaco MB-845	6.0
Titanium Dioxide	175	Xylene	441.3
		Accel. Gaco KV-7103-A	30.0

PHYSICALS - Tensile Strength, psi = 3878; Elong. at Break, % = 986

SERIES KV-8361, POLYACRYLIC RUBBER/NEOPRENE, COATING SOLUTION, UNPIGMENTED

Gumstock KV-8110	GRAMS	Coating Solution	GRAMS
Hycar 4021	175	Above Gumstock	100
Neoprene AC	175	Stabilizer Gaco MB-845	3
		Xylene	497
		Vulc. Ag. Gaco KV-7103-A	30

PHYSICALS - Tensile Strength, psi = 2206; Elong. at Break, % = 1206

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-8368-A, NEOPRENE COATING COMPOSITIONS

Gumstock KV-8138	GRAMS	Coating Solution	GRAMS
Neoprene AC	350	Above Gumstock	131.4
Ionol, Antioxidant	10	Stabilizer Gaco MB-845	6
Titanium Dioxide, R-110	100	Xylene	462.6
		Accel. Gaco KV-7103-A	30

PHYSICALS - Tensile Strength, psi = 3192; Elong. at Break, % = 993

SERIES KV-8378, POLYACRYLIC RUBBER/NEOPRENE COATING COMPOSITION

Gumstock KV-8172	GRAMS	Gumstock Solution	GRAMS
Polyacrylic Rubber (Hycar 4021)	175	Above Gumstock	128.5
Neoprene AC	175	Xylene	257
Titanium Dioxide, R-110	100	MIBK	192.7

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-8378-A	KV-7103-A	20	2140	1080
KV-8378-B	KV-7103-A	25	1591	1030
KV-8378-C	KV-7103-A	30	1913	1140
KV-8378-D	KV-7103-A	40	1759	1010
KV-8378-E	KV-7108-F	30	1249	1053
KV-8378-F	KV-7108-F	40	1049	966
KV-8378-G	KV-7108-G	30	1390	946
KV-8378-H	KV-7108-G	40	1086	810

SERIES KV-8386,A,B,C,D AND KV-8741 NEOPRENE COATING SOLUTION PIGMENTED

Gumstock KV-8196	GRAMS	Gumstock Solution	GRAMS
Neoprene AC	350	Gumstock KV-8196	157.8
Ionol	10	Xylene	300
Titanium Dioxide, R-110	175	Toluene	92.2
Plumb-O-Sil A	17.5	Methyl Isobutyl Ketone	50

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-8386A,B,C,D AND KV-8741 NEOPRENE COATING SOLUTIONS, PIGMENTED (continued)

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-8368-A	KV-7103-A	25	3552	1007
KV-8368-B	KV-7103-A	20	3718	1113
KV-8368-C	KV-7103-A	15	1541	900
KV-8368-D	KV-7108-G	30	3181	980
KV-8741	Same As KV-8386-A			

SERIES KV-8386-E,F,G,H, NEOPRENE COATING SOLUTIONS, PIGMENTED

Gumstock KV-8197	GRAMS
Neoprene AC	350
Ionol	10
Titanium Dioxide, R-110	100
Plumb-O-Sil A	17.5

Gumstock Solution	GRAMS
Gumstock KV-8197	136.3
Xylene	321.5
Toluene	92.2
Methyl Isobutyl Ketone	50

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-8386-E	KV-7103-A	25	3483	1447
KV-8386-F	KV-7103-A	20	3861	1093
KV-8386-G	KV-7103-A	15	2905	1280
KV-8386-H	KV-7108-G	30	3809	906

SERIES KV-8394, NEOPRENE COATING COMPOSITION

Gumstock KV-8145	GRAMS
Neoprene AC	350
Ionol	10
Titanium Dioxide, R-110	175
#201 Basic Silicate White Lead	17.5

Coating Solution	GRAMS
Above Gumstock	157.8
Stabilizer Gaco MB-845	4
Xylene	438.2
Accel. Gaco KV-7103-A	25

PHYSICALS

Solids, %	24.3
Tensile Strength, psi	3003
Viscosity, cp.	960
Elong. at Break, %	820

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-8382, BUNA-N/HYPALON COATING SOLUTIONS, PIGMENTED

Gumstock KV-8142	GRAMS	Gumstock Solution	GRAMS
Hycar OR-15	175	Gumstock KV-8142	151.4
Hypalon	175	Toluene	98.6
Ionol, Antioxidant	5	2 Nitro Propane	200
Titanium Dioxide, R-110	175	Methyl Ethyl Ketone	150

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-8382-A	KV-7103-A	30	1316	1113
KV-8382-B	KV-7108-F	30	865	1633
KV-8382-C	KV-7108-G	30	718	1100

SERIES KV-8382, KEL-F ELASTOMER COATING SOLUTION, PIGMENTED

Gumstock KV-8400	GRAMS	Gumstock KV-8400	GRAMS
Kel-F Elastomer	320	Isopropanol, 99%	1096
Titanium Dioxide, R-110	160	Toluene	320
Methyl Isobutyl Ketone	948	Total Weights	3792
Amyl Acetate	948		

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-8382-D	KV-7103-A	20	1121	506
KV-8382-F	KV-7108-F	25	1000	967
KV-8382-G	KV-7108-G	25	1011	760
KV-8382-H	KV-7108-J	25	762	1767

SERIES KV-8720, CURING CHARACTERISTICS OF KEL-F ELASTOMER SOLUTIONS

Gumstock Solution KV-8401	GRAMS		
Kel-F Elastomer	200	Butyl Acetate	600
Titanium Dioxide, R-110	100	Isopropanol, 99%	700
MIBK	600	Toluene	200

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-8720, CURING CHARACTERISTICS OF KEL-F ELASTOMER SOLUTIONS (continued)

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Accelerator Type	Accelerator Weight Grams	Cured Temp.	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-8720-A	KV-7103-A	20	R. T.	1142	473
KV-8720-A	KV-7103-A	20	150°F.	1466	300
KV-8720-B	KV-7103-A	20	200°F.	2255	333
KV-8720-B	KV-7103-A	20	250°F.	2055	306
KV-8720-C	KV-7103-A	30	R. T.	1177	326
KV-8720-C	KV-7103-A	30	150°F.	1602	300
KV-8720-D	KV-7103-A	30	200°F.	1644	233
KV-8720-D	KV-7103-A	30	250°F.	1999	253
KV-8720-E	KV-7108-G	30	R. T.	904	600
KV-8720-E	KV-7108-G	30	150°F.	1233	420
KV-8720-F	KV-7108-G	30	200°F.	1388	366
KV-8720-F	KV-7108-G	30	250°F.	1355	333

SERIES KV-8732, NEOPRENE COATING SOLUTION, LOW FILLER CONTENT

Gumstock KV-8928	GRAMS	Gumstock Solution	GRAMS
Neoprene AC	350	Gumstock KV-8928	117.8
Ionol, Antioxidant	10	Xylene	300
Plumb-O-Sil A	17.5	Toluene	132.2
Titanium Dioxide, R-110	35	MIBK	50

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-8732-A	KV-7103-A	30	3839	847
KV-8732-B	KV-7103-A	25	4114	869
KV-8732-C	KV-7103-A	20	3476	933
KV-8732-D	KV-7108-F	30	1886	1340
KV-8732-E	KV-7108-F	40	899	810
KV-8732-F	KV-7108-G	30	1889	1027
KV-8732-G	KV-7108-G	40	1802	1052
KV-8732-H	KV-7108-J	30	709	2000+

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-8734, NEOPRENE COATING SOLUTION, LEAD SILICATE FILLER

Gumstock KV-8929	GRAMS	Gumstock Solution	GRAMS
Neoprene AC	350	Gumstock KV-8929	152.5
Ionol, Antioxidant	10	Xylene	300
Plumb-O-Sil A	175	Toluene	97.5
		MIBK	50

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-8734-A	KV-7103-A	30	3685	680
KV-8734-B	KV-7103-A	25	3561	680
KV-8734-C	KV-7103-A	20	3234	620
KV-8734-D	KV-7108-F	30	2037	687
KV-8734-E	KV-7108-F	40	1579	493
KV-8734-F	KV-7108-G	30	2440	600
KV-8734-G	KV-7108-G	40	1933	627
KV-8734-H	KV-7108-J	30	806	1400

NEOPRENE COATING KV-8741 - - PLEASE SEE KV-8386-A

SERIES KV-8748, POLYACRYLIC RUBBER/NEOPRENE COATING SOLUTION, PIGMENTED

Gumstock KV-8930	GRAMS	Gumstock Solution	GRAMS
Polyacrylic Rubber Hycar 4021	175	Gumstock KV-8930	163
Neoprene AC	175	Xylene	137
Ionol, Antioxidant	10	Toluene	100
Plumb-O-Sil A	75	MIBK	100
Titanium Dioxide, R-610	175	2 Nitro Propane	100

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-8748-A	KV-7103-A	20	1321	846
KV-8748-B	KV-7103-A	30	1678	620
KV-8748-C	KV-7108-F	20	622	1020
KV-8748-D	KV-7108-F	30	643	973
KV-8748-E	KV-7108-G	20	545	940
KV-8748-F	KV-7108-G	30	563	946
KV-8748-G	KV-7109	25	Film could not be stripped	
KV-8748-H	KV-7109	35	Film could not be stripped	

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-8750, POLYACRYLIC RUBBER/NEOPRENE GN-A COATING SOLUTIONS, PIGMENTED

Gumstock KV-8931	GRAMS	Gumstock Solution	GRAMS
Polyacrylic Rubber Hycar 4021	175	Gumstock KV-8931	163
Neoprene GN-A	175	Xylene	137
Ionol, Antioxidant	10	Toluene	100
Plumb-O-Sil-A	35	MIBK	100
Titanium Dioxide, R-110	175	2 Nitro Propane	100

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals Tensile Strength psi	Physicals Elongation at Break %
KV-8750-A	KV-7103-A	20	1127	787
KV-8750-B	KV-7103-A	30	1339	700
KV-8750-C	KV-7108-F	20	485	1007
KV-8750-D	KV-7108-F	30	600	986
KV-8750-E	KV-7108-G	20	1000	1026
KV-8750-F	KV-7108-G	30	775	880
KV-8750-G	KV-7108-J	20	444	820
KV-8750-H	KV-7108-J	30	216	1133
KV-8752-A	KV-7109	20	522	810
KV-8752-B	KV-7109	30	461	670

SERIES KV-8754, POLYACRYLIC RUBBER/NEOPRENE COATING SOLUTION, PIGMENTED

Gumstock KV-8933	GRAMS	Gumstock Solution	GRAMS
Neoprene AC	175	Gumstock KV-8933	163
Polyacrylic Rubber Hycar 4021	175	Xylene	137
Ionol, Antioxidant	10	Toluene	100
Plumb-O-Sil A	35	MIBK	100
Titanium Dioxide, R-110	175	2 Nitro Propane	100

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals Tensile Strength psi	Physicals Elongation at Break %
KV-8754-A	KV-7103-A	20	1815	946
KV-8754-B	KV-7103-A	30	2033	713
KV-8754-C	KV-7108-F	20	686	1273
KV-8754-D	KV-7108-F	30	775	1206
KV-8754-E	KV-7108-G	20	1462	993
KV-8754-F	KV-7108-G	30	1083	980
KV-8754-G	KV-7109	25	466	1400
KV-8754-H	KV-7109	35	366	1213

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-8758, NEOPRENE COATINGS - SPECIAL SOLVENT BLEND

Gumstock KV-8909	GRAMS	Gumstock Solution	GRAMS
Neoprene AC	350	Gumstock KV-8909	157.8
Ionol, Antioxidant	10	Toluene	92.2
Titanium Dioxide, R-110	175	Xylene	150.0
Plumb-Sil A	17.5	2 Nitro Propane	100.0
		Ethyl Amyl Ketone	100.0

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals Tensile Strength psi	Physicals Elongation at Break %
KV-8758-A	KV-7103-A	20	3114	746
KV-8758-B	KV-7103-A	25	3176	726
KV-8758-C	KV-7103-A	30	2777	633
KV-8758-D	KV-7108-F	30	1851	773
KV-8758-E	KV-7108-G	30	2321	873
KV-8758-F	KV-7108-J	30	1391	1600
KV-8758-G	KV-7109	30	2044	920
KV-8758-H	KV-7110-A	30	1971	453

SERIES KV-8760, NEOPRENE COATINGS - PIGMENTED, CONTAINING ZINC OXIDE AND DYPHOS

Gumstock KV-8938	GRAMS	Gumstock Solution KV-8789	GRAMS
Neoprene AC	350	Gumstock KV-8938	193
Ionol, Antioxidant	10	Toluene	107
Titanium Dioxide, R-110	175	Xylene	100
Zinc Oxide	70	2 Nitro Propane	100
Dyphos	70	Ethyl Amyl Ketone	100

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals Tensile Strength psi	Physicals Elongation at Break %
KV-8760-A	KV-7103-A	20	3468	760
KV-8760-B	KV-7103-A	25	3100	653
KV-8760-C	KV-7103-A	30	3218	1053
KV-8760-D	KV-7108-F	30	2704	706
KV-8760-E	KV-7108-G	30	2666	720
KV-8760-F	KV-7108-J	30	1094	1093
KV-8760-G	KV-7109	30	2661	827
KV-8760-H	KV-7110-A	30	2098	766

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-8762, NEOPRENE COATINGS - PIGMENTED, CONTAINING DYPHOS

Gumstock KV-8937	GRAMS
Neoprene AC	350
Ionol, Antioxidant	10
Titanium Dioxide, R-110	175
Dyphos	70

Gumstock Solution KV-8790	GRAMS
Gumstock KV-8937	173
Toluene	127
Xylene	100
2 Nitro Propane	100
Ethyl Amyl Ketone	100

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-8762-A	KV-7103-A	20	3544	860
KV-8762-B	KV-7103-A	25	3080	720
KV-8762-C	KV-7103-A	30	3591	760
KV-8762-D	KV-7108-F	30	2425	720
KV-8762-E	KV-7108-G	30	2869	573
KV-8762-F	KV-7108-J	30	1607	740
KV-8762-G	KV-7109	30	2282	953
KV-8762-H	KV-7110-A	30	1502	646

SERIES KV-8766, POLYACRYLIC RUBBER/NEOPRENE AC - PIGMENTED, CONTAINING ZINC OXIDE AND DYPHOS

Gumstock KV-8940	GRAMS
Neoprene AC	175
Polyacrylic Rubber Hycar 4021	175
Titanium Dioxide, R-110	175
Zinc Oxide	70
Dyphos	70
Ionol, Antioxidant	10

Gumstock Solution KV-8792	GRAMS
Gumstock KV-8940	193
Toluene	107
Xylene	100
2 Nitro Propane	100
Ethyl Amyl Ketone	100

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-8766-A	KV-7103-A	20	1895	806
KV-8766-B	KV-7103-A	25	2264	706
KV-8766-C	KV-7103-A	30	1641	606
KV-8766-D	KV-7108-F	20	939	833
KV-8766-E	KV-7108-F	30	1213	793
KV-8766-F	KV-7108-G	20	1168	833
KV-8766-G	KV-7108-G	30	706	'80
KV-8766-H	KV-7109	30	1194	853

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-8770, NEOPRENE COATINGS - ZINC OXIDE AS FILLER

Gumstock KV-8943	GRAMS	Gumstock Solution KV-8794	GRAMS
Neoprene AC	350	Gumstock KV-8943	189
Ionol, Antioxidant	10	Toluene	111
Dyphos	70	Xylene	100
Zinc Oxide	230	2 Nitro Propane	100
		Ethyl Amyl Ketone	100

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-8770-A	KV-7103-A	20	3031	706
KV-8770-B	KV-7103-A	25	2775	526
KV-8770-C	KV-7103-A	30	2872	620
KV-8770-D	KV-7108-F	30	2248	666
KV-8770-E	KV-7108-G	30	2069	573
KV-8770-F	KV-7108-J	30	866	920
KV-8770-G	KV-7109	30	1398	793
KV-8770-H	KV-7110-A	30	679	1046

SERIES KV-8772, NEOPRENE COATINGS - ZIRCONIUM OXIDE AS FILLER

Gumstock KV-8944	GRAMS	Gumstock Solution KV-8795	GRAMS
Neoprene AC	350	Gumstock KV-8944	210
Ionol, Antioxidant	10	Toluene	90
Zirconium Oxide - cp	235	Xylene	100
Zinc Oxide	70	2 Nitro Propane	100
Dyphos	70	Ethyl Amyl Ketone	100

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-8772-A	KV-7101-A	20	2216	640
KV-8772-B	KV-7101-A	25	1902	580
KV-8772-C	KV-7101-A	30	1680	780
KV-8772-D	KV-7108-F	25	1181	793
KV-8772-E	KV-7108-F	30	1373	826
KV-8772-F	KV-7108-G	25	2100	820
KV-8772-G	KV-7108-G	30	1833	726
KV-8772-H	KV-7109	25	1254	1000

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-8774, NEOPRENE COATINGS - TIO2, HI-SIL, ZINC OXIDE AND DYPHOS, AND FILLERS

Gumstock KV-8945	GRAMS
Neoprene AC	350
Ionol, Antioxidant	10
Titanium Dioxide, R-110	87.5
Hi-Sil	64
Zinc Oxide	50
Dyphos	70

Gumstock Solution KV-8796	GRAMS
Gumstock KV-8945	180
Toluene	120
Xylene	100
2 Nitro Propane	100
Ethyl Amyl Ketone	100

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals Tensile Strength psi	Physicals Elongation at Break %
KV-8774-A	KV-7103-A	20	3487	666
KV-8774-B	KV-7103-A	25	3688	633
KV-8774-C	KV-7103-A	30	2983	580
KV-8774-D	KV-7108-F	25	3047	640
KV-8774-E	KV-7108-F	30	2533	653
KV-8774-F	KV-7108-G	25	3105	593
KV-8774-G	KV-7108-G	30	2385	560
KV-8774-H	KV-7109	25	1997	1000

SERIES KV-8780 A-D, NATURAL RUBBER/NEOPRENE COATINGS PIGMENTED

Gumstock KV-8960	GRAMS
Smoked Sheet	262.5
Neoprene AC	87.5
Ionol, Antioxidant	10.0
Eagle Sublimed Blue Lead	17.5

Gumstock Solution KV-8810	GRAMS
Gumstock KV-8960	107.7
Toluene	192.3
Xylene	400.0
2 Nitro Propane	25.0
Ethyl Amyl Ketone	25.0

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals Tensile Strength psi	Physicals Elongation at Break %
KV-8780-A	KV-7103-A	30	2768	787
KV-8780-B	KV-7103-A	40	2965	573
KV-8780-C	KV-7108-G	30	2922	660
KV-8780-D	KV-7108-G	40	3387	653

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-8780 G-H, NEOPRENE GRT COATING SOLUTIONS, UNPIGMENTED

Gumstock KV-8962	GRAMS	Gumstock Solution KV-8812	GRAMS
Neoprene GRT	350	Gumstock KV-8962	102.8
Ionol, Antioxidant	10	Toluene	197.2
		Xylene	100
		2 Nitro Propane	100
		Ethyl Amyl Ketone	100

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals Tensile Strength psi	Physicals Elongation at Break %
KV-8780-G	KV-7108-J	30	2550	1047
KV-8780-H	KV-7108-J	40	1889	1120

SERIES KV-8782 E-H, POLYACRYLIC RUBBER/NEOPRENE COATINGS, MILL ACCELERATED, PIGMENTED

Gumstock KV-8964	GRAMS	Gumstock Solution KV-8814	GRAMS
Polyacrylic Rubber Hycar 4021	175	Gumstock KV-8964	191.5
Neoprene AC	175	Toluene	108.5
Titanium Dioxide, R-110	175	Xylene	100
Dyphos	35	2 Nitro Propane	100
Ionol, Antioxidant	10	Ethyl Amyl Ketone	100
KV-7103-A	100		

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals Tensile Strength psi	Physicals Elongation at Break %
KV-8782-E	-	-	1860	740
KV-8782-F	KV-7108-G	20	1597	607
KV-8782-G	KV-7108-J	20	1367	420
KV-8782-H	KV-7109	20	2657	673

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-8784 A-D, POLYACRYLIC RUBBER/NEOPRENE GN-A COATING, PIGMENTED, CONTAINING CHLORINATED RUBBER

Gumstock KV-8965	GRAMS
Polyacrylic Rubber Hycar 4021	175
Neoprene GNA	175
Parlon-20"	35
Ionol, Antioxidant	10
Dyphos	35
Titanium Dioxide, R-110	175

Gumstock Solution KV-8815	GRAMS
Gumstock KV-8965	172.8
Toluene	127.2
Xylene	100
2 Nitro Propane	100
Ethyl Amyl Ketone	100

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-8784-A	KV-7103-A	25	2230	700
KV-8784-B	KV-7103-A	30	2162	620
KV-8784-C	KV-7108-F	30	939	733
KV-8784-D	KV-7108-G	30	1349	720

SERIES KV-8824 B-D, NEOPRENE COATING, PIGMENTED WITH CARBON BLACK

Gumstock KV-8969	GRAMS
Neoprene AC	350
Thermax	128
Ionol, Antioxidant	10
Dyphos	70

Gumstock Solution KV-8817	GRAMS
Gumstock KV-8969	159.5
Toluene	127.0
Xylene	100
2 Nitro Propane	100
Ethyl Amyl Ketone	100

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-8824-B	KV-7103-A	20	3000	607
KV-8824-C	KV-7103-A	30	3153	880
KV-8824-D	KV-7108-G	25	3147	760

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-8824-E-G, NEOPRENE COATING, PIGMENTED WITH CALCIUM SILICATE

Gumstock KV-8970	GRAMS	Gumstock Solution KV-8818	GRAMS
Neoprene AC	350	Gumstock KV-8970	164.7
Silene EF	146	Toluene	127.0
Ionol, Antioxidant	10	Xylene	100
Dyphos	70	2 Nitro Propane	100
		Ethyl Amyl Ketone	100

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals Tensile Strength psi	Physicals Elongation at Break %
KV-8824-E	KV-7103-A	20	3278	580
KV-8824-F	KV-7103-A	30	3093	547
KV-8824-G	KV-7108-G	25	2190	420

SERIES KV-8830 A-C, NEOPRENE COATING, PIGMENTED WITH ZINC OXIDE

Gumstock KV-8971	GRAMS	Gumstock Solution KV-8819	GRAMS
Neoprene AC	350	Gumstock KV-8971	236.3
Zinc Oxide	398	Toluene	127
Ionol, Antioxidant	10	Xylene	100
Dyphos	70	2 Nitro Propane	100
		Ethyl Amyl Ketone	100

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals Tensile Strength psi	Physicals Elongation at Break %
KV-8830-A	KV-7103-A	20	2990	813
KV-8830-B	KV-7103-A	30	2973	833
KV-8830-C	KV-7108-G	25	2947	753

SERIES KV-8830 D-F, NEOPRENE COATING, PIGMENTED WITH ZIRCONIUM DIOXIDE

Gumstock KV-8972	GRAMS	Gumstock Solution KV-8820	GRAMS
Neoprene AC	350	Gumstock KV-8972	239.1
Zirconium Oxide	407	Toluene	127
Ionol, Antioxidant	10	Xylene	100
Dyphos	70	2 Nitro Propane	100
		Ethyl Amyl Ketone	100

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-8830 D-F, NEOPRENE COATING, PIGMENTED WITH ZIRCONIUM DIOXIDE (continued)

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator		Physicals	
	Type	Weight Grams	Tensile Strength psi	Elongation at Break %
KV-8830-D	KV-7103-A	20	2176	700
KV-8830-E	KV-7103-A	30	2507	640
KV-8830-F	KV-7108-G	25	1905	860

SERIES KV-8830 G-H, NEOPRENE COATING, PIGMENTED WITH DIBASIC LEAD PHOSPHITE

Gumstock KV-8793	GRAMS
Neoprene AC	350
Dyphos	564
Ionol, Antioxidant	10

Gumstock Solution KV-8821	GRAMS
Gumstock KV-8793	275.2
Toluene	127
Xylene	100
2 Nitro Propane	100
Ethyl Amyl Ketone	100

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator		Physicals	
	Type	Weight Grams	Tensile Strength psi	Elongation at Break %
KV-8830-G	KV-7103-A	20	3214	693
KV-8830-H	KV-7103-A	30	2913	687

SERIES KV-8838 A-H, NEOPRENE COATING, PIGMENTED WITH A SMALL QUANTITY OF CARBON BLACK

Gumstock KV-8983	GRAMS
Neoprene AC	350
Thermax	74
Ionol, Antioxidant	10
Dyphos	70

Gumstock Solution KV-8849	GRAMS
Gumstock KV-8983	127
Xylene	100
Toluene	173
2 Nitro Propane	100
Ethyl Amyl Ketone	100

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-8838 A-H, NEOPRENE COATING, PIGMENTED WITH A SMALL QUANTITY OF CARBON BLACK (continued)

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-8838-A	KV-7103-A	15	3639	1517
KV-8838-B	KV-7103-A	20	3650	833
KV-8838-C	KV-7103-A	25	3751	807
KV-8838-D	KV-7108-F	30	2862	773
KV-8838-E	KV-7108-G	20	2772	733
KV-8838-F	KV-7108-G	30	2970	873
KV-8838-G	KV-7109	20	1574	927
KV-8838-H	KV-7109	30	1311	927

SERIES KV-8840 A-H, NEOPRENE COATING, PIGMENTED WITH CALCIUM SILICATE

Gumstock KV-8984	GRAMS	Gumstock Solution KV-8850	GRAMS
Neoprene AC	350	Gumstock KV-8984	146.7
Silene EF	84.3	Toluene	153.3
Ionol, Antioxidant	10	Xylene	100
Dyphos	70	2 Nitro Propane	100
		Ethyl Amyl Ketone	100

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-8840-A	KV-7103-A	15	3200	727
KV-8840-B	KV-7103-A	20	3202	693
KV-8840-C	KV-7103-A	25	3214	773
KV-8840-D	KV-7108-F	30	2521	793
KV-8840-E	KV-7108-G	20	2953	773
KV-8840-F	KV-7108-G	30	2843	833
KV-8840-G	KV-7109	20	1566	1180
KV-8840-H	KV-7109	30	1667	1093

SERIES KV-8842 A-H, NEOPRENE COATING, PIGMENTED WITH ZINC OXIDE

Gumstock KV-8985	GRAMS	Gumstock Solution KV-8851	GRAMS
Neoprene AC	350	Gumstock KV-8985	189
Zinc Oxide	230.3	Toluene	111
Ionol, Antioxidant	10	Xylene	100
Dyphos	70	2 Nitro Propane	100
		Ethyl Amyl Ketone	100

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-8842 A-H, NEOPRENE COATING, PIGMENTED WITH ZINC OXIDE (continued)

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Acclerator Type	Weight Grams	Physicals Tensile Strength psi	Elongation at Break %
KV-8842-A	KV-7103-A	15	3761	827
KV-8842-B	KV-7103-A	20	3735	860
KV-8842-C	KV-7103-A	25	3698	820
KV-8842-D	KV-7108-F	30	3282	780
KV-8842-E	KV-7108-G	20	3708	787
KV-8842-F	KV-7108-G	30	3502	820
KV-8842-G	KV-7109	20	1738	1007
KV-8842-H	KV-7109	30	3299	727

SERIES KV-8844 A-H, NEOPRENE COATING, PIGMENTED WITH ZIRCONIUM DIOXIDE

Gumstock KV-8986	GRAMS
Neoprene AC	350
Zirconium Oxide	234.5
Ionol, Antioxidant	10.0
Dyphos	70.0

Gumstock Solution KV-8852	GRAMS
Gumstock KV-8986	189.7
Toluene	110.3
Xylene	100
2 Nitro Propane	100
Ethyl Amyl Ketone	100

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Weight Grams	Physicals Tensile Strength psi	Elongation at Break %
KV-8844-A	KV-7103-A	15	3222	867
KV-8844-B	KV-7103-A	20	3402	793
KV-8844-C	KV-7103-A	25	3300	773
KV-8844-D	KV-7108-F	30	2511	840
KV-8844-E	KV-7108-G	20	3056	780
KV-8844-F	KV-7108-G	30	2635	720
KV-8844-G	KV-7109	20	1500	1060
KV-8844-H	KV-7109	30	1579	887

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-8846, LIGHT COLORED NEOPRENE RAIN EROSION RESISTANT COATINGS

Gumstock KV-8938	GRAMS
Neoprene AC	350
Ionol, Antioxidant	10
Titanium Dioxide, R-110	175
Zinc Oxide	70
Dyphos	70

Gumstock Solution KV-8789	GRAMS
Gumstock KV-8938	193
Toluene	107
Xylene	100
2 Nitro Propane	100
Ethyl Amyl Ketone	100

Coating KV-8846	
KV-8789	600
KV-7103-A	22

PHYSICALS

Tensile Strength, psi = 3468
Elongation at Break, % = 760
Shelf Life = Good
Solids, % = apprx. 32
Peel-pull adhesion, lbs./in. width = 60-90
Rain erosion resistance (Cornell), min. = 45-69

Diffuse Reflectance = R_{ir} 90.7
R_a 88.2
R_g 80.6
R_b 69.8

SERIES KV-8864 A-H, NEOPRENE COATING, PIGMENTED WITH DIBASIC LEAD PHOSPHITE

Gumstock KV-8987	GRAMS
Neoprene AC	350
Dyphos	355.3
Ionol, Antioxidant	10

Gumstock Solution KV-8853	GRAMS
Gumstock KV-8987	204.3
Xylene	95.7
Toluene	100
2 Nitro Propane	100
Ethyl Amyl Ketone	100

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-8864-A	KV-7103-A	15	2727	580
KV-8864-B	KV-7103-A	20	3051	673
KV-8864-C	KV-7103-A	25	3357	667
KV-8864-D	KV-7108-F	30	2389	680
KV-8864-E	KV-7108-G	20	3030	680
KV-8864-F	KV-7108-G	30	2788	733
KV-8864-G	KV-7109	20	1962	727
KV-8864-H	KV-7109	20	2346	800

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-8868 A-F, NEOPRENE COATINGS, COMPARABLE STUDY WITH FILLERS WITH DIFFERENT SPECIFIC GRAVITIES

PHYSICALS versus VARIOUS FILLERS

22 Grams of KV-7103-A per 600 Grams of Gumstock Solution

Accelerated Coating Solution Number	Gumstock Solution KV #	Filler	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-8868-A	8849	Carbon Black	2833	913
KV-8868-B	8850	Calcium Silicate	2739	807
KV-8868-C	8851	Zinc Oxide	3390	827
KV-8868-D	8852	Zirconium Dioxide	3334	967
KV-8868-E	8853	Basic Lead Phosphite	3575	867
KV-8868-F	8808	Conductive Black	3822	907
KV-8846	8789	Titanium Dioxide	3422	900

SERIES KV-8870 A-H, POLYACRYLIC RUBBER/NEOPRENE COATING, PIGMENTED, MILL ACCELERATED

Gumstock KV-8964	GRAMS	Gumstock Solution KV-8814	GRAMS
Polyacrylic Rubber Hycar 4021	175	Gumstock KV-8964	191.5
Neoprene AC	175	Toluene	108.5
Titanium Dioxide, R-110	175	Xylene	100
Dyphos	35	2 Nitro Propane	100
Ionol, Antioxidant	10	Ethyl Amyl Ketone	100
KV-7103-A	100		

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator: Type	Gaco Accelerator: Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-8870-A	KV-7103-A	10	1737	773
KV-8870-B	KV-7103-A	15	1663	720
KV-8870-C	KV-7103-A	20	1707	673
KV-8870-D	KV-7109	5	1870	787
KV-8870-E	KV-7109	10	2027	793
KV-8870-F	KV-7109	15	1800	647
KV-8870-G	KV-7109	20	2042	627
KV-8870-H	KV-7109	15	1690	613

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-8882 A-C, KEL-F ELASTOMER COATING, PIGMENTED

	KV-8896	KV-8745
Kel-F Elastomer	250	300
Titanium Dioxide, R-110	125	150
Toluene	800	500
MEK	500	0
MIBK	800	1500
Butyl Acetate	550	1500

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi 150°F.	Tensile Strength psi 200°F.	Elongation at Break % 150°F.	Elongation at Break % 200°F.
KV-8882-A	KV-7103-A	20	1167	1476	190	290
KV-8882-B	KV-7103-A	30	1365	1337	247	287
KV-8882-C	KV-7103-A	25	2347	1571	273	253

SERIES KV-9302 A-H, POLYACRYLIC RUBBER/NEOPRENE C ATING, LOW PERCENTAGE OF POLYACRYLIC RUBBER

Gumstock KV-9010	GRAMS	Gumstock Solution KV-8891	GRAMS
Neoprene AC	262.5	Gumstock KV-9010	177.2
Polyacrylic Rubber Hycar 4021	87.5	Toluene	122.8
Ionol, Antioxidant	10.0	Xylene	100
Plumb-O-Sil A	35.0	2 Nitro Propane	100
Titanium Dioxide, R-110	225.0	Ethyl Amyl Ketone	100

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-9302-A	KV-7103-A	25	1911	720
KV-9302-B	KV-7103-A	30	2150	723
KV-9302-C	KV-7103-A	40	2169	490
KV-9302-D	KV-7103-A	50	2205	627
KV-9302-E	KV-7108-F	30	1368	793
KV-9302-F	KV-7108-G	30	1595	817
KV-9302-G	KV-7108-G	30	1286	750
KV-9302-H	KV-7109	40	1440	730

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-9306 A-H, POLYACRYLIC RUBBER COATINGS

Gumstock KV-9028	GRAMS
Hycar 4021	350
Titanium Dioxide, R-110	150
Hi-Sil 101	50

Gumstock Solution KV-9343	GRAMS
Gumstock KV-9028	118.0
Toluene	182
Xylene	100
2 Nitro Propane	100
Ethyl Amyl Ketone	100

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-9306-A	KV-7103-A	20	1217	847
KV-9306-B	KV-7103-A	30	1209	667
KV-9306-C	KV-7103-A	40	1379	476
KV-9306-D	KV-7108-F	25	568	1900
KV-9306-E	KV-7108-G	20	745	837
KV-9306-F	KV-7108-G	30	632	887
KV-9306-G	KV-7108-J	20	714	180
KV-9306-H	KV-7109	30	798	920

SERIES KV-9316, KEL-F ELASTOMER COATINGS, PIGMENTED WITH TITANIUM DIOXIDE

Gumstock Solution KV-9345	GRAMS
Kel-F Elastomer #3700	250
MIBK	1250
Butyl Acetate	1250
Toluene	400
Titanium Dioxide, R-110	125

Gumstock Solution KV-9364	GRAMS
Kel-F Elastomer #3700	250
MIBK	1250
Butyl Acetate	1250
Toluene	400

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator KV-7103-A Type	Gaco Accelerator Weight Grams	Physicals (cured at 200°F): Tensile Strength psi	Physicals (cured at 200°F): Elongation at Break %
KV-9316-A	KV-9345	15	2074	667
KV-9316-B	KV-9345	20	2333	580
KV-9316-C	KV-9345	25	2345	547
KV-9316-D	KV-9345	15	2250	693
KV-9316-E	KV-9364	20	2428	647

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-9318, NEOPRENE COATINGS, PIGMENTED WITH TITANIUM DIOXIDE ZINC OXIDE AND BASIC LEAD PHOSPHITE

Gumstock KV-8938	GRAMS	Gumstock Solution KV-9347	GRAMS
Neoprene AC	350	Gumstock KV-8938	193
Ionol, Antioxidant	10	Toluene	207
Titanium Dioxide, R-110	175	Xylene	100
Zinc Oxide	70	2 Nitro Propane	100
Dyphos	70	Ethyl Amyl Ketone	100

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-9318-A	KV-7103-A	10	2783	880
KV-9318-B	KV-7103-A	15	3068	840
KV-9318-C	KV-7103-A	20	3331	807
KV-9318-D	KV-7103-A	22	3153	740
KV-9318-E	KV-7103-A	25	3439	740
KV-9318-F	KV-7103-A	30	3467	720
KV-9318-G	KV-7103-A	40	3529	633
KV-9318-H	KV-7103-A	50	2978	527

SERIES KV-9324, NEOPRENE COATINGS, COMBINATIONS OF MILL-ACCELERATED WITH UNACCELERATED SOLUTIONS

Gumstock KV-8963	GRAMS	Gumstock KV-8938	GRAMS
Neoprene AC	350	Neoprene AC	350
Titanium Dioxide, R-110	150	Ionol, Antioxidant	10
Zinc Oxide	25	Titanium Dioxide, R-110	175
Dyphos	35	Zinc Oxide	70
Ionol, Antioxidant	10	Dyphos	70
KV-7103-A	75		

Gumstock Solution KV-9366	GRAMS	Gumstock Solution KV-9347	GRAMS
Gumstock KV-8963	184.3	Gumstock KV-8938	193
Toluene	215.7	Toluene	207
Xylene	100	Xylene	100
2 Nitro Propane	100	2 Nitro Propane	100
Ethyl Amyl Ketone	100	Ethyl Amyl Ketone	100

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-9324, NEOPRENE COATINGS, COMBINATIONS OF MILL-ACCELERATED WITH UNACCELERATED SOLUTIONS (continued)

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Mill-Accel. Solution KV-9366 Grams	Unaccelerated Solution KV-9347 Grams	Physicals Tensile Strength psi	Elongation at Break %
KV-9324-A	700	0	3070	893
KV-9324-B	600	100	3239	933
KV-9324-C	550	150	3600	7000
KV-9324-D	500	200	3428	933
KV-9324-E	450	250	3397	953
KV-9324-F	400	300	3176	933
KV-9324-G	350	350	3093	940
KV-9324-H	300	400	2695	993

SERIES KV-9332, NEOPRENE COATINGS, COMBINATIONS OF MILL-ACCELERATED WITH UNACCELERATED SOLUTIONS

Gumstock KV-8963	GRAMS
Neoprene AC	350
Titanium Dioxide, R-110	150
Zinc Oxide	25
Dyphos	35
Ionol, Antioxidant	10
KV-7103-A	75

Gumstock KV-8938	GRAMS
Neoprene AC	350
Ionol, Antioxidant	10
Titanium Dioxide, R-110	175
Zinc Oxide	10
Dyphos	70

Gumstock Solution KV-9366	GRAMS
Gumstock KV-8963	184.3
Toluene	215.7
Xylene	100
2 Nitro Propane	100
Ethyl Amyl Ketone	100

Gumstock Solution KV-9347	GRAMS
Gumstock KV-8938	193
Toluene	207
Xylene	100
2 Nitro Propane	100
Ethyl Amyl Ketone	100

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Mill-Accel. Solution KV-9366 Grams	Unaccelerated Solution KV-9347 Grams	Physicals Tensile Strength psi	Elongation at Break %
KV-9332-A	575	125	3011	973
KV-9332-B	550	150	3035	987
KV-9332-C	525	175	3211	927
KV-9332-D	500	200	2989	953

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-9336, POLYACRYLIC RUBBER COATINGS, WITH VARIOUS SOLVENTS

Gumstock KV-9027	GRAMS	Gumstock KV-9027	GRAMS
Polyacrylic Rubber Hycar 4021	350	Titanium Dioxide, R-110	175

Gumstock Solution KV-9374	KV-9374-A	KV-9374-B	KV-9374-C	KV-9374-D
Gumstock KV-9027	112.5	112.5	112.5	112.5
Toluene	287.5	0	187.5	187.5
Xylene	0	287.5	200.0	100.0
2 Nitro Propane	100.0	100.0	0	200.0
Ethyl Amyl Ketone	100.0	100.0	100.0	0

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Gumstock Solution	Gaco Accelerator Type	Weight Grams	Physicals Tensile Strength psi	Physicals Elongation at Break %
KV-9336-A	KV-9374-A	KV-7103-A	30	933	1220
KV-9336-B	KV-9374-B	KV-7103-A	30	939	1387
KV-9336-C	KV-9374-C	KV-7103-A	30	1028	1107
KV-9336-D	KV-9374-D	KV-7103-A	30	889	1320

SERIES KV-9356, NEOPRENE GN COATINGS, CONTAINING ZINC OXIDE AND DYPHOS

Gumstock KV-9090	GRAMS	Gumstock Solution KV-9375	GRAMS
Neoprene GN	350	Gumstock KV-9090	193
Ionol, Antioxidant	10	Toluene	207
Titanium Dioxide, R-110	175	Xylene	100
Zinc Oxide	70	2 Nitro Propane	100
Dyphos	70	Ethyl Amyl Ketone	100

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gacc Accelerator Type	Gacc Accelerator Weight Grams	Physicals Tensile Strength psi	Physicals Elongation at Break %
KV-9356-A	KV-7103-A	20	2222	847
KV-9356-B	KV-7103-A	30	2611	693
KV-9356-C	KV-7103-A	40	2411	620
KV-9356-D	KV-7108-F	25	2000	987
KV-9356-E	KV-7108-G	20	2161	900
KV-9356-F	KV-7108-G	30	2267	887
KV-9356-G	KV-7108-J	20	1500	807
KV-9356-H	KV-7109	30	2104	787

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-9362, KEL-F ELASTOMER COATINGS, COMPARING KEL-F ELASTOMER TYPE 3700 TYPE 5500

Kel-F Elastomer Gumstock Solution KV-9378	GRAMS
Kel-F Elastomer #3700	225
MIBK	1200
Ethyl Amyl Ketone	800
Toluene	400
2 Nitro Propane	200

Kel-F Elastomer Gumstock Solution KV-9379	
Kel-F Elastomer #5500	225
MIBK	1200
Ethyl Amyl Ketone	800
Toluene	400
2 Nitro Propane	200

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gumstock Solution	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Cured @ 150°F. TS	Cured @ 150°F. E	Cured @ 200°F. TS	Cured @ 200°F. E	Cured @ 400°F. TS	Cured @ 400°F. E
KV-9362-A	KV-9378	KV-7103-A	20	1333	567	1333	500	1524	333
KV-9362-B	KV-9378	KV-7103-A	25	1442	440	1312	433	1533	267
KV-9362-C	KV-9378	KV-7103-A	30	1649	407	1069	327	975	213
KV-9362-D	KV-9379	KV-7103-A	20	1571	360	1705	347	1433	240
KV-9362-E	KV-9379	KV-7103-A	25	1605	333	1867	260	1485	240
KV-9362-F	KV-9379	KV-7103-A	30	1322	220	1996	247	1432	213

SERIES KV-9384, KEL-F ELASTOMER COATINGS, TYPE 3700 VERSUS TYPE 5500, PIGMENTED AND UNPIGMENTED, CURED AT VARIOUS TEMPERATURES

Kel-F Elastomer Gumstock Solution KV-9345	GRAMS
Kel-F Elastomer #3700	250
MIBK	1250
Butyl Acetate	1250
Toluene	400

Kel-F Elastomer Gumstock Solution KV-9364	
Kel-F Elastomer #3700	250
MIBK	1250
Butyl Acetate	1250
Toluene	400

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-9384, KEL-F ELASTOMER COATING, TYPE 3700 VERSUS TYPE 5500, PIGMENTED AND UNPIGMENTED, CURED AT VARIOUS TEMPERATURES (continued)

Kel-F Elastomer Gumstock Solution KV-8896-A	GRAMS
Kel-F Elastomer #3700	250
Titanium Dioxide, R-110	125
Toluene	800
MEK	500
MIBK	800
Butyl Acetate	550

Kel-F Elastomer Gumstock Solution KV-9365	
Kel-F Elastomer #5500	250
MIBK	1250
Butyl Acetate	1250
Toluene	400

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gumstock Solution	Type	Weight Grams	Cured @ 150°F. TS	E	Cured @ 225°F. TS	E	Cured @ 300°F. TS	E
KV-9384-A	KV-9345	KV-7103-A	14	1503	393	2778	400	1659	307
KV-9384-B	KV-9345	KV-7103-A	21	1552	273	2756	330	1267	187
KV-9384-C	KV-9364	KV-7103-A	14	2540	607	2133	667	2206	527
KV-9384-D	KV-9364	KV-7103-A	21	2595	533	1988	533	2889	460
KV-9384-E	KV-8896-A	KV-7103-A	14	1949	467	2773	507	2133	460
KV-9384-F	KV-8896-A	KV-7103-A	21	2424	513	1528	367	2239	380
KV-9384-G	KV-9365	KV-7103-A	14	1650	207	2162	253	1400	207
KV-9384-H	KV-9365	KV-7103-A	21	1244	233	2317	183	1528	160

KV-9405, POLYACRYLIC RUBBER/NEOPRENE COATINGS, WITH STABILIZER

Gumstock KV-8933	GRAMS
Neoprene AC	175
Polyacrylic Rubber Hycar 4021	175
Ionol, Antioxidant	10
Plumb-O-Sil A	35
Titanium Dioxide, R-110	175

Coating Solution KV-9405	
Gumstock Solution KV-9404	600
Accel. Gaco KV-7103-A	30

Gumstock Solution KV-9404	GRAMS
Gumstock KV-8933	163.0
Xylene	127.0
MB-5545 Stabilizer	10.0
Toluene	100
MIBK	100
2 Nitro Propane	100

PHYSICALS

Tensile Strength, psi = 1002
Elongation at Break, % = 1080

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-9392 AND 9407, POLYACRYLIC RUBBER/NEOPRENE COATINGS WITH STABILIZER

Gumstock KV-9010	GRAMS
Neoprene AC	262.5
Polyacrylic Rubber Hycar 4021	87.5
Ionol, Antioxidant	10.0
Plumb-O-Sil A	35.0
Titanium Dioxide, R-110	225.0

Gumstock Solution KV-9406	GRAMS
Gumstock KV-9010	177.2
Toluene	212.8
MB-5545 Stabilizer	10.0
Xylene	100.0
2 Nitro Propane	100.0
Ethyl Amyl Ketone	100.0

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-9392-A	KV-7103-A	20	1847	945
KV-9392-B	KV-7103-A	30	2099	727
KV-9392-C	KV-7103-A	40	2281	913
KV-9392-D	KV-7108-F	25	1638	935
KV-9392-E	KV-7108-F	40	1434	816
KV-9392-F	KV-7108-G	25	1632	840
KV-9392-G	KV-7108-G	40	1290	747
KV-9392-H	KV-7109	30	855	965
KV-9407	KV-7103-A	30	1980	1 000

SERIES KV-9394 AND 9409, NEOPRENE COATINGS, WITH STABILIZER

Gumstock KV-8938	GRAMS
Neoprene AC	350
Ionol, Antioxidant	10
Titanium Dioxide, R-110	175
Zinc Oxide	70
Dyphos	70

Gumstock Solution KV-9408	GRAMS
Gumstock KV-8938	193
Toluene	97
MB-5545 Stabilizer	10
2 Nitro Propane	100
Xylene	100
Ethyl Amyl Ketone	100

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-9394-A	KV-7103-A	20	2583	927
KV-9394-B	KV-7103-A	30	3260	747
KV-9394-C	KV-7103-A	40	3181	780
KV-9394-D	KV-7108-F	25	2196	967
KV-9394-E	KV-7108-F	40	2094	893
KV-9394-F	KV-7108-G	25	2708	842
KV-9394-G	KV-7108-G	40	2522	765
KV-9394-H	KV-7109	30	1009	1217
KV-9409	KV-7103-A	22	2137	1033

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

KV-9425, POLYACRYLIC RUBBER COATING, WITH STABILIZER

Gumstock KV-9027	GRAMS
Polyacrylic Rubber Hycar 4021	350
Titanium Dioxide, R-110	175

Gumstock Solution KV-9424	GRAMS
Gumstock KV-9027	112.5
Toluene	177.5
MB-5545 Stabilizer	10.0
Xylene	100.0
2 Nitro Propane	100.0
Ethyl Amyl Ketone	100.0

Coating Solution KV-9425	GRAMS
Gumstock Solution KV-9424	600
Accel. Gaco KV-7103-A	30

PHYSICALS

Tensile Strength, psi = 1742
Elongation at Break, % = 880

SERIES KV-9398 AND 9427 POLYACRYLIC RUBBER COATINGS, WITH STABILIZER

Gumstock KV-9028	GRAMS
Polyacrylic Rubber Hycar 4021	350
Titanium Dioxide, R-110	150
Hi-Sil 101	50

Gumstock Solution KV-9426	GRAMS
Gumstock KV-9028	118.0
Toluene	172.0
Xylene	100.0
2 Nitro Propane	100.0
Ethyl Amyl Ketone	100.0
MB-5545 Stabilizer	10.0

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-9398-A	KV-7103-A	20	1118	1000
KV-9398-B	KV-7103-A	30	1606	800
KV-9398-C	KV-7103-A	40	1691	733
KV-9398-D	KV-7108-F	25	1356	918
KV-9398-E	KV-7108-F	40	892	727
KV-9398-F	KV-7108-G	25	974	717
KV-9398-G	KV-7108-G	40	1389	560
KV-9398-H	KV-7109	30	442	2000+
KV-9427	KV-7103-A	40	1469	807

SERIES KV-9412 AND 9431, NEOPRENE COATINGS, WITH STABILIZER

Gumstock KV-8938	GRAMS
Neoprene AC	350
Ionol, Antioxidant	10
Titanium Dioxide, R-110	175
Zinc Oxide	70
Dyphos	70

Gumstock Solution KV-9430	GRAMS
Gumstock KV-8938	193
Toluene	197
Xylene	100
2 Nitro Propane	100
Ethyl Amyl Ketone	100
MB-5545 Stabilizer	10

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-9412 AND 9431, NEOPRENE COATINGS, WITH STABILIZER (continued)

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-9412-A	KV-7103-A	20	4433	837
KV-9412-B	KV-7103-A	30	3364	695
KV-9412-C	KV-7103-A	40	3571	608
KV-9412-D	KV-7108-F	25	3030	900
KV-9412-E	KV-7108-F	40	2733	717
KV-9412-F	KV-7108-G	25	3293	858
KV-9412-G	KV-7108-G	40	2893	804
KV-9412-H	KV-7109	30	2530	1003
KV-9431	KV-7103-A	22	2961	760

SERIES KV-9414 AND 9433, NEOPRENE COATINGS, LOW VISCOSITY, WITH STABILIZER

Gumstock KV-8909	GRAMS
Neoprene AC	350
Ionol, Antioxidant	10
Titanium Dioxide, R-110	175
Plumb-O-Sil A	17.5

Gumstock Solution KV-9432	GRAMS
Gumstock KV-8909	157.8
Toluene	232.2
Xylene	100.0
2 Nitro Propane	100.0
Ethyl Amyl Ketone	100.0
MB-5545 Stabilizer	10.0

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-9414-A	KV-7103-A	20	2984	933
KV-9414-B	KV-7103-A	30	3026	863
KV-9414-C	KV-7103-A	40	3789	852
KV-9414-D	KV-7108-F	25	2621	960
KV-9414-E	KV-7108-F	40	2630	883
KV-9414-F	KV-7108-G	25	2098	850
KV-9414-G	KV-7108-G	40	3000	810
KV-9414-H	KV-7109	30	1731	917
KV-9433	KV-7103-A	25	2833	1150

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-9416 AND 9441, NEOPRENE COATINGS, WITH STABILIZER

Gumstock KV-9089	GRAMS
Neoprene GN	350
Ionol, Antioxidant	10
Titanium Dioxide, R-110	175
Plumb-O-Sil A	17.5

Gumstock Solution KV-9440	GRAMS
Gumstock KV-9089	157.8
Toluene	232.2
Xylene	100.0
2 Nitro Propane	100.0
Ethyl Amyl Ketone	100.0
MB-5545 Stabilizer	10.0

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals Tensile Strength psi	Physicals Elongation at Break %
KV-9416-A	KV-7103-A	20	1792	1127
KV-9416-B	KV-7103-A	30	1933	987
KV-9416-C	KV-7103-A	40	2095	947
KV-9416-D	KV-7108-F	25	2000	1027
KV-9416-E	KV-7108-F	40	2433	1020
KV-9416-F	KV-7108-G	25	2457	1060
KV-9416-G	KV-7108-G	40	2058	1020
KV-9416-H	KV-7109	30	1765	873
KV-9441	KV-7103-A	30	2375	653

SERIES KV-9418 AND 9443, NEOPRENE GN COATINGS WITH STABILIZER

Gumstock KV-9090	GRAMS
Neoprene GN	350
Ionol, Antioxidant	10
Titanium Dioxide, R-110	175
Zinc Oxide	70
Dyphos	70

Gumstock Solution KV-9442	GRAMS
Gumstock KV-9090	193.0
Toluene	197.0
Xylene	100.0
2 Nitro Propane	100.0
Ethyl Amyl Ketone	100.0
MB-5545 Stabilizer	10.0

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals Tensile Strength psi	Physicals Elongation at Break %
KV-9418-A	KV-7103-A	20	2053	980
KV-9418-B	KV-7103-A	30	2487	900
KV-9418-C	KV-7103-A	40	2261	740
KV-9418-D	KV-7108-F	25	2402	927
KV-9418-E	KV-7108-F	40	2300	813
KV-9418-F	KV-7108-G	25	2436	773
KV-9418-G	KV-7108-G	40	2202	627
KV-9418-H	KV-7109	30	2361	853
KV-9443	KV-7103-A	30	2876	607

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-9420 AND 9449, POLYACRYLIC COATINGS LOW VISCOSITY, WITH STABILIZER

Gumstock KV-9028	GRAMS
Hycar 4021	350
Titanium Dioxide, R-110	150
Hi-Sil 101	50

Gumstock Solution KV-9448	GRAMS
Gumstock KV-9028	118
Toluene	172
Xylene	100
2 Nitro Propane	100
Ethyl Amyl Ketone	100
MB-5545 Stabilizer	10
MIBK	100

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-9420-A	KV-7103-A	25	1030	1007
KV-9420-B	KV-7103-A	35	1170	846
KV-9420-C	KV-7103-A	45	1361	793
KV-9420-D	KV-7108-F	25	806	1013
KV-9420-E	KV-7108-F	40	1111	760
KV-9420-F	KV-7108-G	25	1111	247
KV-9420-G	KV-7108-G	40	1630	673
KV-9420-H	KV-7109	30	379	2000
KV-9449	KV-7103-A	40	1800	600

KV-9434, NEOPRENE COATING, COMPRISING A MIXTURE OF A MILL-ACCELERATED WITH UNACCELERATED NEOPRENE SOLUTIONS

Gumstock KV-8963	GRAMS
Neoprene AC	350
Titanium Dioxide, R-110	150
Zinc Oxide	25
Dyphos	35
Ionol, Antioxidant	10

Gumstock KV-8938	GRAMS
Neoprene AC	350
Ionol, Antioxidant	10
Titanium Dioxide, R-110	175
Zinc Oxide	70
Dyphos	70

Coating Solution KV-9428	GRAMS
Gumstock KV-8963	184.3
Toluene	105.7
2 Nitro Propane	100.0
Ethyl Amyl Ketone	100.0
MB-5545 Stabilizer	10.0

Coating Solution KV-9408	GRAMS
Gumstock KV-8938	193
Toluene	97
MB-5545 Stabilizer	10
Xylene	100
2 Nitro Propane	100
Ethyl Amyl Ketone	100

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

KV-9434, NEOPRENE COATING, COMPRISING A MIXTURE OF A MILL-ACCELERATED WITH UNACCELERATED NEOPRENE SOLUTIONS (continued)

Coating Solution KV-9428	425 Grams
Coating Solution KV-9408	175
Toluene	100

Tensile Strength, psi = 3107
Elongation at Break, % = 873

Diffuse Reflectance

R_{ir} = 91.8
R_a = 85.2
R_g = 81.4
R_b = 69.2

KV-9435, NEOPRENE COATING, MIXTURE OF MILL-ACCELERATED WITH UNACCELERATED SOLUTIONS

Gumstock KV-8963	GRAMS
Neoprene AC	350
Titanium Dioxide, R-110	150
Zinc Oxide	25
Dyphos	35
Ionol, Antioxidant	10
KV-7103-A, Gaco Accel.	75

Gumstock KV-8938	GRAMS
Neoprene AC	350
Ionol, Antioxidant	10
Titanium Dioxide, R-110	175
Zinc Oxide	70
Dyphos	70

Coating Solution KV-9429	
Gumstock KV-8963	184.3
Toluene	205.7
Xylene	100.0
2 Nitro Propane	100.0
Ethyl Amyl Ketone	100.0
MB-5545 Stabilizer	10.0

Coating Solution KV-9430	
Gumstock KV-8938	193
Toluene	197
Xylene	100
2 Nitro Propane	100
Ethyl Amyl Ketone	100
MB-5545 Stabilizer	10

Coating Solution KV-9429	525
Coating Solution KV-9430	175

Tensile Strength, psi = 3123
Elongation at Break, % = 1140

Diffuse Reflectance

R_{ir} = 90.2
R_a = 84.8
R_g = 82.5
R_b = 71.0

KV-9436, NEOPRENE COATING, MIXTURE OF MILL ACCELERATED WITH UNACCELERATED SOLUTIONS

Gumstock KV-8963	GRAMS
Neoprene AC	350
Titanium Dioxide, R-110	150
Zinc Oxide	25
Dyphos	35
Ionol, Antioxidant	10
KV-7103-A, Gaco Accel.	75

Gumstock KV-8909	GRAMS
Neoprene AC	350
Ionol, Antioxidant	10
Titanium Dioxide, R-110	175
Plumb-O-Sil A	17.5

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

KV-9436, NEOPRENE COATING, MIXTURE OF MILL ACCELERATED WITH UNACCELERATED SOLUTIONS (continued)

Coating Solution KV-9429	GRAMS
Gumstock KV-8963	184.3
Toluene	205.7
Xylene	100
2 Nitro Propane	100
Ethyl Amyl Ketone	100
MB-5545 Stabilizer	10

Coating Solution KV-9432	GRAMS
Gumstock KV-8909	157.8
Toluene	232.2
Xylene	100
2 Nitro Propane	100
Ethyl Amyl Ketone	100
MB-5545 Stabilizer	10.0

Coating Solution KV-9429	500
Coating Solution KV-9432	200

Tensile Strength, psi = 2818
Elongation at Break, % = 1113

Diffuse Reflectance

R_{ir} = 91.6
R_a = 85.0
R_g = 82.5
R_b = 71.5

KV-9437, COMBINATION OF A MILL-ACCELERATED NEOPRENE COATING SOLUTION WITH A POLYACRYLIC RUBBER COATING SOLUTION

Gumstock KV-8963	GRAMS
Neoprene AC	350
Titanium Dioxide, R-110	150
Zinc Oxide	25
Dyphos	35
Ionol, Antioxidant	10
KV-7103-A Gaco Accel.	75

Gumstock KV-9027	GRAMS
Polyacrylic Rubber Hycar 4021	350
Titanium Dioxide, R-110	175

Coating Solution KV-9429	
Gumstock KV-8963	184.3
Toluene	205.7
Xylene	100
2 Nitro Propane	100
Ethyl Amyl Ketone	100
MB-5545 Stabilizer	10

Coating Solution KV-9424	
Gumstock KV-9027	112.5
Toluene	177.5
MB-5545 Stabilizer	10.0
Xylene	100
2 Nitro Propane	100
Ethyl Amyl Ketone	100

Coating Solution KV-9429	450
Coating Solution KV-9424	200

Tensile Strength, psi = 2977
Elongation at Break, % = 953

Diffuse Reflectance

R_{ir} = 92.0
R_a = 86.0
R_g = 84.0
R_b = 73.0

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

KV-9438, COMBINATION OF A MILL-ACCELERATED NEOPRENE COATING SOLUTION WITH A POLYACRYLIC RUBBER COATING SOLUTION

Gumstock KV-8963	GRAMS
Neoprene AC	350
Titanium Dioxide, R-110	150
Zinc Oxide	25
Dyphos	35
Ionol, Antioxidant	10
KV-7103-A, Gaco Accel.	75

Coating Solution KV-9429	
Gumstock KV-8963	184.3
Toluene	205.7
Xylene	100
2 Nitro Propane	100
Ethyl Amyl Ketone	100
MB-5545 Stabilzer	10

Coating Solution KV-9429	350
Coating Solution KV-9424	300

Tensile Strength, psi =	1325
Elongation at Break, % =	1113

Gumstock KV-9027	GRAMS
Polyacrylic Rubber Hycar 4021	350
Titanium Dioxide, R-110	175

Coating Solution KV-9424	
Gumstock KV-9027	112.5
Toluene	177.5
MB-5545 Stabilizer	10.0
Xylene	100.0
2 Nitro Propane	100.0
Ethyl Amyl Ketone	100.0

Diffuse Reflectance

$R_{ir} = 93.1$
$R_a = 87.6$
$R_g = 86.0$
$R_b = 76.5$

KV-9450, POLYACRYLIC RUBBER/NEOPRENE COATING SOLUTION PREPARED VIA THE SEPARATE SOLUTION TECHNIQUE WITH THE ADDITION OF STABILIZER

Gumstock KV-9027	GRAMS
Polyacrylic Rubber Hycar 4021	350
Titanium Dioxide, R-110	175

Coating Solution KV-9424	
Gumstock KV-9027	112.5
Toluene	177.5
MB-5545 Stabilizer	10.0
Xylene	100.0
2 Nitro Propane	100.0
Ethyl Amyl Ketone	100.0

Gumstock KV-8938	GRAMS
Neoprene AC	350
Ionol, Antioxidant	10
Titanium Dioxide, R-110	175
Zinc Oxide	70
Dyphos	70

Coating Solution KV-9430	
Gumstock KV-8938	193.0
Toluene	197.0
Xylene	100.0
2 Nitro Propane	100.0
Ethyl Amyl Ketone	100.0
MB-5545 Stabilizer	10.0

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

KV-9450, POLYACRYLIC RUBBER/NEOPRENE COATING SOLUTION PREPARED VIA THE SEPERATE SOLUTION TECHNIQUE WITH THE ADDITION OF STABILIZER (continued)

Polyacrylic Rubber Solution KV-9424	300	Diffuse Reflectance	
Neoprene Coating Solution KV-9430	350		
Toluene	50	R_{ir}	= 97.8
Gaco Accel. KV-7103-A	26	R_a	= 89.5
		R_g	= 86.2
		R_b	= 74.8

Tensile Strength, psi = 2449
Elongation at Break, % = 640

KV-9452, POLYACRYLIC RUBBER/NEOPRENE COATING SOLUTION PREPARED VIA THE SEPARATE SOLUTION TECHNIQUE AND CONTAINING A STABILIZER

Gumstock KV-9028	GRAMS
Hycar 4021	350
Titanium Dioxide, R-110	150
Hi-Sil 101	50

Gumstock KV-8938	GRAMS
Neoprene AC	350
Ionol, Antioxidant	10
Titanium Dioxide, R-110	175
Zinc Oxide	70
Dyphos	70

Coating Solution KV-9426	
Gumstock KV-9028	118.0
Toluene	172.0
Xylene	100.0
2 Nitro Propane	100.0
Ethyl Amyl Ketone	100.0
MB-5545 Stabilizer	10.0

Coating Solution KV-9430	
Gumstock KV-8938	193.0
Toluene	197.0
Xylene	100.0
2 Nitro Propane	100.0
Ethyl Amyl Ketone	100.0
MB-5545 Stabilizer	10.0

Polyacrylic Rubber Solution KV-9426	300	Diffuse Reflectance	
Neoprene Coating Solution KV-9430	350		
Toluene	50	R_{ir}	= 98.2
Gaco Accel. KV-7103-A	31	R_a	= 90.1
		R_g	= 87.0
		R_b	= 76.2

Tensile Strength, psi = 2440
Elongation at Break, % = 747

KV-9453, POLYACRYLIC RUBBER/NEOPRENE COATING SOLUTION PREPARED VIA THE SEPARATE SOLUTION TECHNIQUE AND CONTAINING A STABILIZER

Gumstock KV-9028	GRAMS
Hycar 4021	350
Titanium Dioxide, R-110	150
Hi-Sil 101	50

Gumstock KV-8909	GRAMS
Neoprene AC	350
Ionol, Antioxidant	10
Titanium Dioxide, R-110	175
Plumb-O-Sil A	17.5

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

KV-9453, POLYACRYLIC RUBBER/NEOPRENE COATING SOLUTION PREPARED VIA THE SEPARATE SOLUTION TECHNIQUE AND CONTAINING A STABILIZER (continued)

Coating Solution KV-9426	GRAMS
Gumstock KV-9028	118.0
Toluene	172.0
Xylene	100.0
2 Nitro Propane	100.0
Ethyl Amyl Ketone	100.0
MB-5545 Stabilizer	10.0

Coating Solution KV-9432	GRAMS
Gumstock KV-8909	157.8
Toluene	232.2
Xylene	100.0
2 Nitro Propane	100.0
Ethyl Amyl Ketone	100.0
MB-5545 Stabilizer	10.0

Polyacrylic Rubber Solution KV-9426	300
Neoprene Coating Solution KV-9432	350
Toluene	50
Gaco Accel. KV-7103-A	32-1/2

Tensile Strength, psi = 3171
Elongation at Break, % = 800

Diffuse Reflectance

R_{ir} = 97.2
R_a = 89.2
R_g = 85.9
R_b = 74.0

KV-9457, POLYACRYLIC RUBBER/NEOPRENE COATING SOLUTION PREPARED VIA THE SEPARATE SOLUTION TECHNIQUE WITH A STABILIZER

Gumstock KV-9028	GRAMS
Hycar 4021	350
Titanium Dioxide, R-110	150
Hi-Sil 101	50

Gumstock KV-8909	GRAMS
Neoprene AC	350
Ionol, Antioxidant	10
Titanium Dioxide, R-110	175
Plumb-O-Sil A	17.5

Coating Solution KV-9448	
Gumstock KV-9028	188.0
Toluene	172.0
Xylene	100.0
2 Nitro Propane	100.0
Ethyl Amyl Ketone	100.0
MB-5545 Stabilizer	10.0
MIBK	100.0

Coating Solution KV-9432	
Gumstock KV-8909	157.8
Toluene	232.2
Xylene	100.0
2 Nitro Propane	100.0
Ethyl Amyl Ketone	100.0
MB-5545 Stabilizer	10.0

Polyacrylic Rubber Solution KV-9448	350
Neoprene Coating Solution KV-9432	350
Gaco Accel. KV-7103-A	32-1/2

Tensile Strength, psi = 1874
Elongation at Break, % = 945

Diffuse Reflectance

R_{ir} = 93.0
R_a = 87.2
R_g = 84.3
R_b = 73.2

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

KV-9458, POLACRYLIC RUBBER/NEOPRENE COATING SOLUTION PREPARED VIA THE SEPARATE SOLUTION TECHNIQUE WITH A STABILZIER

Gumstock KV-9027	GRAMS
Polyacrylic Rubber Hycar 4021	350
Titanium Dioxide, R-110	175

Gumstock KV-8938	GRAMS
Neoprene AC	350
Ionol, Antioxidant	10
Titanium Dioxide, R-110	175
Zinc Oxide	70
Dyphos	70

Coating Solution KV-9454	
Gumstock KV-9027	112.5
Toluene	177.5
Xylene	100.0
2 Nitro Propane	100.0
Ethyl Amyl Ketone	100.0
MIBK	100.0
MB-5545 Stabilizer	10.0

Coating Solution KV-9430	
Gumstock KV-8938	193
Toluene	197
Xylene	100
2 Nitro Propane	100
Ethyl Amyl Ketone	100
MB-5545 Stabilizer	10.0

Polyacrylic Rubber Solution KV-9454	350
Neoprene Coating Solution KV-9430	350
Gaco Accel. KV-7103-A	26

Tensile Strength, psi = 2221
Elongation at Break, % = 916

Diffuse Reflectance

R_{ir} = 91.8
R_a = 87.8
R_g = 85.8
R_b = 76.4

SERIES KV-9476, NEOPRENE COATINGS, COMBINATION OF NEOPRENE AC WITH NEOPRENE GN

Gumstock KV-9936	GRAMS
Neoprene AC	175
Neoprene GN	175
Ionol, Antioxidant	10
Titanium Dioxide, R-110	175
Plumb-O-Sil A	17.5

Gumstock Solution KV-9494	GRAMS
Gumstock KV-9936	158
Toluene	232
Xylene	100
2 Nitro Propane	100
Ethyl Amyl Ketone	100
MB-5545 Stabilizer	10

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break, %
KV-9476-A	KV-7103-A	15	2875	993
KV-9476-B	KV-7103-A	20	2843	840
KV-9476-C	KV-7103-A	30	2581	970
KV-9476-D	KV-7103-A	40	2952	927
KV-9476-E	KV-7108-F	15	2547	993
KV-9476-F	KV-7108-F	25	2286	853
KV-9476-G	KV-7108-G	15	3000	1000
KV-9476-H	KV-7108-G	25	2484	873

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

KV-9459, POLYACRYLIC RUBBER/NEOPRENE COATING SOLUTION PREPARED VIA THE SEPARATE SOLUTION TECHNIQUE WITH A STABILIZER

Gumstock KV-9027	GRAMS
Polyacrylic Rubber Hycar 4021	350
Titanium Dioxide, R-110	175

Gumstock KV-8909	GRAMS
Neoprene AC	350
Ionol, Antioxidant	10
Titanium Dioxide, R-110	175
Plumb-O-Sil A	17.5

Coating Solution KV-9454	
Gumstock KV-9027	112.5
Toluene	177.5
Xylene	100
2 Nitro Propane	100
Ethyl Amyl Ketone	100
MIBK	100
MB-5545 Stabilizer	10.0

Coating Solution KV-9432	
Gumstock KV-8909	157.8
Toluene	232.2
Xylene	100.0
2 Nitro Propane	100.0
Ethyl Amyl Ketone	100.0
MB-5545 Stabilizer	10.0

Polyacrylic Rubber Solution KV-9454	350
Neoprene Coating Solution KV-9432	350
Gaco Accel. KV-7103-A	27-1/2

Tensile Strength, psi = 1818
Elongation at Break, % = 900

Diffuse Reflectance

R_{ir} = 91.1
R_a = 88.1
R_g = 85.9
R_b = 76.2

KV-9455, POLYACRYLIC RUBBER COATING SOLUTION WITH STABILIZER

Gumstock KV-9027	GRAMS
Polyacrylic Rubber Hycar 4021	350
Titanium Dioxide, R-110	175

Gumstock Solution KV-9454	GRAMS
Gumstock KV-9027	112.5
Toluene	177.5
Xylene	100.0
2 Nitro Propane	100.0
Ethyl Amyl Ketone	100.0
MIBK	100.0
MB-5545 Stabilizer	10.0

Coating Solution KV-9455	
Gumstock Solution KV-9454	700
Accel. Gaco KV-7103-A	30

PHYSICALS

Tensile Strength, psi = 1879
Elongation at Break, % = 667

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-10702, NEOPRENE COATINGS, MADE WITH ANATASE TITANIUM DIOXIDE

Gumstock KV-9942	GRAMS
Neoprene AC	350
Ionol, Antioxidant	10
Titanium Dioxide, Anatase	175
Zinc Oxide	70
Dyphos	70

Gumstock Solution KV-10716	GRAMS
Gumstock KV-9942	193
Toluene	197
Xylene	100
2 Nitro Propane	100
Ethyl Amyl Ketone	100
MB-5545 Stabilizer	10.0

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-10702-A	KV-7103-A	20	2751	1000
KV-10702-B	KV-7103-A	30	2918	860
KV-10702-C	KV-7103-A	40	2914	907
KV-10702-D	KV-7108-F	25	2222	1060
KV-10702-E	KV-7108-F	40	2296	987
KV-10702-F	KV-7108-G	25	2554	873
KV-10702-G	KV-7108-G	40	2296	740
KV-10702-H	KV-7103-A &	20	2507	780
	KV-7108-G	20		

SERIES KV-10704, NEOPRENE COATINGS, MADE WITH ANATASE TITANIUM DIOXIDE

Gumstock KV-9942	GRAMS
Neoprene AC	350
Ionol, Antioxidant	10
Titanium Dioxide, Anatase	175
Zinc Oxide	70
Dyphos	70

Gumstock Solution KV-10717	GRAMS
Gumstock KV-9942	193
Amsco Solv A	347
Modsol 51	100
MEK	50
MB-5545 Stabilizer	10

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-10704-A	KV-7103-A	20	2732	825
KV-10704-B	KV-7103-A	30	2857	753
KV-10704-C	KV-7103-A	40	2437	580
KV-10704-D	KV-7108-F	25	2972	767
KV-10704-E	KV-7108-F	40	2162	700
KV-10704-F	KV-7108-G	25	2613	700
KV-10704-G	KV-7108-G	40	2089	687
KV-10704-H	KV-7103-A &	20	2159	687
	KV-7108-G	20		

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-10706, NEOPRENE COATINGS MADE WITH ANATASE TITANIUM DIOXIDE

Gumstock KV-9944	GRAMS
Neoprene GN	350
Ionol, Antioxidant	10
Titanium Dioxide, Anatase	175
Plumb-O-Sil A	17.5

Gumstock Solution KV-10718	GRAMS
Gumstock KV-9944	157.8
Toluene	232.2
Xylene	100
2 Nitro Propane	100
Ethyl Amyl Ketone	100
MB-5545 Stabilizer	10

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-10706-A	KV-7103-A	20	1714	1027
KV-10706-B	KV-7103-A	30	1809	973
KV-10706-C	KV-7103-A	40	2369	1053
KV-10706-D	KV-7108-F	25	1698	1233
KV-10706-E	KV-7108-F	40	1476	973
KV-10706-F	KV-7108-G	25	1667	1133
KV-10706-G	KV-7108-G	40	1429	980
KV-10706-H	KV-7103-A &	20	1869	960
	KV-7108-G	20		

SERIES KV-10708, POLYACRYLIC RUBBER COATINGS MADE WITH ANATASE TITANIUM DIOXIDE

Gumstock KV-9943	GRAMS
Hycar 4021	350
Titanium Dioxide, Anatase	150
HiSil 101	50

Gumstock Solution KV-10719	GRAMS
Gumstock KV-9943	118
Toluene	172
Xylene	100
2 Nitro Propane	100
Ethyl Amyl Ketone	100
MIBK	100
MB-5545 Stabilizer	10

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

SERIES KV-10708, POLYACRYLIC RUBBER COATINGS MADE WITH ANATASE TITANIUM DIOXIDE (continued)

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-10708-A	KV-7103-A	25	1485	760
KV-10708-B	KV-7103-A	35	1593	540
KV-10708-C	KV-7103-A	45	1682	433
KV-10708-D	KV-7108-F	25	793	1033
KV-10708-E	KV-7108-F	40	667	1120
KV-10708-F	KV-7108-G	25	1222	600
KV-10708-G	KV-7108-G	40	1151	606
KV-10708-H	KV-7103-A &	20	1270	447
	KV-7108-G	20		

SERIES KV-10710 AND 10721, NEOPRENE COATINGS, MADE WITH ANATASE TITANIUM DIOXIDE

Gumstock KV-9948	GRAMS
Neoprene AC	350
AC-1	10
Anatase Titanium Dioxide	175
Plumb-O-Sil A	17.5

Gumstock Solution KV-10720	GRAMS
Gumstock KV-9948	157.8
Toluene	282.2
Xylene	100
2 Nitro Propane	100
Ethyl Amyl Ketone	100
MB-5545 Stabilizer	10

PHYSICALS versus ACCELERATION

Accelerated Coating Solution Number	Gaco Accelerator Type	Gaco Accelerator Weight Grams	Physicals: Tensile Strength psi	Physicals: Elongation at Break %
KV-10710-A	KV-7103-A	20	2667	893
KV-10710-B	KV-7103-A	30	2533	793
KV-10710-C	KV-7103-A	40	2378	767
KV-10710-D	KV-7108-F	25	2722	900
KV-10710-E	KV-7108-F	40	2167	727
KV-10710-F	KV-7108-G	25	2200	753
KV-10710-G	KV-7108-G	40	2267	780
KV-10710-H	KV-7103-A &	20		
	KV-7108-G	20	1833	633
KV-10721	KV-7103-A	30	2635	1147

TABLE I (continued)

FORMULATIONS AND PHYSICAL PROPERTIES

KV-6982-2-B, NEOPRENE WRT COATING SOLUTION

Gumstock KV-7379	GRAMS
Neoprene WRT	350
Ionol	10
Eagle Sublimed Blue Lead	17.5

Coating Solution KV-6982-2-B	GRAMS
Gumstock KV-7379	107.8
Stabilizer Gaco MB-845	6
Toluene	486.2
Accel. Gaco KV-7103-A	30

PHYSICALS

Tensile Strength psi, = 1590
Elongation at Break, % = 1286

TABLE II

DIFFUSE REFLECTANCES - INTRODUCTION

The diffuse reflectance of all the light-colored coatings has been measured between the wave length range of approximately 0.45 to 0.7 microns, via the use of a Gardner M-1 Reflectometer. The coatings were painted out onto aluminum panels and cured in the usual manner. The following remarks are presented as an aid in interpreting the data:

(1) For convenience, the diffuse reflectances are listed in a more or less chronological order. The coatings are identified by a coating number which appears to the left of each set of columns. The coating numbers numerically increase in the order of their chronology. In the interest of brevity only the more interesting coatings have been listed in the Table (462 out of 1,212 coatings).

(2) The terms "Infra red", "Amber", "Green" and "Blue" have reference to the colors of the Wratten filter used - in effect such filters pass the light of the indicated colors.

(3) The cured films were usually ten mils in thickness. With a reasonable concentration of pigments of good hiding power, these film thicknesses are generally sufficient to yield apparent reflectance readings not unduly influenced by the background.

(4) The diffuse reflectances, as set forth, represent the reflectances of the top or exposed side of the coatings, generally taken after a few days' exposure to air and light. Attention is called to the fact that the "underneath" sides of the coatings are usually lighter in color and give higher reflectance readings.

(5) Except for coatings prepared from products marked with an (*), all films were cured in a hot air oven at 150°F. As a rule, coatings cured at room temperatures are lighter in color and have a slightly higher reflectance.

(6) The reflectances listed in the Table, unless otherwise noted, should be regarded as "initial values", inasmuch as the measurements were generally made a few days after the films were prepared. Upon extended exposure to light and air, the color usually darkens and the reflectances drop off because the films become discolored as they weather and become soiled. The greatest drop in the diffuse reflectance occurs in the blue region of the spectrum. Polyacrylic rubber coatings seem to retain their whiteness better than coatings based upon other polymers examined.

TABLE II

DIFFUSE REFLECTANCES

Percent Diffuse Reflectance in the Various Regions of the Spectrum

Coating KV#	Infra-Red	Amber	Green	Blue	Coating KV#	Infra-Red	Amber	Green	Blue
7007-A	73.8	58.4	53.0	35.0	8340-B	90.8	81.2	76.4	61.8
7007-B	74.6	81.0	56.0	36.8	8340-C	91.0	79.0	73.4	56.0
7007-C	84.6	74.2	69.8	50.0	8342-A	91.0	80.8	76.8	62.4
7007-D	84.0	74.0	69.0	48.0	8342-B	92.4	76.6	71.0	49.6
7007-E	85.4	72.0	65.6	42.8	8342-C	94.0	76.6	71.4	48.6
7007-F	74.0	53.0	47.8	34.6	8342-D	83.0	72.2	68.0	52.0
8303-B	87.0	75.0	69.4	47.2	8342-E	84.4	72.8	67.6	50.4
8304-A	47.8	47.0	45.0	26.2	8344-A	84.4	69.2	65.0	53.4
8310-C	19.4	17.0	14.6		8344-B	83.0	64.8	59.2	43.4
8310-D	80.0	76.4	73.0	58.4	8344-C	84.8	65.0	59.4	39.4
8315	72.8	66.8	60.4	41.6	8344-D	85.2	74.2	70.4	56.8
8320-A	86.4	75.4	70.4	51.6	8344-E	85.0	67.4	62.2	47.6
8320-B	89.0	76.0	70.6	50.2	8346-A	87.6	72.8	68.8	55.2
8320-C	90.4	74.4	68.6	46.8	8346-B	90.0	75.0	69.0	49.0
8320-D	89.2	74.8	69.0	49.6	8346-C	92.0	76.2	68.4	45.0
8320-E	84.2	74.2	69.6	55.2	8346-D	89.8	76.2	69.8	51.0
8320-F	76.4	61.2	60.0	48.0	8346-E	87.4	72.4	69.0	55.0
8320-G	87.0	73.0	67.8	49.2	8346-F	88.6	79.6	76.4	63.2
8320-H	82.0	76.0	73.8	66.6	8360	88.0	75.4	71.0	54.4
8324-A	77.8	74.6	72.0	55.0	8361	39.6	31.2	28.4	14.2
8324-B	81.2	75.2	72.0	52.4	8368-A	88.0	73.4	67.4	45.0
8324-C	88.4	75.8	70.2	47.0	8378-A	87.8	78.6	74.0	57.0
8324-D	86.6	80.0	76.6	65.0	8378-B	87.0	77.0	72.4	55.0
8324-E	87.4	80.0	81.0	63.0	8378-C	89.2	78.4	73.8	55.0
8324-F	75.0	70.0	71.0	57.4	8378-D	87.8	76.4	71.8	52.4
8326-A	84.0	71.6	67.2	52.0	8378-E	87.4	77.0	72.2	52.6
8326-B	85.0	71.2	66.2	47.8	8378-F	88.2	76.0	70.2	47.4
8326-C	84.6	70.2	65.4	47.4	8378-G	87.2	76.6	71.8	53.0
8328-A	90.4	75.0	68.4	48.0	8378-H	87.2	75.8	71.0	50.6
8328-B	92.6	75.0	66.0	39.0	8382-A	86.6	76.4	73.0	55.4
8328-C	93.4	74.6	65.8	37.8	8382-B	85.0	78.0	78.0	63.4
8328-D	86.0	74.4	68.6	51.0	8382-C	85.6	74.0	69.2	50.4
8328-E	83.2	70.0	64.0	47.4	8382-D	94.4	89.0	89.2	73.0
8332-A	87.2	71.2	65.4	44.6	8382-F	93.4	90.0	89.0	80.4
8332-B	87.6	68.4	62.0	39.4	8382-G	93.0	88.0	87.4	79.0
8332-C	89.6	78.0	73.4	56.0	8382-H	90.8	82.6	80.6	66.0
8332-D	88.8	79.4	75.0	60.2	8386-A	86.2	73.0	69.0	50.8
8332-E	89.8	80.8	76.0	60.0	8386-B	85.0	74.0	70.2	53.4
8332-F	83.0	73.6	70.6	58.4	8386-C	86.0	75.0	71.0	53.2
8340-A	92.4	82.2	79.0	66.6	8386-D	87.6	74.0	71.0	54.8

TABLE II (continued)

DIFFUSE RELFECTANCES

Percent Diffuse Reflectance in the Various Regions of the Spectrum

Coating KV#	Infra-Red	Amber	Green	Blue
8386-E	86.4	71.0	66.4	47.2
8386-F	90.4	72.0	67.4	49.0
8386-G	85.0	72.4	68.0	49.2
8386-H	86.0	72.0	67.8	50.6
8394	88.0	76.0	71.0	54.0
8720-A	95.6	90.3	87.7	66.4
8720-B	94.6	86.0	82.1	53.9
8720-C	96.1	90.4	87.7	66.4
8720-D	93.2	84.7	78.7	59.9
8720-E	94.4	88.9	85.1	71.9
8720-F	91.7	86.5	81.2	66.6
8732-A	83.7	67.8	62.0	39.2
8732-B	86.6	69.6	64.0	42.6
8732-C	87.0	70.8	66.4	40.2
8732-D	85.3	71.5	66.1	49.2
8732-E	83.6	71.9	66.1	47.8
8732-F	84.5	70.2	64.4	44.5
8732-G	85.0	72.8	67.7	48.4
8732-H	78.3	63.0	59.6	48.4
8734-A	23.5	21.2	17.6	
8734-B	22.0	21.2	18.0	
8734-C	23.7	22.6	19.2	
8734-D	43.0	37.0	32.6	15.1
8734-E	59.5	50.2	45.1	23.7
8734-F	33.8	28.5	24.4	10.1
8734-G	30.2	26.9	23.3	9.5
8734-H	29.0	17.8	14.7	9.4
8741	86.2	73.0	69.0	50.8
8748-A	92.8	78.1	69.7	56.5
8748-B	93.6	79.4	69.1	53.8
8748-C	92.1	82.6	73.4	66.4
8748-D	83.8	83.8	73.5	68.1
8748-E	83.2	81.0	70.2	62.6
8748-F	82.0	79.1	68.8	60.8
8750-A	90.6	81.8	78.2	70.7
8750-B	90.3	80.6	75.2	62.6
8750-C	89.3	84.7	81.4	77.1
8750-D	88.3	84.2	79.9	75.4
8750-E	89.7	84.0	80.1	75.0
8750-F	89.4	83.6	79.3	72.9
8750-G	69.3	55.1	46.1	39.6
8750-H	74.6	65.0	56.0	51.4
8752-A	77.2	67.9	63.6	52.3
8752-B	74.4	68.2	61.7	50.5
8754-A	80.4	81.4	77.0	64.0
8754-B	81.4	82.0	77.2	62.0
8754-C	81.5	82.5	76.5	66.2
8754-D	80.4	82.5	77.1	64.9
8754-E	81.5	82.6	76.7	63.6
8754-F	81.5	82.0	75.0	62.2
8758-A	81.5	71.8	65.7	45.5
8758-B	79.7	69.5	63.1	39.9
8758-C	80.6	69.1	62.0	38.9
8758-D	79.6	77.0	70.7	57.2
8758-E	89.6	76.5	71.4	55.5
8758-F	84.6	68.7	66.7	56.7
8758-G	70.7	60.9	56.6	46.5
8758-H	56.7	37.0	30.8	21.7
8760-A	85.4	71.0	65.3	47.9
8760-B	85.9	74.9	69.8	52.0
8760-C	88.4	74.4	68.6	47.8
8760-D	89.1	79.8	76.0	63.6
8760-E	88.0	76.8	73.0	58.8
8760-F	84.6	69.5	66.0	56.8
8760-G	77.8	61.4	57.8	51.0
8760-H	56.1	29.5	26.3	18.9
8762-A	91.2	79.6	75.8	58.2
8762-B	91.4	77.6	72.6	50.8
8762-C	90.6	77.2	71.0	45.7
8762-D	90.2	79.5	76.3	61.7

TABLE II (continued)

DIFFUSE REFLECTANCES

Percent Diffuse Reflectance in the Various Regions of the Spectrum

Coating KV#	Infra-Red	Amber	Green	Blue	Coating KV#	Infra-Red	Amber	Green	Blue
8762-E	88.7	74.7	69.7	54.2	8774-H	79.8	66.9	63.4	51.2
8762-F	87.1	72.1	68.7	59.8	8780-A	18.1	14.8	11.5	Nil
8762-G	83.4	65.8	62.0	47.1	8780-B	13.4	11.5	10.5	Nil
8762-H	65.3	31.0	27.7	19.7	8780-C	14.0	12.3	11.1	Nil
8766-A	89.6	76.4	72.6	53.1	8780-D	15.7	13.5	12.5	Nil
8766-B	90.4	77.6	73.3	52.6	8780-G	10.5	Nil	Nil	Nil
8766-C	92.4	76.6	71.3	47.5	8780-H	9.2	Nil	Nil	Nil
8766-D	88.4	78.2	75.6	63.0	8782-E	79.7	70.5	65.9	46.7
8766-E	87.1	77.8	74.3	59.6	8782-F	88.7	75.0	69.8	46.9
8766-F	88.8	78.9	75.4	60.8	8782-G	80.4	70.3	66.6	50.1
8766-G	88.5	78.9	75.5	61.4	8782-H	81.6	71.6	66.7	46.0
8766-H	81.1	62.1	59.9	47.7	8784-A	81.5	76.5	73.3	56.6
8770-A	78.9	66.8	62.9	39.9	8784-B	82.2	76.3	72.0	52.4
8770-B	80.2	65.7	60.5	32.7	8784-C	80.7	76.7	73.9	59.8
8770-C	80.7	65.3	59.4	30.4	8784-D	77.1	73.6	70.2	54.8
8770-D	79.8	70.1	67.3	48.3	8824-E	62.9	51.3	45.0	26.8
8770-E	79.8	68.6	65.0	43.3	8824-F	61.9	46.9	40.5	22.4
8770-F	73.3	55.8	52.9	39.2	8824-G	59.4	46.1	39.9	22.9
8770-G	72.8	53.0	51.1	38.5	8830-A	62.0	62.2	60.3	46.3
8770-H	39.2	23.8	21.5	15.5	8830-B	63.7	62.6	59.7	42.1
8772-A	80.3	72.6	66.6	47.9	8830-C	61.4	61.7	59.8	46.6
8772-B	79.4	70.3	66.1	44.4	8830-D	75.8	69.4	65.9	48.7
8772-C	80.5	72.9	68.3	45.7	8830-E	76.0	68.1	63.6	40.7
8772-D	81.1	74.1	71.3	56.7	8830-F	72.8	67.4	63.8	47.2
8772-E	81.1	74.1	70.7	56.3	8830-G	76.7	70.9	67.4	50.3
8772-F	81.2	73.2	69.3	55.7	8830-H	77.5	70.7	66.0	41.3
8772-G	80.4	72.3	68.4	52.2	8840-A	63.3	58.2	52.9	35.5
8772-H	76.9	63.6	59.7	46.2	8840-B	62.9	56.2	50.8	33.0
8774-A	84.4	72.5	67.7	50.0	8840-C	63.0	57.5	52.4	34.3
8774-B	85.9	75.3	71.0	54.3	8840-D	64.8	56.1	49.9	32.1
8774-C	85.8	73.6	69.1	49.2	8840-E	64.4	58.0	52.6	34.6
8774-D	86.5	76.8	72.5	56.5	8840-F	64.5	55.1	49.1	30.5
8774-E	86.7	77.4	73.2	57.3	8840-G	58.9	45.3	40.7	28.9
8774-F	85.3	74.4	70.4	54.1	8840-H	58.0	42.4	38.3	26.7
8774-G	86.0	74.7	70.2	52.3	8842-A	82.0	69.0	63.2	42.9

TABLE II (continued)

DIFFUSE REFLECTANCES

Percent Diffuse Reflectance in the Various Regions of the Spectrum

Coating KV#	Infra-Red	Amber	Green	Blue	Coating KV#	Infra-Red	Amber	Green	Blue
8842-B	82.7	68.5	62.5	41.4	8870-H	91.3	79.9	73.6	48.3
8842-C	81.7	67.9	61.9	39.5	8882-A	89.5	86.1	80.7	60.5
8842-D	81.6	69.9	64.0	43.9	8882-B	90.2	86.5	79.8	57.2
8842-E	81.1	67.4	61.6	41.0	8882-C	86.5	82.0	78.3	65.6
8842-F	82.3	67.5	61.2	39.9	9302-A	92.5	84.8	80.8	65.6
8842-G	74.2	58.5	54.6	43.1	9302-B	91.0	83.6	78.9	60.3
8842-H	70.9	53.4	49.8	38.7	9302-C	92.4	82.8	77.0	53.8
8844-A	77.3	66.5	61.0	43.0	9302-D	92.2	83.7	78.9	57.7
8844-B	77.4	64.9	58.9	39.4	9302-E	92.3	86.9	83.9	71.4
8844-C	78.3	64.7	58.4	37.0	9302-F	91.7	83.7	79.6	63.7
8844-D	79.2	68.4	62.6	43.9	9302-G	90.6	83.7	79.7	63.6
8844-E	77.8	64.4	58.5	39.1	9302-H	85.9	76.2	73.3	62.8
8844-F	77.9	65.1	59.2	39.3	9306-A	88.7	86.7	85.7	78.9
8844-G	74.2	60.6	56.2	42.3	9306-B	87.0	86.5	85.2	78.2
8844-H	70.1	54.9	50.8	37.6	9306-C	90.4	88.8	87.4	79.1
8846	90.7	88.2	80.6	69.8	9306-D	89.0	86.2	84.4	78.1
8864-A	79.0	71.1	66.4	47.7	9306-E	88.9	86.4	85.3	79.5
8864-B	78.4	71.0	65.6	45.1	9306-F	87.7	86.6	85.8	79.5
8864-C	79.9	70.8	64.9	41.5	9306-G	89.9	87.4	86.1	80.5
8864-D	79.3	71.7	66.3	45.5	9306-H	86.6	84.1	83.0	78.2
8864-E	79.0	71.0	66.0	47.2	9318-A	85.6	80.8	78.0	66.2
8864-F	78.3	70.8	65.4	44.6	9318-B	85.6	79.2	77.8	62.0
8864-G	75.6	60.8	56.4	42.2	9318-C	86.0	78.2	74.4	59.0
8864-H	75.7	63.1	59.1	45.4	9318-D	86.4	79.8	76.0	59.4
8868-B	67.0	51.0	41.9	23.7	9318-E	86.8	78.2	74.0	59.0
8868-C	79.8	64.4	56.6	36.5	9318-F	87.0	77.8	73.5	54.6
8868-D	79.7	62.7	56.2	35.2	9318-G	88.0	77.8	72.8	52.6
8868-E	80.7	66.7	61.2	42.5	9318-H	89.2	78.0	72.5	50.3
8870-A	90.1	79.4	68.6	52.4	9324-A	91.8	82.2	78.0	61.4
8870-B	91.0	81.3	70.3	52.3	9324-B	91.4	83.6	80.0	65.0
8870-C	90.3	79.7	69.1	54.0	9324-C	91.0	84.4	81.2	68.2
8870-D	90.8	78.6	72.9	52.1	9324-D	91.2	85.0	81.8	69.2
8870-E	91.2	81.5	76.2	53.9	9324-E	91.2	85.4	82.0	69.1
8870-F	90.9	77.9	66.7	50.2	9324-F	90.7	84.6	81.6	68.8
8870-G	88.7	76.2	66.1	52.1	9324-G	90.2	84.4	81.8	69.6

TABLE II (continued)

DIFFUSE REFLECTANCES

Percent Diffuse Reflectance
in the Various Regions of the Spectrum

Coating KV#	Infra-Red	Amber	Green	Blue
9324-H	90.0	84.4	81.8	70.2
9332-A	92.4	85.0	82.2	69.4
9332-B	92.8	84.6	82.2	68.8
9332-C	92.8	85.0	83.2	70.8
9332-D	92.8	84.2	82.2	69.4
9336-A	93.2	90.2	89.4	82.3
9336-B	92.6	89.6	89.0	83.0
9336-C	93.0	90.2	89.6	83.6
9336-D	93.5	90.2	89.7	78.0
9356-A	89.0	81.2	78.2	64.2
9356-B	90.0	81.6	77.9	61.0
9356-C	91.3	81.4	77.0	58.6
9356-D	90.0	80.7	77.2	62.8
9356-E	90.0	80.4	76.9	62.2
9356-F	90.0	89.8	76.0	60.8
9356-G	51.7	34.6	31.6	24.4
9356-H	65.2	49.6	46.6	37.4
9362-A	81.4	73.2	70.0	53.6
9362-B	83.8	72.2	67.4	49.9
9362-C	85.5	70.0	66.8	48.4
9362-D	88.4	79.0	76.4	41.3
9362-E	86.0	78.6	75.0	59.2
9362-F	88.0	74.8	71.8	59.7
9384-A	93.7	86.8	81.4	60.8
9384-B	93.0	86.7	81.4	60.0
9384-C	51.8	54.1	50.4	32.2
9384-D	54.6	55.6	52.0	34.3
9384-E	92.0	86.5	82.8	69.0
9384-F	92.2	85.4	80.7	65.0
9384-G	93.4	87.4	82.0	62.7
9384-H	93.4	87.0	81.0	58.2
9392-A	92.6	86.0	83.2	81.4
9392-B	94.0	85.6	82.0	80.0
9392-C	95.1	85.7	81.6	79.8
9392-D	92.9	85.8	83.2	81.1
9392-E	91.4	86.6	84.2	82.0
9392-F	93.4	86.4	83.0	82.0
9392-G	94.4	86.9	85.1	81.8
9392-H	91.4	78.4	71.0	74.0
9394-A	87.0	84.8	81.0	68.4
9394-B	89.3	84.1	79.8	62.8
9394-C	90.1	83.8	79.2	61.4
9394-D	88.0	84.4	81.2	69.4
9394-E	88.2	84.2	81.1	67.6
9394-F	88.4	84.8	81.4	68.6
9394-G	88.2	83.2	79.4	64.6
9394-H	86.4	73.2	68.6	54.4
9396-A	93.8	90.8	88.4	79.4
9396-B	94.9	91.8	88.4	71.2
9396-C	96.6	93.0	89.4	69.0
9396-D	90.8	88.6	86.8	77.2
9396-E	92.8	88.0	84.6	71.6
9396-F	94.0	90.8	88.2	76.4
9396-G	94.6	90.8	87.7	71.0
9396-H	93.8	90.0	86.4	77.0
9398-A	95.0	90.6	88.8	79.8
9398-B	94.4	89.8	87.2	74.6
9398-C	94.1	90.2	87.2	71.8
9398-D	94.9	90.8	89.2	81.4
9398-E	93.6	90.2	88.6	78.6
9398-F	94.2	90.0	88.6	79.4
9398-G	94.6	90.1	88.0	75.0
9398-H	93.4	88.5	86.2	76.0
9405	97.0	86.9	82.9	64.5
9407	95.9	84.8	80.5	62.8
9412-A	88.8	83.2	80.0	66.4
9412-B	89.2	82.4	78.8	64.0
9412-C	90.0	82.0	77.2	57.8
9412-D	89.0	82.8	79.6	66.2
9412-E	88.4	82.0	79.4	64.4

TABLE II (continued)

DIFFUSE REFLECTANCES

Percent Diffuse Reflectance
in the Various Regions of the Spectrum

Coating KV#	Infra-Red	Amber	Green	Blue	Coating KV#	Infra-Red	Amber	Green	Blue
9412-F	90.0	83.6	80.0	65.8	9425	95.5	90.9	89.1	78.9
9412-G	89.9	83.4	77.4	60.8	9431	90.2	81.0	76.8	61.6
9412-H	89.8	78.4	75.0	62.4	9433	95.4	82.4	81.6	68.4
9414-A	90.0	84.6	78.6	62.8	9434	91.8	85.2	81.4	69.2
9414-B	90.4	87.2	75.4	57.6	9435	90.2	84.8	82.5	71.0
9414-C	90.1	87.8	75.6	57.1	9436	91.6	85.0	82.5	71.5
9414-D	89.6	82.4	79.2	62.6	9437	92.0	86.0	84.0	73.0
9414-E	89.2	84.6	76.8	59.4	9438	93.1	87.6	86.0	76.5
9414-F	90.2	79.6	76.7	59.2	9441	91.1	80.0	75.4	59.8
9414-G	88.8	79.2	73.6	59.8	9443	91.8	81.1	77.0	60.8
9414-H	85.4	74.8	68.4	56.4	9449	93.2	90.4	88.6	78.4
9416-A	90.8	86.6	76.0	58.6	9450	97.8	89.5	86.2	74.8
9416-B	89.4	82.8	74.8	56.4	9452	98.2	90.1	87.0	76.2
9416-C	90.4	86.2	73.6	53.8	9453	97.2	89.2	85.9	74.0
9416-D	88.4	80.2	75.0	51.4	9455	94.9	91.8	90.0	81.2
9416-E	87.6	82.2	73.2	54.9	9457	93.0	87.2	84.3	73.2
9416-F	87.0	80.8	73.6	55.1	9458	91.8	87.8	85.8	76.4
9416-G	86.9	79.6	70.8	50.6	9459	91.1	88.1	85.9	76.2
9416-H	82.4	70.4	59.0	44.6	9476-A	87.4	82.2	80.1	68.2
9418-A	87.8	82.0	78.4	62.2	9476-B	91.1	84.4	81.2	67.1
9418-B	91.6	80.4	75.8	57.2	9476-C	91.8	82.2	78.1	59.8
9418-C	92.0	81.4	77.0	58.6	9476-D	91.0	82.0	77.4	56.6
9418-D	92.6	82.0	77.6	60.4	9476-E	91.8	84.1	81.1	67.6
9418-E	91.2	80.4	75.6	75.6	9476-F	90.2	83.4	80.6	66.9
9418-F	91.4	80.6	76.0	57.2	9476-G	91.4	84.0	80.4	66.4
9418-G	92.0	79.2	74.0	53.4	9476-H	90.6	82.4	79.4	64.4
9418-H	78.6	55.4	50.8	38.1	10702-A	87.8	81.4	78.6	72.8
9420-A	92.6	91.0	90.1	75.6	10702-B	88.1	80.0	76.6	73.6
9420-B	91.4	90.4	89.4	79.8	10702-C	89.0	80.0	75.8	69.0
9420-C	91.2	90.0	89.1	80.6	10702-D	87.8	81.1	78.6	65.0
9420-D	92.1	90.8	90.1	82.4	10702-E	88.2	80.0	76.6	73.4
9420-E	92.0	90.0	88.6	80.0	10702-F	87.8	80.4	77.8	73.2
9420-F	91.8	90.2	89.8	82.4	10702-G	88.4	76.9	74.8	73.4
9420-G	92.0	90.1	88.6	76.2	10702-H	88.8	78.9	74.6	71.4
9420-H	91.2	88.2	86.2	72.2	10704-A	86.9	83.0	79.4	63.2

TABLE II (continued)

DIFFUSE REFLECTANCES

Percent Diffuse Reflectance
in the Various Regions of the Spectrum

Coating KV#	Infra-Red	Amber	Green	Blue	Coating KV#	Infra-Red	Amber	Green	Blue
10704-B	86.4	82.1	78.0	58.2					
10704-C	87.0	80.6	75.4	53.8					
10704-D	84.2	80.8	79.6	65.1					
10704-E	85.8	81.2	78.2	63.6					
10704-F	87.1	81.2	78.4	63.8					
10704-G	85.6	80.4	77.4	62.0					
10704-H	86.6	80.8	77.4	60.4					
10706-A	83.6	80.2	76.0	60.8					
10706-B	84.0	76.8	73.6	50.0					
10706-C	86.6	76.8	71.8	52.4					
10706-D	82.0	78.2	73.2	59.4					
10706-E	83.9	78.4	74.0	52.8					
10706-F	83.0	78.8	74.6	59.6					
10706-G	85.8	80.6	78.6	64.4					
10706-H	85.0	81.4	78.4	64.8					
10708-A	89.8	87.8	86.4	77.4					
10708-B	88.4	87.4	86.2	76.2					
10708-C	88.2	87.2	86.4	75.2					
10708-D	89.2	87.1	86.2	78.4					
10708-E	89.1	87.0	88.0	75.6					
10708-F	89.0	87.2	86.2	75.4					
10708-G	87.8	86.6	85.4	74.0					
10708-H	88.8	87.0	85.8	73.6					
10710-A	82.8	80.8	67.1	64.4					
10710-B	85.4	82.6	78.4	62.8					
10710-C	86.2	75.8	70.2	48.6					
10710-D	83.6	77.6	73.0	55.2					
10710-E	82.2	77.0	72.6	53.8					
10710-F	83.6	75.0	70.1	48.0					
10710-G	82.6	75.4	69.8	49.0					
10710-H	84.6	75.4	70.1	48.2					
10721	87.2	77.6	74.8	72.2					

TABLE III

RESISTANCE TO RAIN EROSION - INTRODUCTION

The resistance to rain erosion was determined by the "whirling arm" technique at a speed of 500 miles per hour under a simulated rainfall of one inch per hour. The tests were carried out by the Cornell Aeronautical Laboratories under the direction of Norman P. Wahl, Head of the Plastics Section.

The air-foil specimens conformed to Figure I of Specification MIL-C-7439B. The majority of air-foil specimens were based upon 181 Volan A with two surface plies of 116 Volan A, using Selectron 5003 resin as binder. In some studies 24 ST aluminum alloy specimens were used.

The polyester glass fiber laminates were first solvent wiped and then given a light sanding followed by an additional solvent wipe with toluene or heptane. The specimens were then given a brush coat of primer. After the primer had dried sufficently, a coat of tie-cement (if used) was brush applied followed by the brush application of a multiplicity of top-coats calculated to achieve a total coating thickness of in the neighborhood of ten mils.

The aluminum alloy specimens were variously treated, e.g., some were cleaned with common cleansing powder and then primed, et cetera. Other specimens were first cleaned and then given a treatment with Alodine 1200 prior to priming.

The coated specimens were allowed to air dry for a period of a few hours and were then forced dried and cured in a hot air-circulating oven, at a temperature of 150°F, so as to effect a cure comparable to what would be achieved by curing at room temperatures in a period of about ten days.

The coated specimens were then trimmed and identified and forwarded to the Cornell Aeronautical Laboratory, which promptly subjected the specimens to the "whirling arm" test and forwarded the results, together with the tested specimens (for examination) to the Gates Engineering Company.

Approximately 255 coating systems were subjected to the "whirling arm" test. In the interest of brevity, only 107 coating systems, representing the more interesting or promising systems, are listed in the Table.

The majority of the specimens failed due to "loss of adhesion" or "bubbling". However, attention must be called to the fact that in the bulk of the cases where "loss of adhesion" or "bubbling" has been cited as a cause of the failure, what actually happened was that the laminate immediately below the coating was disintegrated and pulverized with the result that the coating system became separated from the laminate proper by an intervening layer of pulverized laminate.

TABLE III

Resistance to Rain Erosion of Coated Air-Foil Specimens
Whirling Arm Tests - 500 Miles per Hour, Simulated Rain Fall One Inch per Hour

C.A.L. No.	Gates No.K-	Type Air-Foil	Primer KV#	Tie-Cement KV#	Body-Coat KV#	Initial Erosion Min.	Thru Coating Min.	Total Time Min.	Appearance After Test
1424-A,B	134-E	Polyester	Bostik*	None	N-79	3-3	5-6	6-7	L. of A.
1426-A,B	134-G	Polyester	N-15	None	8303-B	3-3	16-13	17-14	L. of A.
1427-A,B	134-H	Polyester	5979	None	8303-B	3-3	9-10	12-12	L. of A.
1429-A,B	134-K	Polyester	N-15	N-79	8303-B	5-5	7-11	9-13	L. of A.
1438-A,B	136-B	Polyester	5992	None	8303-B	4-5	6-10	7-11	L. of A.
1442-A,B	136-F	Polyester	5989	None	8394	5-5	8-7	12-8	L. of A.
1443-A,B	136-G	Polyester	5992	None	8394	3-3	8-9	9-11	L. of A.
1451-A,B	183-A	Polyester	N-15	8366-D	8303-B	5-3	17-8	21-10	Several Pits
1453-A,B	183-C	Polyester	N-15	8370-D	8368-A	6-8	13-13	21-15	Scattered Pits
1455-A,B	183-E	Polyester	N-15	8370-D	XP-104	3-3	5-5	7-7	L.of A., Scattered Pits
1467-A,B	184-A	Polyester	N-15	None	N-79	5-5	28-32	30-34	L.of A., Numerous Pits
1468-A,B	184-B	Polyester	N-15	None	XP-104	5-5	9-9	10-10	Scattered Pitting & Bubbling
1471-A,B	184-E	Polyester	N-15	None	8303-B	12-7	22-17	27-27	L. of A., Bubbled
1472-A,B	184-F	Polyester	N-15	8366-D	8303-B	10-10	17-22	20-28	Scattered Bubbling
1475-A,B	184J-K	Polyester	5992	8372-C	8378-G	11-18	26-20	30-27	Some Pitting & Bubbling
			6006-A			5-2	8-5	10-8	
1483-A,B	223-A	Polyester	6006-N	8366-D	8386-A	10-13	60-80	90-90	L.of A., Uniform Erosion
1484-A,B	223-B	Polyester	6006-N	8374-G	8386-A	15-10	66-35	83-50	L.of A., Uniform Erosion
1486-A,B	223-D	Polyester	6006-N	8374-G	8386-E	10-16	23-20	25-25	L. of A.
1487-A,B	223-E	Polyester	6006-N	8364-B	8378-C	10-10-	23-13	27-15	L. of A.
1488-A,B	223-F	Polyester	6006-N	8364-C	8378-C	13-10	22-12	26-13	L. of A.
1490-A,B	223-H	Polyester	6006-N	8370-D	N-79	5-5	28-18	30-21	L. of A.
1492-A,B	223-K	Polyester	6006-G	None	8386-A	6-6	22-32	27-41	L. of A.
1600-A,B	276-A	Polyester	8502-C	8704-G	8386-A	12-7	22-12	27-17	L. of A.
1601-A,B	276-B	Polyester	8502-C	8704-G	8386-A	35-25	51-40	61-43	L.of A., Eroded Uniformly
1602-A,B	276-C	Polyester	8502-C	8704-G	8386-A	45-25	52-35	55-45	Some Pits & Bubbling
1603-A,B	276-D	Polyester	8502-C	8704-G	8386-A	5-15	12-22	15-24	L. of A.
1604-A,B	276-E	Polyester	8502-C	8704-G	8386-A	5-12	12-18	15-20	L. of A.
1605-A,B	276-F	Polyester	8502-C	8704-G	8386-A	5-15	10-17	17-19	L. of A.
1606-A,B	276-G	Polyester	8502-C	8704-G	8386-A	25-5	30-14	36-15	L. of A.
1607-A,B	276-H	Polyester	8502-C	8704-G	8386-A	15-20	20-26	28-28	L. of A.
1608-A,B	276-J	Polyester	8502-C	8704-G	8386-A	3-8	5-12	8-13	L. of A.
1609-A,B	276-K	Polyester	8502-C	8704-G	8386-A	20-25	24-57	25-59	L.of A.,Pitting & Bubbling

* Bostik 1007 was used.

TABLE III (continued)

Resistance to Rain Erosion of Coated Air-Foil Specimens
Whirling Arm Tests - 500 Miles per Hour, Simulated Rain Fall One Inch per Hour

C.A.L. No.	Gates No.K-	Type Air-Foil	Primer KV#	Tie-Cement KV#	Body-Coat KV#	Initial Erosion Min.	Thru Coating Min.	Total Time Min.	Appearance After Test
1645-A,B	277-B	Polyester	8502-C 8506-N	8704-G	8386-A	14-2	20-4	23-5	Good Adhesion - Bubbled.
1646-A,B	277-C	Polyester	8506-N	8722-H	8741	20-20	27-31	30-33	Good Adhesion
1648-A,B	277-E	Polyester	8506-N	8746-E	8741	10-10	17-15	18-18	Good Adhesion
1649-A,B	277-F	Polyester	8506-N	8746-F	8741	11-15	13-17	16-19	Good Adhesion
1653-A,B	277-K	Polyester	8506-N	None	8741	7-7	10-13	13-19	Good Adhesion
1678-A,B	380-K	Polyester	8510-D	8736-D,E	8748-G	9-9	24-23	26-25	Uniform Erosion
1696-A,B	410-C	Polyester	8510-E	8746-B	8734-C	3-15	3-26	8-42	Uniform Erosion, Bubbled
1698-A,B	410-E	Polyester	8510-E	8746-B	8760-B	8-8	35-37	37-43	Uniform Erosion
1699-A,B	410-F	Polyester	8510-E	8746-B	8732-B(2)	3-5	22-27	22-28	Uniform Erosion
1700-A,B	410-G	Polyester	8510-E	8746-B	8732-C(2)	4-4	18-20	20-22	Uniform Erosion, Bubbled
1701-A,B	410-H	Polyester	8510-E	8746-B	8734-C(2)	12-12	20-29	23-32	Uniform Erosion
1727-A,B	455-B	Polyester	8510-E	8746-B	8760-B	6-6	26-13	27-14	Scattered Pitting
1728-A,B	455-C	Polyester	8510-E	8746-B	8770-A	7-7	17-20	21-21	Scattered Pitting
1730-A,B	455-E	Polyester	8510-E	8746-B	8774-A	7-7	36-7	37-7	Scattered Pitting
1731-A,B	455-F	Polyester	8510-E	8746-B	8774-F	7-7	14-9	17-20	Scattered Pitting
1732-A,B	455-J	Polyester	8510-E	8746-B	8846	3-11	6-26	6-33	No To Heavy Pitting
1733-A,B	455-K	Polyester	8510-E	None	8846	20-20	69-45	70-55	Heavy Pitting
1748-A,B	532-D	Polyester	8510-E	8746-B	8868-C			14-18	Stiff & Inelastic
1753-A,B	532-J	Polyester	Bostik*	None	53-26*			41-44	Film Very Elastic
1803-A,B	740-D	Aluminum	8542-J	8746-B	8774-A		14-6	14-6	L.of A.,Sl. Permanent Set
1806-A,B	740-G	Aluminum	8542-J	8846 8756-B	8378-C		20-24	25-25	L.of A., Very Elastic
1809-A,B	740-K	Aluminum	8542-J	8846 8756-B	8870-F		5-5	8-8	Slight Permanent Set
1810-A,B	741-A	Aluminum	N-15	8746-B	8732-B		37-31	54-37	Unif. Eros.,Good Adhesion
1811-A,B	741-B	Aluminum	N-15	8746-B	8741		37-47	40-57	Unif. Eros.,Good Adhesion
1812-A,B	741-C	Aluminum	N-15	None	N-79		25-25	30-30	Unif. Eros.,Good Adhesion
1813-A,B	741-D	Aluminum	N-15	8846 8750-B	8870-F		32-34	37-37	L.of A.,Tr. Perm. Set
1818-A,B	751-D	Aluminum	8542-J	8746-B	8774-A		32-15	32-15	L.of A.,Sl. Perm. Set
1821-A,B	751-G	Polyester	8542-J	8846 8756-B	8378-C		5-9	5-9	L.of A.,Tr. Perm. Set

* NOTE - Bostik 1007 was used, and Rain erosion resistant coating from the Goodyear Tire and Rubber Corp.

TABLE III (continued)

Resistance to Rain Erosion of Coated Air-Foil Specimens

Whirling Arm Tests - 500 Miles per Hour, Simulated Rain Fall One Inch per Hour

C.A.L. No.	Gates No.K-	Type Air-Foil	Primer KV#	Tie-Cement KV#	Body-Coat KV#	Initial Erosion Min.	Thru Coating Min.	Total Time Min.	Appearance After Test
1824-A,B	751-K	Polyester	8542-J	8846 8756-B	8870-F		18-21	18-21	Unif. Eros.,Sl. Perm. Set
1825-A,B	752-A	Polyester	N-15	8746-B	8732-B		16-10	16-11	L.of A.,Sl. Perm. Set
1826-A,B	752-B	Polyester	N-15	8746-B	8741		13-13	13-18	L.of A.,Large Perm. Set
1827-A,B	752-C	Polyester	N-15	None	N-79		23-19	24-19	L.of A.,No Perm. Set
1828-A,B	752-D	Polyester	N-15	8846 8756-B	8870-F		21-15	21-15	Unif. Eros.,Tr. Perm. Set
1853-A,B	822-A,B	Polyester	N-15	None	N-79	15-15	57-60	60-70	Unif. Eros.,
1854-A,B	822-C,D	Polyester	N-15	None	N-79	15-15	45-22*	50-22	1/16 Cloth Delaminated
1855-A,B	822-E,F	Polyester	N-15	None	N-79	15-15	90-55	95-65	Several Small Bubbles
1856-A,B	823-A,B	Polyester	Bostik*	None	N-79	15-15	68-60	70-70	Ply Delaminated
1857-A,B	823-C,D	Polyester	Bostik*	None	N-79	15-12	20-22*	20-22	Ply Delamination
1858-A,B	823-E,F	Polyester	Bostik*	None	N-79	15-15	60-25*	70-25	Spec. Delaminated
1859-A,B	824-A,B	Aluminum	N-15	None	N-79	10-10	35-38	45-45	Unif. Eros., Heavy Pitting
1860-A,B	824-C,D	Aluminum	N-15	None	N-79	10-10	35-40	40-45	Unif. Eros.,
1861-A,B	824-E,F	Aluminum	N-15	None	N-79	15-15	75-65	95-75	Unif. Eros.
1862-A,B	825-A,B	Aluminum	Bostik*	None	N-79	10-10	50-50	65-55	Unif. Eros.
1863-A,B	825-C,D	Aluminum	Bostik*	None	N-79	10-10	35-35	40-35	Unif. Eros.
1864-A,B	825-E,F	Aluminum	Bostik*	None	N-79	15-15	75-70	80-75	Unif. Eros.
1955-A,B	912-F	Polyester	8512-A	8587	9431	5-5	22-22	22-29	L.of A., Pitting
1956-A,B	912-G	Polyester	8512-A	8587	9433	6-7	27-22	29-22	L.of A., Pitting
1957-A,B	912-H	Plyester	8512-A	8587	9434	7-7	20-20	21-20	L.of A., Pitting
1965-A,B	913-F	Aluminum	8512-A	8587	9431	3-3	35-18	40-18	L.of A., Pitting
1966-A,B	913-G	Aluminum	8512-A	8587	9433	3-3	28-33	30-45	L.of A., Pitting

* The two surface plies of 116-glass cloth in the supporting specimen delaminated during the erosion test. The time to erode "thru coating" on these specimens is the time at which the coating and top plies of cloth tore open. The coating did not erode through by normal pitting, as observed with the rest of the specimens. Bostik 1007 was used.

TABLE III (continued)

Resistance to Rain Erosion of Coated Air-Foil Specimens
Whirling Arm Tests - 500 Miles per Hour, Simulated Rain Fall One Inch per Hour

C.A.L. No.	Gates No.K-	Type Air-Foil	Primer KV#	Tie-Cement KV#	Body-Coat KV#	Initial Erosion Min.	Thru Coating Min.	Total Time Min.	Appearance After Test
1967-A,B	913-H	Aluminum	8512-A	8587	9434	3-3	21-20	22-22	L.of A., Small Pits
1982-A	961-A	Aluminum	8582	8589	9431	1	18	20	L.of A., Light Pitting
1984-A,B	961-E	Aluminum	8582	8589	9409	1-1	24-13	24-15	L.of A., Heavy Pitting
1985-A	961-G	Aluminum	8582	8589	9443	1	45	53	L.of A., Mod. Pitting
1986-A,B	961-J,K	Aluminum	8582	None	9441	1-1	15-34	15-37	L.of A., Mod. Pitting
					9443				
1987-A	961R-A	Aluminum	8582	8589	9431	1	4	14	L.of A., Light Pitting
1989-A,B	961R-E	Aluminum	8582	8589	9409	1-1	13-43	13-47	L.of A., Mod. Pitting
1990-A	961R-G	Aluminum	8582	8589	9443	1	27	27	L.of A., Mod. Pitting
1991-A,B	961R-J,K	Aluminum	8582	None	9441	1-1	50-45	54-48	L.of A.,Very Heavy Pitting
					9443				
2201-A,B	960-B	Aluminum	8582	8589	9433	10-10	20-20	24-20	L.of A., Mod. Pitting
2202-A,B	960-C	Aluminum	8582	None	9431	5-5	21-5	21-21	L.of A., Heavy Pitting
2203-A,B	960-D	Aluminum	8582	None	9433	13-13	40-13	43-13	L.of A., Heavy Pitting
2204-A,B	960-E	Aluminum	8582	8589	9441	10-10	26-26	26-26	L.of A., Heavy Pitting
2205-A,B	960-F	Aluminum	8582	8589	9443	10-10	31-26	35-26	L.of A., Heavy Pitting
2206-A,B	960-G	Aluminum	8582	8589	9436	8-8	10-33	10-43	L.of A., Heavy Pitting
2217-A,B	1009-C,D	Aluminum	8542-J	8587	9431			8-31	L.of A., Scat. Pitting
2218-A,B	1009-E,F	Aluminum	8542-J	8587	10702-A			22-29	L.of A., Scat. Pitting
2219-A,B	1009-G,H	Aluminum	8542-J	8587	10702-B			13-24	L.of A., Scat. Pitting
2223-A,B	1010-E,F	Aluminum	8542-J	8587	10706-C			13-19	L.of A., Fine Abrasion
2243-A,B	1018-E,F	Aluminum	8544-J	8587	10721	7-7		13-28	L.of A., Scat. Pitting
2242-A,B	1018-C,D	Aluminum	8544-J	None	10721	7-7		16-20	L.of A., Scat. Pitting
2244-A,B	1018-G,H	Aluminum	8544-J	8587	10721	3-7		21-21	L.of A., Scat. Pitting
2245-A,B	1018-J,K	Aluminum	8544-J	8587	10721	10-3		11-28	L.of A., Scat. Pitting
					10708-B				
2256-A,B	1045-A,B	Aluminum	8582	8600	9431			20-23	L.of A., Many Fine Pits
2262-A,B	1046-E,F	Aluminum	8582	8600	9431			39-34	L.of A., Heavy Pitting
2263-A,B	1046-G,H	Aluminum	8582	8600	9431			19-29	L.of A., Mod. Pitting

TABLE IV

ADHESION OF COATING SYSTEMS TO POLYESTER GLASS FIBER LAMINATES - INTRODUCTION

The adhesion data listed in the Table was obtained via the "Hop-Toad" variation of the peel-pull technique described in Section X.

Sanded polyester glass fiber laminate panels measuring 2" by 6" and 3/32" to 1/8" in thickness were used as the substrate.

The indicated primers were applied. The primer was usually allowed to dry for at least one hour, except in the case of the di-isocyanate primer, Gaco N-15, which was permitted to dry two hours before the application of other coatings.

After the primer had been given an opportunity to air dry, a tie-cement (where called for) was applied and usually permitted to air dry for about thirty minutes. The exact air drying period was influenced somewhat by the nature of the specific tie-cement, the temperature at the time of application, as well as the prevailing drafts. The object was to time the drying period so that the first coat of the subsequent body-coat could "bite" into the tie-cement. (If the drying period is too short, then, when the first coat of body-coat is brushed on, there is a tendency for the body-coat and the tie-cement to intermix to a point where the efficacy of the tie-cement might be seriously impaired. On the other hand, if the tie-cement is allowed to dry too long, or is permitted to undergo some "cure", then the adhesion of the body-coat to the tie-cement may be seriously impaired and, in the course of rain erosion tests, the body-coat may peel from the tie-cement.)

The body-coat was usually brush applied. The drying interval between coats was usually between ten and twenty minutes, depending upon the nature of the coating, the temperature at time of application and the prevailing drafts. It was considered desirable that each coat (also referred to as "top-coat") should bite into the coat beneath. When the time between coats is too short, one ends up with a very thick soft coat containing a large amount of solvent which requires a long time for its elimination from the coating. On the other hand, if the drying interval between coats is too long, the inter-coat adhesion is seriously interfered with - in such situations, during the course of the "whirling arm" tests, one frequently observes that the successive coats peel off.

Five peel-pull readings were taken per specimen - the average of the three best results was selected as giving the best measure of the peel-pull adhesion. The cross arm of the Scott Tester was geared to move at the rate of 5" per minute.

In instances where the measured values were not truly indicative of the actual adhesion under test, a plus (+) sign was placed alongside the peel-pull value, indicating that the actual adhesion was greater than indicated. Such plus signs were used in instances where the peel-pull "handle" failed, or where the panel delaminated.

Approximately 5000 coating systems applied to polyester glass fiber laminates were evaluated as regards their peel-pull adhesion. In the interest of brevity, only the more interesting or important coating systems, numbering 1546, are listed in the Table.

TABLE IV

PEEL-PULL ADHESIONS - AVERAGE, 90 DEGREE PULL, POUNDS PER INCH WIDTH

Substrate = Polyester glass fiber laminate

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
101				
A	Bostik 1007	None	N-79	29
B	N-15	None	N-79	64
C	Weldcrete	None	N-79	1
D	KV-5966	None	N-79	24
E	KV-5967	None	N-79	67
F	KV-5968	None	N-79	58
G	KV-5969	None	N-79	36
H	KV-5974	None	N-79	4
J	KV-5975	None	N-79	25
K	KV-5976	None	N-79	3
102				
A	KV-5977	None	N-79	7
B	KV-5978	None	N-79	58
C	KV-5979	None	N-79	31
D	KV-5980	None	N-79	9
E	KV-5981	None	N-79	36
F	KV-5986	None	N-79	9
G	N-10	None	N-79	31
H	N-100-1	None	N-79	37
J	N-100-2	None	N-79	27
K	Carboline #100	None	N-79	8
103				
A	Magic Vulc.F	None	N-79	4
B	Magic Vulc.M	None	N-79	7
C	Carb. Rust Bond	None	N-79	12
D	Grundie rung #40	None	N-79	58
E	Ty Ply RC	None	N-79	3
F	Casey&Case Vinyl	None	N-79	5
G	Neobon	None	N-79	37
H	THEMEG 99-Red	None	N-79	8
J	Ty Ply UP	None	N-79	18
K	N-102-2	None	N-79	13
106			KV#	
A	Magic Vulc.F	None	8303-B	12
B	Magic Vulc.M	None	8303-B	18
C	Carb. Rust Bond	None	8303-B	22
D	Grundie rung #40	None	8303-B	25
E	Ty Ply RC	None	8303-B	8
F	Casey&Case Vinyl	None	8303-B	11
G	Neobon	None	8303-B	13
H	THEMEG 99, Red	None	8303-B	9
J	Ty Ply UP	None	8303-B	31
K	N-102-2	None	8303-B	3

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
107				
A	Bostik 1007	None	XP-104	6
B	N-15	None	XP-104	29
C	Weldcrete	None	XP-104	1
D	KV-5966	None	XP-104	16
E	KV-5967	None	XP-104	12
F	KV-5968	None	XP-104	16
G	KV-5969	None	XP-104	12
H	KV-5974	None	XP-104	15
J	KV-5975	None	XP-104	22
K	KV-5976	None	XP-104	8
109				
A	Magic Vulc.F	None	XP-104	4
B	Magic Vulc.M	None	XP-104	6
C	Carb.Rust Bond	None	XP-104	35
D	Grundie rung#40	None	XP-104	14
E	Ty Ply RC	None	XP-104	13
F	Casey&Case Vinyl	None	XP-104	4
G	Neobon	None	XP-104	19
H	THEMEG 99, Red	None	XP-104	5
J	Ty Ply UP	None	XP-104	15
K	N-102-2	None	XP-104	7
110				
A	Bostik 1007	None	N-79	27
B	Bostik 1007	None	KV-8303-B	18
C	Bostik 1007	None	KV-8303-C	19
D	Bostik 1007	None	KV-8310-B	5
E	Bostik 1007	None	KV-7007-A	22
F	Bostik 1007	None	XP-104	6
111				
A	N-15	None	N-79	71
B	N-15	None	KV-8303-B	34
C	N-15	None	KV-8303-C	36
D	N-15	None	KV-8310-B	5
E	N-15	None	KV-7007-A	25
F	N-15	None	XP-104	31

TABLE IV (continued)

PEEL-PULL ADHESIONS - AVERAGE, 90 DEGREE PULL, POUNDS PER INCH WIDTH

Substrate = Polyester glass fiber laminate

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
113		KV#		
A	Bostik 1007	5970	N-79	12
B	Bostik 1007	5971	N-79	8
C	Bostik 1007	5972	N-79	15
D	Bostik 1007	5970	KV-8303B	18
E	Bostik 1007	5971	KV-8303B	14
F	Bostik 1007	5972	KV-8303B	15
G	Bostik 1007	5970	XP-104	11
H	Bostik 1007	5971	XP-104	6
J	Bostik 1007	5972	XP-104	18
114		KV#		
A	N-15	5970	N-79	40
B	N-15	5971	N-79	17
C	N-15	5972	N-79	46
D	N-15	5970	KV-8303B	31
E	N-15	5971	KV-8303B	12
F	N-15	5972	KV-8303B	36
G	N-15	5970	XP-104	26
H	N-15	5971	XP-104	12
J	N-15	5972	XP-104	20
118				
A	N-15	None	N-79	58
B	KV-5966	None	N-79	24
C	KV-5977	None	N-79	12
D	KV-5984	None	N-79	10
E	Prodor #1	None	N-79	3
F	Prodor #2	None	N-79	3
G	E-893	None	N-79	25
H	Unichrome 219-PX	None	N-79	19
J	Micro C-1250	None	N-79	12
K	Micro C-1314	None	N-79	7
119			KV#	
A	N-15	None	8303-B	32
B	KV-5966	None	8303-B	20
C	KV-5977	None	8303-B	14
D	KV-5984	None	8303-B	10
E	Prodor #1	None	8303-B	17
F	Prodor #3	None	8303-B	20
G	E-893	None	8303-B	32
H	Unichrome 219-PX	None	8303-B	22
J	Micro C-1250	None	8303-B	19
K	Unichrome C-1314	None	8303-B	12
120				
A	N-15	None	XP-104	22
B	KV-5966	None	XP-104	16
C	KV-5977	None	XP-104	16
D	KV-5984	None	XP-104	9
E	Prodor #1	None	XP-104	6
F	Prodor #3	None	XP-104	7
G	E-893	None	XP-104	15
H	Unichrome 219-PX	None	XP-104	13
J	Micro C-1250	None	XP-104	8
K	Unichrome C-1314	None	XP-104	7
121				
A	Amercoat #23	None	N-79	16
B	Unichrome AP#10	None	N-79	3
C	MicrosolE-1003#1	None	N-79	3
D	Amercoat #23	None	KV-8303-B	10
E	Unichrome AP#10	None	KV-8303-B	20
F	Microsol E-1003#1	None	KV-8303-B	16
G	Amercoat #23	None	XP-104	18
H	Unichrome AP#10	None	XP-104	16
J	Microsol E-1003#1	None	XP-104	8
122				
A	KV-5987	None	N-79	3
B	KV-5989	None	N-79	53
C	KV-5990	None	N-79	20
D	KV-5991	None	N-79	36
E	KV-5992	None	N-79	64
F	KV-5993	None	N-79	61
G	KV-5994	None	N-79	22
H	KV-5995	None	N-79	67
J	KV-5996	None	N-79	57
K	KV-5997	None	N-79	24
123			KV#	
A	KV-5987	None	8303-B	16
B	KV-5989	None	8303-B	45
C	KV-5990	None	8303-B	32
D	KV-5991	None	8303-B	32
E	KV-5992	None	8303-B	45
F	KV-5993	None	8303-B	46
G	KV-5994	None	8303-B	28
H	KV-5995	None	8303-B	38
J	KV-5996	None	8303-B	40
K	KV-5997	None	8303-B	23

TABLE IV (continued)

PEEL-PULL ADHESIONS - AVERAGE, 90 DEGREE PULL, POUNDS PER INCH WIDTH

Substrate = Polyester glass fiber laminate

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
124				
A	KV-5987	None	XP-104	3
B	KV-5989	None	XP-104	22+
C	KV-5990	None	XP-104	20
D	KV-5991	None	XP-104	32+
E	KV-5992	None	XP-104	22+
F	KV-5993	None	XP-104	23+
G	KV-5994	None	XP-104	20
H	KV-5995	None	XP-104	28
J	KV-5996	None	XP-104	21+
K	KV-5997	None	XP-104	6
136			KV#	
A	KV-5989	None	8303-B	45
B	KV-5992	None	8303-B	45
C	KV-5993	None	8303-B	44
D	KV-5995	None	8303-B	38
E	KV-5996	None	8303-B	40
F	KV-5989	None	8394	43
G	KV-5992	None	8394	44
H	KV-5993	None	8394	45
J	KV-5995	None	8394	42
K	KV-5996	None	8394	43
137				
A	KV-5992	None	N-79	62
B	KV-6006-A	None	N-79	53
C	KV-6006-B	None	N-79	52+
D	KV-6006-C	None	N-79	48+
E	KV-6006-D	None	N-79	56
F	KV-5992	None	KV-8303B	32
G	KV-6006-A	None	KV-8303B	51+
H	KV-6006-B	None	KV-8303B	35
J	KV-6006-C	None	KV-8303B	52
K	KV-6006-D	None	KV-8303B	48
142				
A	KV-6006-E	None	N-79	68
B	KV-6006-F	None	N-79	68
C	KV-6006-G	None	N-79	68
D	KV-6006-H	None	N-79	63
E	KV-6006-J	None	N-79	64
F	KV-6006-E	None	KV-8303B	30
G	KV-6006-F	None	KV-8303B	24
H	KV-6006-G	None	KV-8303B	27
J	KV-6006-H	None	KV-8303B	50
K	KV-6006-J	None	KV-8303B	30

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
147		KV#		
A	N-15	8366-A	N-79	55
B	N-15	8366-B	N-79	58
C	N-15	8366-C	N-79	58
D	N-15	8366-D	N-79	59
E	N-15	8366-E	N-79	54+
F	N-15	8366-F	N-79	37+
G	N-15	8366-G	N-79	50+
H	N-15	8366-H	N-79	53+
J	KV-5992	8366-B	N-79	53
K	KV-5992	8366-D	N-79	62
148		KV#	KV#	
A	N-15	8366-A	8303-B	44
B	N-15	8366-B	8303-B	45
C	N-15	8366-C	8303-B	48
D	N-15	8366-D	8303-B	50+
E	N-15	8366-E	8303-B	28+
F	N-15	8366-F	8303-B	33+
G	N-15	8366-G	8303-B	38+
H	N-15	8366-H	8303-B	41+
J	KV-5992	8366-B	8303-B	44+
K	KV-5992	8366-D	8303-B	33
153		KV#	KV#	
A	KV-6006-A	8372-A	8368-A	36
B	KV-6006-A	8372-B	8368-A	41
C	KV-6006-A	8372-C	8368-A	40
D	KV-6006-A	8372-D	8368-A	41
E	KV-6006-A	8372-E	8368-A	38
F	KV-6006-A	8372-F	8368-A	36
G	KV-6006-A	8372-G	8368-A	39
H	KV-6006-A	8372-H	8368-A	40
J	KV-6006-J	8372-B	8368-A	41
K	KV-6006-J	8372-D	8368-A	40
154		KV#	KV#	
A	KV-6006-A	8372-A	8378-C	39
B	KV-6006-A	8372-B	8378-C	40
C	KV-6006-A	8372-C	8378-C	40
D	KV-6006-A	8372-D	8378-C	29
E	KV-6006-A	8372-E	8378-C	38
F	KV-6006-A	8372-F	8378-C	42
G	KV-6006-A	8372-G	8378-C	37
H	KV-6006-A	8372-H	8378-C	36
J	KV-6006-J	8372-B	8378-C	39
K	KV-6006-J	8372-D	8378-C	38

TABLE IV (continued)

PEEL-PULL ADHESIONS - AVERAGE, 90 DEGREE PULL, POUNDS PER INCH WIDTH

Substrate = Polyester glass fiber laminate

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
160		KV#	KV#	
A	KV-6012-A	8372-A	8372-C	39
B	KV-6012-B	8372-A	8378-C	39
C	KV-6012-C	8372-A	8378-C	25
D	KV-6012-D	8372-A	8378-C	19
E	KV-6012-E	8372-A	8378-C	20
F	KV-6012-F	8372-A	8378-C	36
G	KV-6012-G	8372-A	8378-C	15
H	KV-6012-H	8372-A	8378-C	14
J	KV-6012-J	8372-A	8378-C	16
K	KV-6012-H	None	8378-C	37
172				
A	KV-6006-K	None	N-79	59
B	KV-6006-M	None	N-79	60
C	KV-6006-N	None	N-79	60
D	KV-6012-K	None	N-79	17
E	KV-6012-N	None	N-79	16
F	KV-6006-K	None	KV-8368-A	20
G	KV-6006-M	None	KV-8368-A	42
H	KV-6006-N	None	KV-8368-A	58
J	KV-6012-K	None	KV-8368-A	30
K	KV-6012-N	None	KV-8368-A	20
175				
A	KV-6012-A	None	XP-104	38+
B	KV-6012-B	None	XP-104	32+
C	KV-6012-C	None	XP-104	7
D	KV-6012-D	None	XP-104	7
E	KV-6012-E	None	XP-104	30+
F	KV-6012-F	None	XP-104	40+
G	KV-6012-G	None	XP-104	32+
H	KV-6012-H	None	XP-104	28
J	N-15	None	XP-104	30
K	KV-6012-J	None	XP-104	27
184		KV#		
A	N-15	None	N-79	58
B	N-15	None	XP-104	28
C	KV-6006-B	None	XP-104	37
D	KV-6006-F	None	XP-104	33
E	N-15	None	KV-8303-B	46
F	N-15	8366-D	8303-B	57
G	KV-5979	None	8303-B	48
H	KV-5992	None	8303-B	31
J	KV-5992	None	KV-8394	51
K	KV-6006-A	8372-C	8378-G	20+

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
184-A				
A	This series is a duplicate of			58
B	series KV-184 except that, after			34
C	cure, the panels were let soak			37
D	in water at room temperature			37
E	for 3 days (72 hours) and then			57
F	tested in the Scott Tester for			66
G	Peel-Pull data.			65
H			Laminate	Failed
J				47
K				19+
185				
A	KV-5992	None	N-79	57
B	KV-6006-A	None	N-79	63
C	KV-6006-B	None	N-79	55
D	KV-6006-C	None	N-79	55
E	KV-6006-E	None	N-79	54
F	KV-6006-G	None	N-79	57
G	KV-6006-H	None	N-79	64
H	KV-6006-K	None	N-79	62
J	KV-6006-M	None	N-79	57
K	KV-6006-N	None	N-79	58
219		KV#	KV#	
A	KV-6006-G	8348-C	8386-A	60
B	KV-6006-G	8364-C	8386-A	25
C	KV-6006-G	8366-C	8386-A	40
D	KV-6006-G	8372-C	8386-A	23
E	KV-6006-G	8374-C	8386-A	33
F	KV-6006-G	8348-C	8386-E	37
G	KV-6006-G	8364-C	8386-E	28
H	KV-6006-G	8366-C	8386-E	19
J	KV-6006-G	8372-C	8386-E	28
K	KV-6006-G	8374-C	8386-E	32
220		KV#	KV#	
A	KV-6006-N	8348-C	8386-A	36
B	KV-6006-N	8364-C	8386-A	28
C	KV-6006-N	8366-C	8386-A	53
D	KV-6006-N	8372-C	8386-A	25
E	KV-6006-N	8374-C	8386-A	61
F	KV-6006-N	8348-C	8386-E	29
G	KV-6006-N	8364-C	8386-E	31
H	KV-6006-N	8366-C	8386-E	61
J	KV-6006-N	8372-C	8386-E	29
K	KV-6006-N	8374-C	8386-E	60

TABLE IV (continued)

PEEL-PULL ADHESIONS - AVERAGE, 90 DEGREE PULL, POUNDS PER INCH WIDTH

Substrate = Polyester glass fiber laminate

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
223		KV#	KV#	
A	KV-6006-N	8366-D	8386-A	85
B	KV-6006-N	8374-G	8386-A	48
C	KV-6006-N	8366-D	8386-E	45
D	KV-6006-N	8374-G	8386-E	48
E	KV-6006-N	8364-B	8378-C	48
F	KV-6006-N	8364-C	8378-C	39+
G	KV-6006-N	8366-A	8378-C	21+
H	KV-6006-N	8370-D	N-79	38
J	KV-6006-N	8370-G	N-79	54
K	KV-6006-G	None	8386-A	75
224		KV#	KV#	
A	KV-8502-A	None	8386-A	47
B	KV-8502-B	None	8386-A	39
C	KV-8502-C	None	8386-A	55
D	KV-8502-D	None	8386-A	40
E	KV-8502-E	None	8386-A	28
F	KV-8502-F	None	8386-A	21
G	KV-8502-G	None	8386-A	25
H	KV-8502-H	None	8386-A	34
J	KV-8502-C	8348-C	8386-A	27
K	KV-8502-C	8374-C	8386-A	48
229		KV#	KV#	
A	N-15	8348-B	8386-A	48
B	KV-6006-A	8374-A	8386-A	53
C	KV-6006-A	8374-G	8386-A	41
D	KV-6006-K	8374-B	8386-A	36
E	KV-6006-N	8366-D	8386-A	39
F	KV-6006-A	8348-C	8386-A	32
G	KV-6006-A	8364-C	8386-A	28
H	KV-6006-A	8366-C	8386-A	50
J	KV-6006-A	8372-C	8386-A	31
K	KV-6006-A	8374-C	8386-A	61
230				
A	KV-6006-N	None	N-79	73
B	KV-8502-C	None	N-79	64
C	KV-8506-A	None	N-79	65
D	KV-8506-B	None	N-79	71
E	KV-8506-C	None	N-79	64
F	KV-8506-D	None	N-79	64
G	KV-8506-E	None	N-79	64
H	KV-8506-F	None	N-79	65
J	KV-8506-G	None	N-79	67
K	KV-8506-H	None	N-79	63

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
235		KV#	KV#	
A	KV-8502-C	8704-E	8386-A	38
B	KV-8502-C	8704-F	8386-A	42
C	KV-8502-C	8704-G	8386-A	72+
D	KV-8502-C	8704-H	8386-A	60+
E	KV-6006-G	8704-E	8386-A	47+
F	KV-6006-G	8704-F	8386-A	37
G	KV-6006-G	8704-G	8386-A	51+
H	KV-6006-G	8704-H	8386-A	31
J	KV-8502-C	None	8386-A	38
K	KV-6006-G	None	8386-A	66
241		KV#	KV#	
A	KV-8502-C	8714-A	8386-A	29
B	KV-8502-C	8714-B	8386-A	56
C	KV-8502-C	8714-C	8386-A	36+
D	KV-8502-C	8714-D	8386-A	45
E	KV-8502-C	8714-E	8386-A	35
F	KV-8502-C	8714-F	8386-A	57
G	KV-8502-C	8714-G	8386-A	53
H	KV-8502-C	8714-H	8386-A	26
J	KV-8502-C	8366-D	8386-A	34
K	KV-8502-C	8374-C	8386-A	26
244		KV#	KV#	
A	KV-8502-C	8366-D	8386-A	39
B	KV-8502-C	8374-C	8386-A	45+
C	KV-8502-C	8704-G	8386-A	61+
D	KV-8502-C	8366-D	8386-A	48+
E	KV-8502-C	8374-C	8386-A	45+
F	KV-8502-C	8704-G	8386-A	31+
G	KV-8502-C	8366-D	8386-A	36
H	KV-8502-C	8374-C	8386-A	39+
J	KV-8502-C	8704-G	8386-A	51+
246				
A	KV-8502-C	8716-A	8386-A	35
B	KV-8502-C	8716-B	8386-A	57
C	KV-8502-C	8716-C	8386-A	32
D	KV-8502-C	8716-D	8386-A	41
E	KV-8502-C	8716-E	8386-A	64
F	KV-8502-C	8716-F	8386-A	34
G	KV-8502-C	8716-G	8386-A	64
H	KV-8502-C	8716-H	8386-A	65
J	KV-8502-C	8366-D	8386-A	43
K	KV-8502-C	8374-C	8386-A	50

TABLE IV (continued)

PEEL-PULL ADHESIONS - AVERAGE, 90 DEGREE PULL, POUNDS PER INCH WIDTH

Substrate = Polyester glass fiber laminate

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
247		KV#		
A	KV-8502-C	8716-A	8386-A	45
B	KV-8502-C	8716-B	8386-A	38
C	KV-8502-C	8716-C	8386-A	31
D	KV-8502-C	8716-D	8386-A	43
E	KV-8502-C	8716-E	8386-A	58
F	KV-8502-C	8716-F	8386-A	65
G	KV-8502-C	8716-G	8386-A	49
H	KV-8502-C	8716-H	8386-A	67
J	KV-8502-C	8366-D	8386-A	34
K	KV-8502-C	8374-C	8386-A	45
252		KV#	KV#	
A	KV-8502-J	8366-D	8386-A	40
B	KV-8502-J	8374-C	8386-A	45
C	KV-8502-J	8704-G	8386-A	68
D	KV-8502-J	8706-A	8386-A	42
E	KV-8502-J	8706-E	8386-A	56
F	KV-8502-J	8708-E	8386-A	32
G	KV-8502-J	8708-G	8386-A	54
H	KV-8502-J	8712-B	8386-A	42
J	KV-8502-J	8714-B	8386-A	41
K	KV-8502-J	8714-G	8386-A	39
256		KV#	KV#	
A	KV-8502-C	8366-D	8386-A	47
B	KV-8502-C	8374-C	8386-A	36
C	KV-8502-C	8704-G	8386-A	59
D	KV-8502-C	8366-D	8386-A	38
E	KV-8502-C	8374-C	8386-A	38
F	KV-8502-C	8704-G	8386-A	60
G	KV-8502-C	8366-D	8386-A	43
H	KV-8502-C	8374-C	8386-A	51
J	KV-8502-C	8704-G	8386-A	62
257		KV#	KV#	
A	KV-8502-C	8366-D	8386-A	44
B	KV-8502-C	8374-C	8386-A	32
C	KV-8502-C	8704-G	8386-A	56
D	KV-8502-C	8366-D	8386-A	35
E	KV-8502-C	8374-C	8386-A	41
F	KV-8502-C	8704-G	8386-A	37
G	KV-8502-C	8366-D	8386-A	45
H	KV-8502-C	8374-C	8386-A	50+
J	KV-8502-C	8704-G	8386-A	57

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
259		KV#	KV#	
A	KV-8506-C	8374-C	8386-A	44
B	KV-8506-F	8374-C	8386-A	46
C	KV-8506-G	8374-C	8386-A	53
D	KV-8506-C	8704-G	8386-A	65
E	KV-8506-F	8704-G	8386-A	70
F	KV-8506-G	8704-G	8386-A	69
G	KV-8506-C	8716-H	8386-A	70
H	KV-8506-F	8716-H	8386-A	47
J	KV-8506-G	8716-H	8386-A	46
K	KV-8506-C	8716-H	8386-A	40
268		KV#	KV#	
A	KV-8502-J	8348-B	8386-A	45
B	KV-8502-J	8366-D	8386-A	48
C	KV-8502-J	8374-C	8386-A	48
D	KV-8502-J	8704-G	8386-A	72
E	KV-8502-J	8708-E	8386-A	31
F	KV-8502-J	8712-B	8386-A	54
G	KV-8502-J	8714-F	8386-A	42
H	KV-8502-J	8716-H	8386-A	32
269		KV#	KV#	
A	KV-8502-K	8348-B	8386-A	34
B	KV-8502-K	8366-D	8386-A	36
C	KV-8502-K	8374-C	8386-A	54
D	KV-8502-K	8704-G	8386-A	71
E	KV-8502-K	8708-E	8386-A	45
F	KV-8502-K	8712-B	8386-A	51
G	KV-8502-K	8714-F	8386-A	44
H	KV-8502-K	8716-H	8386-A	52
276		KV#	KV#	
A	KV-8502-C	8704-G	8386-A	54
B	KV-8502-C	8704-G	8386-A	59
C	KV-8502-C	8704-G	8386-A	50
D	KV-8502-C	8704-G	8386-A	64+
E	KV-8502-C	8704-G	8386-A	56
F	KV-8502-C	8704-G	8386-A	41
G	KV-8502-C	8704-G	8386-A	60
H	KV-8502-C	8704-G	8386-A	65+
J	KV-8502-C	8704-G	8386-A	65+
K	KV-8502-C	8704-G	8386-A	49

TABLE IV (continued)

PEEL-PULL ADHESIONS - AVERAGE, 90 DEGREE PULL, POUNDS PER INCH WIDTH

Substrate = Polyester glass fiber laminate

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
282		KV#	KV#	
A	KV-8506-N	8348-B	8741	31
B	KV-8506-N	8366-D	8741	39
C	KV-8506-N	8374-C	8741	51+
D	KV-8506-N	8704-G	8741	57+
E	KV-8506-N	8708-E	8741	56+
F	KV-8506-N	8762-B	8741	49+
G	KV-8506-N	8714-F	8741	41
H	KV-8506-N	8716-H	8741	55+
J	KV-8506-N	8722-B	8741	29
K	KV-8506-N	8722-D	8741	45
286		KV#	KV#	
A	KV-8502-C	8366-D	8741	51
B	KV-8502-C	8374-C	8741	56
C	KV-8502-C	8704-G	8741	59+
D	KV-8502-C	8712-B	8741	54+
E	KV-8502-C	8716-H	8741	61+
F	KV-8502-K	8366-D	8741	46
G	KV-8502-K	8374-C	8741	59+
H	KV-8502-K	8704-G	8741	57+
J	KV-8502-K	8712-B	8741	54+
K	KV-8502-K	8716-H	8741	52+
287		KV#	KV#	
A	KV-8502-C	8374-C	8741	57
B	KV-8502-C	8704-G	8741	67
C	KV-8502-C	8716-H	8741	61
D	KV-8502-K	8374-C	8741	55
E	KV-8502-K	8704-G	8741	71
F	KV-8502-K	8716-H	8741	33
G	KV-8506-M	8374-C	8741	61+
H	KV-8506-M	8704-G	8741	66
J	KV-8506-M	8716-H	8741	55
290		KV#	KV#	
A	N-15	8704-G	8741	46
B	KV-8502-K	8704-G	8741	26
C	N-15	8704-G	8741	25
D	KV-8502-K	8704-G	8741	55
E	N-15	8704-G	8741	54
F	KV-8502-K	8704-G	8741	55
G	N-15	8704-G	8741	57
H	KV-8502-K	8704-G	8741	53

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
291		KV#	KV#	
A	KV-8502-K	8364-C	8720-AB	5+
B	KV-8502-K	8374-C	8720-AB	4
C	KV-8502-K	8704-G	8720-AB	4
D	KV-8502-K	8716-H	8720-AB	3
E	KV-8502-K	8364-C	8720-CD	5+
F	KV-8502-K	8374-C	8720-CD	4+
G	KV-8502-K	8704-G	8720-CD	4
H	KV-8502-K	8716-H	8720-CD	4
294		KV#	KV#	
A	KV-8506-N	8722-H	8732-A	63
B	KV-8506-N	8722-H	8732-B	63
C	KV-8506-N	8722-H	8732-C	63
D	KV-8506-N	8722-H	8732-D	35
E	KV-8506-N	8722-H	8732-E	42
F	KV-8506-N	8722-H	8732-F	41
G	KV-8506-N	8722-H	8732-G	35
H	KV-8506-N	8722-H	8732-H	30
296		KV#	KV#	
A	KV-8506-N	8722-H	8734-A	52
B	KV-8506-N	8722-H	8734-B	47
C	KV-8506-N	8722-H	8734-C	54
D	KV-8506-N	8722-H	8734-D	57+
E	KV-8506-N	8722-H	8734-E	38
F	KV-8506-N	8722-H	8734-F	50+
G	KV-8506-N	8722-H	8734-G	46+
H	KV-8506-N	8722-H	8734-H	55+
311		KV#	KV#	
A	KV-8506-N	8718-H	8741	64+
B	KV-8506-N	8722-B	8741	56
C	KV-8506-N	8722-C	8741	52+
D	KV-8506-N	8722-D	8741	64+
E	KV-8506-N	8722-E	8741	70
F	KV-8506-N	8722-H	8741	69+
G	KV-8506-N	8704-G	8741	57+
H	KV-8506-N	8722-H	8741	74+
J	KV-8506-N	8722-H	8741	60+
K	KV-8506-N	None	8741	69+

TABLE IV (continued)

PEEL-PULL ADHESIONS - AVERAGE, 90 DEGREE PULL, POUNDS PER INCH WIDTH

Substrate = Polyester glass fiber laminate

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
319		KV#	KV#	
A	KV-8502-K	8704-G	8741	49
B	KV-8502-K	8704-G	8741	54+
C	KV-8502-K	8704-G	8741	49
D	KV-8502-K	8704-G	8741	50+
E	KV-8502-K	8704-G	8741	48+
F	KV-8506-N	8704-G	8741	47
G	KV-8506-N	8704-G	8741	47+
H	KV-8506-N	8704-G	8741	43
J	KV-8506-N	8704-G	8741	42
K	KV-8506-N	8704-G	8741	46
323		KV#	KV#	
A	KV-8502-K	8704-G	8732-A	48+
B	KV-8502-K	8722-H	8732-A	45+
C	KV-8502-K	8746-A	8732-A	52+
D	KV-8506-N	8704-G	8732-B	47+
E	KV-8506-N	8722-H	8732-B	44+
F	KV-8506-N	8746-A	8732-B	44+
G	KV-8510-A	8704-G	8732-C	41+
H	KV-8510-A	8722-H	8732-C	56+
J	KV-8510-A	8746-A	8732-C	52
337		KV#	KV#	
A	KV-8506-N	8746-A	8741	52+
B	KV-8506-N	8746-A	8741	37+
C	KV-8506-N	8746-A	8741	49+
D	KV-8506-N	8746-A	8741	54+
E	KV-8506-N	8746-A	8741	53+
F	KV-8510-B	8746-A	8741	55+
G	KV-8510-B	8746-A	8741	51+
H	KV-8510-B	8746-A	8741	43+
J	KV-8510-B	8746-A	8741	43+
K	KV-8510-B	8746-A	8741	51+
340		KV#	KV#	
A	KV-8506-N	8364-C	8750-B	43+
B	KV-8506-N	8366-A	8750-B	43
C	KV-8506-N	8372-C	8750-B	47+
D	KV-8506-N	8374-C	8750-B	44+
E	KV-8506-N	8704-G	8750-B	43
F	KV-8506-N	8736-A	8750-B	32
G	KV-8506-N	8736-B	8750-B	30
H	KV-8506-N	8736-D	8750-B	47
J	KV-8506-N	8736-E	8750-B	42+
K	KV-8506-N	8736-F	8750-B	46

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
343		KV#	KV#	
A	KV-8506-N	8704-G	8734-C	60+
B	KV-8506-N	8722-B	8734-C	41
C	KV-8506-N	8722-D	8734-C	42
D	KV-8506-N	8722-E	8734-C	48+
E	KV-8506-N	8722-H	8734-C	50+
F	KV-8506-N	8746-A	8734-C	57+
G	KV-8506-N	8746-B	8734-C	58+
H	KV-8506-N	8746-C	8734-C	60+
J	KV-8506-N	8746-E	8734-C	54+
K	KV-8506-N	8746-F	8734-C	53+
354		KV#	KV#	
A	KV-8510-B	8704-G	8732-C	49
B	KV-8510-B	8722-B	8732-C	48
C	KV-8510-B	8722-D	8732-C	63
D	KV-8510-B	8722-E	8732-C	58
E	KV-8510-B	8722-H	8732-C	63+
F	KV-8510-B	8746-A	8732-C	62+
G	KV-8510-B	8746-B	8732-C	61+
H	KV-8510-B	8746-C	8732-C	58
J	KV-8510-B	8746-E	8732-C	57
K	KV-8510-B	8746-F	8732-C	47
357		KV#	KV#	
A	KV-8510-B	8704-G	8741	52+
B	KV-8510-B	8722-B	8741	37
C	KV-8510-B	8722-D	8741	26
D	KV-8510-B	8722-E	8741	29
E	KV-8510-B	8722-H	8741	60+
F	KV-8510-B	8746-A	8741	56+
G	KV-8510-B	8746-B	8741	60+
H	KV-8510-B	8746-C	8741	47+
J	KV-8510-B	8746-E	8741	47+
K	KV-8510-B	8746-F	8741	54+
362		KV#	KV#	
A	KV-8510-C	8746-B	8758-A	63+
B	KV-8510-C	8746-B	8758-B	69+
C	KV-8510-C	8746-B	8758-C	67+
D	KV-8510-C	8746-B	8758-D	37+
E	KV-8510-C	8746-B	8758-E	39
F	KV-8510-C	8746-B	8758-F	30
G	KV-8510-C	8746-B	8758-G	29
H	KV-8510-C	8746-B	8758-H	53
J	KV-8510-C	8718-H	8758-B	64
K	KV-8510-C	8718-H	8758-E	21

TABLE IV (continued)

PEEL-PULL ADHESIONS - AVERAGE, 90 DEGREE PULL, POUNDS PER INCH WIDTH

Substrate = Polyester glass fiber laminate

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
369		KV#	KV#	
A	KV-8510-E	8746-B	8762-A	67+
B	KV-8510-E	8746-B	8762-B	69+
C	KV-8510-E	8746-B	8762-C	74+
D	KV-8510-E	8746-B	8762-D	32
E	KV-8510-E	8746-B	8762-E	29+
F	KV-8510-E	8746-B	8762-F	23
G	KV-8510-E	8746-B	8762-G	20
H	KV-8510-E	8746-B	8762-H	59+
J	KV-8510-E	8746-B	8760-A	49+
K	KV-8510-E	8746-B	8760-D	32
370			KV#	
A	KV-8510-E	None	8732-B	62
B	KV-8510-E	None	8732-C	59
C	KV-8510-E	None	8734-C	75+
D	KV-8510-E	None	8741	48
E	KV-8510-E	None	8760-A	88+
F	KV-8510-E	None	8760-B	60+
G	KV-8510-E	None	8760-D	37
H	KV-8510-E	None	8760-E	39+
J	KV-8510-E	None	8760-F	29
K	KV-8510-E	None	8760-G	26
374		KV#	KV#	
A	KV-8502-C	8736-E	8750-A	28+
B	KV-8502-C	8736-E	8750-A	28+
C	KV-8506-N	8736-E	8750-A	31+
D	KV-8506-N	8736-E	8750-A	29+
E	KV-8510-B	8736-E	8750-A	29+
F	KV-8510-B	8736-E	8750-A	36+
G	KV-8510-C	8736-E	8750-A	22+
H	KV-8510-C	8736-E	8750-A	35+
J	KV-8510-E	8736-E	8750-A	32+
K	KV-8510-E	8736-E	8750-A	28+
379		KV#	KV#	
A	KV-8510-D	8718-H	8741	47
B	KV-8510-D	8722-H	8741	49
C	KV-8510-D	8746-B	8741	50+
D	KV-8510-D	8746-B	8734-C	64+
E	KV-8510-B	8746-B	8734-C	51+
F	KV-8510-B	8746-B	8732-C	56
G	KV-8510-D	8746-B	8732-C	55
H	KV-8510-D	8746-B	8732-B	60+
J	KV-8510-B	8746-B	8732-B	53+
K	KV-8510-D	8746-B	8741	61+
384		KV#	KV#	
A	KV-8510-E	8746-B	8732-B	56
B	KV-8510-E	8746-B	8732-C	64+
C	KV-8510-E	8746-B	8734-C	60+
D	KV-8510-E	8746-B	8741	67+
E	KV-8510-E	8746-B	8760-A	82+
F	KV-8510-E	8746-B	8760-B	87+
G	KV-8510-E	8746-B	8760-D	54+
H	KV-8510-E	8746-B	8760-E	55+
J	KV-8510-E	8746-B	8760-F	50+
K	KV-8510-E	8746-B	8760-G	56
387				
A	KV-8510-E	8732-C*	8741	46
B	KV-8510-E	8734-C*	8741	57+
C	KV-8510-E	8732-B*	8741	49+
D	KV-8510-E	8732-C*	8760-A	67+
E	KV-8510-E	8734-C*	8760-A	77+
F	KV-8510-E	8732-B*	8760-A	64+
G	KV-8510-E	8732-C*	8760-B	70
H	KV-8510-E	8734-C*	8760-B	83+
J	KV-8510-E	8732-B*	8760-B	73
K	KV-8510-E	None	8760-B	75+
401				
A	KV-8510-E	8746-B	8770-A	68+
B	KV-8510-E	8746-B	8770-B	62+
C	KV-8510-E	8746-B	8770-C	53
D	KV-8510-E	8746-B	8770-D	64+
E	KV-8510-E	8746-B	8770-E	63+
F	KV-8510-E	8746-B	8770-F	43
G	KV-8510-E	8746-B	8770-G	55
H	KV-8510-E	8746-B	8770-H	54+
J	KV-8510-E	8746-B	8741	61+
K	KV-8510-E	8746-B	8760-A	83+

* A coat of Tie-Cement KV-8746-B was first applied to the primer followed by the application of the indicated second Tie-Cement.

TABLE IV (continued)

PEEL-PULL ADHESIONS - AVERAGE, 90 DEGREE PULL, POUNDS PER INCH WIDTH

Substrate = Polyester glass fiber laminate

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
405		KV#	KV#	
A	KV-8510-E	8746-B	8774-A	73+
B	KV-8510-E	8746-B	8774-B	70+
C	KV-8510-E	8746-B	8774-C	51+
D	KV-8510-E	8746-B	8774-D	58+
E	KV-8510-E	8746-B	8774-E	67+
F	KV-8510-E	8746-B	8774-F	78+
G	KV-8510-E	8746-B	8774-G	60+
H	KV-8510-E	8746-B	8774-H	66+
J	KV-8510-E	None	8774-A	66+
K	KV-8510-E	None	8774-B	61
408		KV#	KV#	
A	KV-8510-E	8746-B	8760-A	63+
B	KV-8510-E	8746-B	8760-A	70+
C	KV-8510-D	8746-B	8760-A	57+
D	KV-8510-D	8746-B	8760-A	61+
E	KV-8510-C	8746-B	8760-A	75+
F	KV-8510-C	8746-B	8760-A	68+
G	KV-8510-B	8746-B	8760-A	66+
H	KV-8510-B	8746-B	8760-A	76+
J	KV-8506-N	8746-B	8760-A	76+
K	KV-8506-N	8746-B	8760-A	66+
410		KV#	KV#	
A	KV-8510-E	8746-B	8732-B	55
B	KV-8510-E	8746-B	8732-C	64+
C	KV-8510-E	8746-B	8734-C	77+
D	KV-8510-E	8746-B	8760-A	80+
E	KV-8510-E	8746-B	8760-B	68+
F	KV-8510-E	8746-B	8732-B	56
G	KV-8510-E	8746-B	8732-C	58+
H	KV-8510-E	8746-B	8734-C	65+
J	KV-8510-E	8746-B	8760-A	74+
K	KV-8510-E	8746-B	8760-B	82+
413		KV#	KV#	
A	KV-8510-E	8746-B	8762-A	71+
B	KV-8510-E	8746-B	8762-B	74+
C	KV-8510-E	8762-H	8762-A	72+
D	KV-8510-E	8762-H	8762-B	67+
E	KV-8510-E	None	8762-A	57+
F	KV-8510-E	None	8762-B	59+
G	KV-8510-E	8790	8762-A	70+
H	KV-8510-E	8790	8762-B	66+
J	KV-8510-E	None	8762-A	61+
K	KV-8510-E	None	8762-B	41

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
430			KV#	
A	KV-8510-E	None	8772-A	62+
B	KV-8510-E	None	8772-B	51+
C	KV-8510-E	None	8772-F	45+
D	KV-8510-E	None	8774-A	58+
E	KV-8510-E	None	8774-B	63+
F	KV-8510-E	None	8774-F	60+
G	KV-8510-E	None	8760-A	74+
H	KV-8510-E	None	8760-B	73+
J	KV-8510-E	None	8762-A	58+
K	KV-8510-E	None	8762-B	55+
441(2)		KV#	KV#	
A	KV-8510-E	8746-B	8760-B	69+
B	KV-8510-E	8746-B	8762-B	68+
C	KV-8510-E	8746-B	8770-A	77+
D	KV-8510-E	8746-B	8772-B	66+
E	KV-8510-E	8746-B	8774-A	64+
F	KV-8510-E	8746-B	8774-F	71+
G	KV-8510-E	8746-B	8780-E	80+
H	KV-8510-E	8746-B	8782-A	73+
J	KV-8510-E	8746-B	8846	69+
K	KV-8510-E	None	8846	69+
445		KV#	KV#	
A	KV-8510-E	8746-B	8830-A	69+
B	KV-8510-E	8746-B	8830-B	60+
C	KV-8510-E	8746-B	8830-C	57+
D	KV-8510-E	8746-B	8830-D	69+
E	KV-8510-E	8746-B	8830-E	50+
F	KV-8510-E	8746-B	8830-F	52+
G	KV-8510-E	8746-B	8830-G	71+
H	KV-8510-E	8746-B	8830-H	50
J	KV-8510-E	8746-B	8774-A	70+
K	KV-8510-E	8746-B	8846	73+

(2) Determine the effect of "baking on" the primer at 300°F.

TABLE IV (continued)

PEEL-PULL ADHESIONS - AVERAGE, 90 DEGREE PULL, POUNDS PER INCH WIDTH

Substrate = Polyester glass fiber laminate

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
450		KV#	KV#	
A	KV-8510-E	8746-E	8780-E	65+
B	KV-8510-E	8746-E	8780-E	71+
C	KV-8510-E	8746-E	8782-A	79
D	KV-8510-E	8746-E	8782-A	30
E	KV-8510-E	8746-E	8770-A	65+
F	KV-8510-E	8746-E	8770-A	69+
G	KV-8510-E	8746-E	8772-A	71+
H	KV-8510-E	8746-E	8772-A	71+
J	KV-8510-E	8746-E	8774-A	66+
K	KV-8510-E	8746-E	8774-A	58+
473			KV#	
A	KV-8510-E	None	8830-A	70+
B	KV-8510-E	None	8830-D	64+
C	KV-8510-E	None	8830-G	71+
D	KV-8510-E	None	8824-B	50+
E	KV-8510-E	None	8824-C	58+
F	KV-8510-E	None	8824-E	64+
G	KV-8510-E	None	8824-F	60+
H	KV-8510-E	None	8774-A	72+
J	KV-8510-E	None	8780-E	58+
K	KV-8510-E	None	8782-A	72+
482		KV#	KV#	
A	KV-8510-E	8746-B	8842-A	69+
B	KV-8510-E	8746-B	8842-B	75+
C	KV-8510-E	8746-B	8842-C	60
D	KV-8510-E	8746-B	8842-D	65+
E	KV-8510-E	8746-B	8842-E	52+
F	KV-8510-E	8746-B	8842-F	69+
G	KV-8510-E	8746-B	8842-G	63+
H	KV-8510-E	8746-B	8842-H	69+
J	KV-8510-E	8746-B	8846	74+
K	KV-8510-E	8746-B	8774-A	72+
484		KV#	KV#	
A	KV-8510-E	8746-B	8844-A	75+
B	KV-8510-E	8746-B	8844-B	81+
C	KV-8510-E	8746-B	8844-C	75+
D	KV-8510-E	8746-B	8844-D	62+
E	KV-8510-E	8746-B	8844-E	60+
F	KV-8510-E	8746-B	8844-F	74+
G	KV-8510-E	8746-B	8844-G	57+
H	KV-8510-E	8746-B	8844-H	72+
J	KV-8510-E	8746-B	8846	71+
K	KV-8510-E	8746-B	8774-A	64+
485		KV#	KV#	
A	KV-8510-E	8746-B	8864-A	78+
B	KV-8510-E	8746-B	8864-B	73+
C	KV-8510-E	8746-B	8864-C	60
D	KV-8510-E	8746-B	8864-D	56
E	KV-8510-E	8746-B	8864-E	34+
F	KV-8510-E	8746-B	8864-F	69+
G	KV-8510-E	8746-B	8864-G	58+
H	KV-8510-E	8746-B	8864-H	58+
J	KV-8510-E	8746-B	8846	72+
K	KV-8510-E	8746-B	8774-A	46+
494				
A	KV-8510-E	8746-B	8846	68+
B	KV-8510-E	8746-B	8762-B	85+
C	KV-8510-E	8746-B	8830-G	73+
D	KV-8510-E	8746-B	8824-E	79+
E	KV-8510-E	8746-B	8772-B	72+
F	KV-8510-E	8746-B	8774-A	77+
G	KV-8510-E	8746-B	8770-A	80+
H	KV-8510-E	8746-B	8780-E	76+
J	KV-8510-E	8746-B	8782-A	82+
K	KV-8510-E	8746-B	8778-G	55+
497 (5)				
A	KV-8510-E	8746-B	8846	4
B	KV-8510-E	8746-B	8770-A	3
C	KV-8510-E	8746-B	8772-B	2
D	KV-8510-E	8746-B	8774-A	3
E	KV-8510-E	8746-B	8774-F	3
F	KV-8510-E	8746-B	8780-E	2
G	KV-8510-E	8746-B	8782-A	
H	KV-8510-E	8746-B	8824-B	2
J	KV-8510-E	8746-B	8824-E	3
K	KV-8510-E	8746-B	8830-A	

(5) To determine the effect of baking on the primer at 400°F. for 20 hours.

TABLE IV (continued)

PEEL-PULL ADHESIONS - AVERAGE, 90 DEGREE PULL, POUNDS PER INCH WIDTH

Substrate = Polyester glass fiber laminate

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
530				
A	Bostik*	None	N-79	26+
B	Bostik*	None	N-79	38
C	Bostik*	None	23-56*	23
D	Bostik*	None	23-56*	23
E	KV-8510-E	None	N-79	77+
F	KV-8510-E	None	N-79	79+
G	KV-8510-E	None	23-56*	38+
H	KV-8510-E	None	23-56*	42
J	KV-8510-E	None	KV-8846	60+
K	KV-8510-E	None	KV-8846	64+
531		KV#		
A	Bostik*	8746-B	N-79	42
B	Bostik*	8746-B	N-79	26
C	Bostik*	8746-B	23-56*	40
D	Bostik*	8746-B	23-56*	41
E	KV-8510-E	8746-B	N-79	68+
F	KV-8510-E	8746-B	N-79	73+
G	KV-8510-E	8746-B	23-56*	33
H	KV-8510-E	8746-B	23-56*	38
J	KV-8510-E	8746-B	KV-8846	72+
K	KV-8510-E	8746-B	KV-8846	65+
532		KV#	KV#	
A	KV-8510-E	8746-B	8868-A	61
B	KV-8510-E	8746-B	8868-B	72+
C	KV-8510-E	8746-B	8846	74+
D	KV-8510-E	8746-B	8868-C	72
E	KV-8510-E	8746-B	8868-D	62+
F	KV-8510-E	8746-B	8868-E	67+
G	KV-8510-E	8746-B	8868-F	42+
H	KV-8510-E	None	8846	58+
J	Bostik*	None	23-56*	25
K	N-15	None	N-79	44+

* Bostik 1007 was used, and Goodyear's 23-56.

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
533		KV#	KV#	
A	KV-8510-E	8746-B	8846	88+
B	KV-8510-E	8746-B	8846	78+
C	KV-8531-A	8746-B	8846	83+
D	KV-8531-A	8746-B	8846	73+
E	KV-8531-A	8746-B	8846	73+
F	KV-8531-B	8746-B	8846	85+
G	KV-8531-C	8746-B	8846	53
H	KV-8531-C	8746-B	8846	53
J	KV-8531-D	8746-B	8846	25
K	KV-8531-D	8746-B	8846	20
534			KV#	
A	KV-8510-E	None	8846	61
B	KV-8510-E	None	8846	55+
C	KV-8531-A	None	8846	80+
D	KV-8531-A	None	8846	53
E	KV-8531-B	None	8846	58
F	KV-8531-B	None	8846	54
G	KV-8531-C	None	8846	40
H	KV-8531-C	None	8846	44
J	KV-8531-D	None	8846	24
K	KV-8531-D	None	8846	23
553		KV#	KV#	
A	KV-8532-A	8746-B	8846	82+
B	KV-8532-B	8746-B	8846	85+
C	KV-8532-C	8746-B	8846	76+
D	KV-8532-D	8746-B	8846	84+
E	KV-8532-E	8746-B	8846	50
F	KV-8532-F	8746-B	8846	71+
G	KV-8532-G	8746-B	8846	82+
H	KV-8532-H	8746-B	8846	74+
J	KV-8532-J	8746-B	8846	61
K	KV-8532-K	8746-B	8846	73+
554			KV#	
A	KV-8532-A	None	8846	98+
B	KV-8532-B	None	8846	86+
C	KV-8532-C	None	8846	50
D	KV-8532-D	None	8846	96+
E	KV-8532-E	None	8846	90+
F	KV-8532-F	None	8846	80+
G	KV-8532-G	None	8846	91+
H	KV-8532-H	None	8846	69+
J	KV-8532-J	None	8846	28
K	KV-8532-K	None	8846	42

TABLE IV (continued)

PEEL-PULL ADHESIONS - AVERAGE, 90 DEGREE PULL, POUNDS PER INCH WIDTH

Substrate = Polyester glass fiber laminate

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
627		KV#	KV#	
A	KV-8532-H	8746-B	8846	69+
B	KV-8532-H	8746-B	8846	74+
C	KV-8534-G	8746-B	8846	72+
D	KV-8534-G	8746-B	8846	80+
E	KV-8536-D	8746-B	8846	75+
F	KV-8536-D	8746-B	8846	85+
G	KV-8538-B	8746-B	8846	79+
H	KV-8538-B	8746-B	8846	80+
J	KV-8538-F	8746-B	8846	79+
K	KV-8538-F	8746-B	8846	76+
641			KV#	
A	KV-8532-D	None	8846	82+
B	KV-8532-H	None	8846	72+
C	KV-8534-D	None	8846	78+
D	KV-8534-G	None	8846	53+
E	KV-8536-D	None	8846	75+
F	KV-8536-E	None	8846	62+
G	KV-8538-B	None	8846	40+
H	KV-8538-F	None	8846	46
J	KV-8544-F	None	8846	81+
K	KV-8544-J	None	8846	75+
649			KV#	
A	KV-8510-E	None	8846	73+
B	KV-8532-D	None	8846	88+
C	KV-8532-G	None	8846	79+
D	KV-8532-H	None	8846	89+
E	KV-8536-E	None	8846	53
F	KV-8538-B	None	8846	82
G	KV-8542-J	None	8846	75+
H	KV-8544-A	None	8846	81+
J	KV-8544-H	None	8846	50
K	KV-8544-J	None	8846	81+
661		KV#	KV#	
A	KV-8532-H	8544-B	8882-A	1
B	KV-8532-H	8544-B	8882-B	2
C	KV-8532-H	8544-B	8882-C	2
D	KV-8532-H	8544-B	8720-A,B	3
E	KV-8532-H	8544-B	8720-C,D	3
F	KV-8542-J	8544-B	8882-A	2
G	KV-8542-J	8544-B	8882-B	1
H	KV-8542-J	8544-B	8882-C	3
J	KV-8542-J	8544-B	8720-A,B	4
K	KV-8542-J	8544-B	8720-C,D	3
662				
A	KV-8532-D	None	8870-F	51
B	KV-8532-H	None	8870-F	49
C	KV-8534-D	None	8870-F	56
D	KV-8534-G	None	8870-F	46
E	KV-8536-D	None	8870-F	39
F	KV-8536-E	None	8870-F	47
G	KV-8538-B	None	8870-F	48
H	KV-8538-F	None	8870-F	47
J	KV-8544-F	None	8870-F	45
K	KV-8544-J	None	8870-F	39
668		KV#	KV#	
A	KV-8542-J	8886-A	8846	68+
B	KV-8542-J	8886-B	8846	74+
C	KV-8542-J	8886-C	8846	75+
D	KV-8542-J	8886-D	8846	68+
E	KV-8542-J	8886-E	8846	77+
F	KV-8542-J	8886-F	8846	83+
G	KV-8542-J	8886-G	8846	81+
H	KV-8542-J	8886-H	8846	96+
J	KV-8542-J	8746-B	8846	87+
K	KV-8542-J	None	8846	73+
673		KV#	KV#	
A	KV-8542-J	9308-A	8846	86+
B	KV-8542-J	9308-B	8846	86+
C	KV-8542-J	9308-C	8846	73+
D	KV-8542-J	9308-D	8846	73+
E	KV-8542-J	9308-E	8846	72+
F	KV-8542-J	9308-F	8846	71+
G	KV-8542-J	9308-G	8846	83+
H	KV-8542-J	9308-H	8846	59+
J	KV-8542-J	8746-B	8846	69+
K	KV-8542-J	None	8846	74+
681		KV#	KV#	
A	KV-8532-D	8746-B	9302-A	67
B	KV-8532-H	8746-B	9302-A	60
C	KV-8534-D	8746-B	9302-A	66+
D	KV-8534-G	8746-B	9302-A	66
E	KV-8536-D	8746-B	9302-A	68+
F	KV-8536-E	8746-B	9302-A	65+
G	KV-8538-B	8746-B	9302-A	59
H	KV-8538-F	8746-B	9302-A	63
J	KV-8544-F	8746-B	9302-A	65
K	KV-8544-J	8746-B	9302-A	55

TABLE IV (continued)

PEEL-PULL ADHESIONS - AVERAGE, 90 DEGREE PULL, POUNDS PER INCH WIDTH

Substrate = Polyester glass fiber laminate

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
684		KV#	KV#	
A	KV-8536-E	8746-B	9302-A	58+
B	KV-8536-E	8746-B	9302-B	75+
C	KV-8536-E	8746-B	9302-C	68+
D	KV-8536-E	8746-B	9302-D	64+
E	KV-8536-E	8746-B	9302-E	67+
F	KV-8536-E	8746-B	9302-F	60+
G	KV-8536-E	8746-B	9302-G	64
H	KV-8536-E	8746-B	9302-H	47
J	KV-8542-J	8746-B	9302-C	70+
K	KV-8542-J	8746-B	9302-D	77+
689		KV#	KV#	
A	KV-8534-G	8756-B**	8782-E	55
B	KV-8534-G	8756-B**	8782-F	50
C	KV-8534-G	8756-B**	8782-G	40
D	KV-8534-G	8756-B**	8782-H	64
E	KV-8534-G	8756-B**	8870-B	50
F	KV-8534-G	8756-B**	8870-C	51
G	KV-8534-G	8756-B**	8870-E	47
H	KV-8534-G	8756-B**	8870-F	70
J	KV-8534-G	8756-B**	8870-G	43
K	KV-8534-G	8756-B**	8754-B	56
710		KV#	KV#	
A	KV-8534-G	8826-D	8782-E	21
B	KV-8534-G	8826-D	8782-E	21
C	KV-8534-G	8826-D	8782-F	19
D	KV-8534-G	8826-D	8782-F	33
E	KV-8534-G	8826-D	8782-F	70
F	KV-8534-G	8826-D	8782-H	76
G	KV-8534-G	8826-D	8870-F	32
H	KV-8534-G	8826-D	8870-F	32
J	KV-8534-D	8826-D	8782-H	68+
K	KV-8534-D	8826-D	8782-H	52+

** A coat of Tie-Cement KV-8846 was first applied to the primer followed by the application of the indicated second Tie-Cement.

* A coat of Tie-Cement KV-8846 was first applied to the primer followed by the application of the indicated second Tie-Cement.

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
731		KV#	KV#	
A	KV-8532-D	8746-B	9306-C	45
B	KV-8532-H	8746-B	9306-C	70+
C	KV-8534-D	8746-B	9306-C	56+
D	KV-8534-G	8746-B	9306-C	81+
E	KV-8536-D	8746-B	9306-C	62+
F-	KV-8536-E	8746-B	9306-C	66+
G	KV-8538-B	8746-B	9306-C	43+
H	KV-8542-J	8746-B	9306-C	66+
J	KV-8544-F	8746-B	9306-C	34+
K	KV-8544-J	8746-B	9306-C	54+
732			KV#	
A	KV-8532-D	None	9306-C	18
B	KV-8532-H	None	9306-C	67+
C	KV-8534-D	None	9306-C	25
D	KV-8534-D	None	9306-C	55
E	KV-8536-D	None	9306-C	32
F	KV-8536 E	None	9306-C	22
G	KV-8538-B	None	9306-C	12
H	KV-8542-J	None	9306-C	72+
J	KV-8544-F	None	9306-C	13
K	KV-8544-J	None	9306-C	22
733		KV#	KV#	
A	KV-8534-G	8746-B	9306-A	75
B	KV-8534-G	8746-B	9306-B	77+
C	KV-8534-G	8746-B	9306-C	69+
D	KV-8534-G	8746-B	9306-D	70+
E	KV-8534-G	8746-B	9306-E	69+
F	KV-8534-G	8746-B	9306-F	69
G	KV-8534-G	8746-B	9306-G	54+
H	KV-8534-G	8746-B	9306-H	58+
J	KV-8534-B	8746-B	9306-C	75+
K	KV-8542-J	8746-B	9306-C	69+
751		KV#	KV#	
A	KV-8542-J	8746-B	8732-B	31
B	KV-8542-J	8746-B	8741	56
C	KV-8542-J	8746-B	8762-B	60
D	KV-8542-J	8746-B	8774-A	57+
E	KV-8542-J	8746-B	8846	50
F	KV-8542-J	8746-B	9302-D	51
G	KV-8542-J	8756-B*	8378-C	54+
H	KV-8542-J	8756-B*	8754-B	49
J	KV-8542-J	8756-B*	8782-E	73+
K	KV-8542-J	8756-B*	8870-F	57

TABLE IV (continued)

PEEL-PULL, ADHESIONS - AVERAGE, 90 DEGREE PULL, POUNDS PER INCH WIDTH

Substrate = Polyester glass fiber laminate

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
753		KV#	KV#	
A	KV-8510-E	8782-G*	8782-H	44
B	KV-8510-E	8782-G*	8782-H	51
C	KV-8510-E	8782-G*	8870-E	50
D	KV-8510-E	8782-G*	8870-E	49
E	KV-8510-E	8782-G*	8870-G	39
F	KV-8510-E	8782-G*	8870-G	44
G	KV-8534-D	8782-G*	8782-H	47
H	KV-8534-D	8782-G*	8782-H	53
J	KV-8534-D	8782-G*	8870-E	56
K	KV-8534-D	8782-G*	8870-E	58
761			KV#	
A	KV-8532-D	None	9318-E	70+
B	KV-8532-H	None	9318-E	65+
C	KV-8534-D	None	9318-E	71+
D	KV-8534-G	None	9318-E	36+
E	KV-8536-D	None	9318-E	53+
F	KV-8536-E	None	9318-E	46+
G	KV-8538-B	None	9318-E	67+
H	KV-8538-F	None	9318-E	51+
J	KV-8542-J	None	9318-E	59+
K	KV-8544-J	None	9318-E	65+
770		KV#	KV#	
A	KV-8510-K	8746-B	8732-B	69+
B	KV-8510-K	8746-B	8741	88+
C	KV-8510-K	8746-B	8762-B	86+
D	KV-8510-K	8746-B	8774-B	75+
E	KV-8510-K	8746-B	8846	84+
F	KV-8510-K	8746-B	9302-D	73+
G	KV-8510-K	8756-B**	8378-C	48
H	KV-8510-K	8756-B**	8754-B	54
J	KV-8510-K	8756-B**	8782-E	68
K	KV-8510-K	8756-B**	8870-F	57+
778		KV#	KV#	
A	KV-8542-J	8746-B	9318-D	66+
B	KV-8542-J	8746-B	9318-D	72+
C	KV-8552-E	8746-B	9318-D	50+
D	KV-8552-E	8746-B	9318-D	60+
E	KV-8542-J	8746-B	9320-D	66+
F	KV-8542-J	8746-B	9320-D	69+
G	KV-8552-E	8746-B	9320-D	67+
H	KV-8552-E	8746-B	9320-D	60
J	N-15	8746-B	9318-D	56
K	N-15	8746-B	9320-D	59+
784		KV#	KV#	
A	KV-8544-J	8746-B	9324-A	57+
B	KV-8544-J	8746-B	9324-B	36
C	KV-8544-J	8746-B	9324-C	64+
D	KV-8544-J	8746-B	9324-D	56+
E	KV-8544-J	8746-B	9324-E	63+
F	KV-8544-J	8746-B	9324-F	54+
G	KV-8544-J	8746-B	9324-G	62+
H	KV-8544-J	8746-B	9324-H	63+
J	N-15	8746-B	9324-A	83+
K	N-15	8746-B	9324-B	74+
785		KV#	KV#	
A	KV-8542-J	8746-B	9324-A	77+
B	KV-8542-J	8746-B	9324-B	71+
C	KV-8542-J	8746-B	9324-C	58+
D	KV-8542-J	8746-B	9324-D	25+
E	KV-8542-J	8746-B	9324-E	65+
F	KV-8542-J	8746-B	9324-F	57+
G	KV-8542-J	8746-B	9324-G	35+
H	KV-8542-J	8746-B	9324-H	62+
J	N-15	8746-B	9324-C	66+
K	N-15	8746-B	9324-D	60+
835		KV#	KV#	
A	KV-8542-J	8746-B	9332-A	71+
B	KV-8542-J	8746-B	9332-A	66+
C	KV-8542-J	8746-B	9332-B	58+
D	KV-8542-J	8746-B	9332-B	65+
E	KV-8542-J	8746-B	9332-C	63+
F	KV-8542-J	8746-B	9332-C	71+
G	KV-8542-J	8746-B	9332-D	62+
H	KV-8542-J	8746-B	9332-D	60+
J	N-15	8746-B	9332-C	48+
K	N-15	8746-B	9332-C	49+

* A coat of Tie-Cement KV-8826-B was first applied to the primer followed by the application of the indicated second Tie-Cement.

** A coat of Tie-Cement KV-8846 was first applied to the primer followed by the application of the indicated second Tie-Cement.

TABLE IV (continued)

PEEL-PULL ADHESIONS - AVERAGE, 90 DEGREE PULL, POUNDS PER INCH WIDTH

Substrate = Polyester glass fiber laminate

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
836		KV#	KV#	
A	KV-8552-E	8746-B	9332-A	48
B	KV-8552-E	8746-B	9332-A	49+
C	KV-8552-E	8746-B	9332-B	56+
D	KV-8552-E	8746-B	9332-B	78+
E	KV-8552-E	8746-B	9332-C	71+
F	KV-8552-E	8746-B	9332-C	57+
G	KV-8552-E	8746-B	9332-D	60+
H	KV-8552-E	8746-B	9332-D	68+
J	N-15	8746-B	9332-A	55+
K	N-15	8746-B	9332-A	53
842		KV#		
A	KV-8512-A	None	XP-104	43
B	KV-8512-A	None	XP-104	45
C	KV-8512-B	None	XP-104	53+
D	KV-8512-B	None	XP-104	53+
E	KV-8512-C	None	XP-104	44+
F	KV-8512-C	None	XP-104	45+
G	KV-8512-A	8886-H	XP-104	24
H	KV-8512-B	8886-H	XP-104	19
J	KV-8512-C	8886-H	XP-104	19
K	KV-8512-A	8746-B	XP-104	34
856				
A	KV-8532-D	None	XP-104	41+
B	KV-8532-H	None	XP-104	42+
C	KV-8534-D	None	XP-104	42+
D	KV-8534-G	None	XP-104	53+
E	KV-8536-D	None	XP-104	28
F	KV-8536-E	None	XP-104	34
G	KV-8538-B	None	XP-104	42
H	KV-8538-F	None	XP-104	27
J	KV-8542-J	None	XP-104	44
K	KV-8544-F	None	XP-104	27
865		KV#	KV#	
A	KV-8542-J	9382-A	8741	47
B	KV-8542-J	9382-B	8741	45
C	KV-8542-J	9382-C	8741	43+
D	KV-8542-J	9382-D	8741	50
E	KV-8542-J	9382-E	8741	58
F	KV-8542-J	9382-F	8741	58
G	KV-8542-J	9382-G	8741	57+
H	KV-8542-J	9382-H	8741	42+
J	N-15	9382-B	8741	50
K	KV-8512-A	9382-B	8741	52

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
866		KV#	KV#	
A	KV-8542-J	9382-A	8754-B	51
B	KV-8542-J	9382-B	8754-B	61
C	KV-8542-J	9382-C	8754-B	51+
D	KV-8542-J	9382-D	8754-B	55
E	KV-8542-J	9382-E	8754-B	64+
F	KV-8542-J	9382-F	8754-B	51+
G	KV-8542-J	9382-G	8754-B	45+
H	KV-8542-J	9382-H	8754-B	57+
J	KV-8542-J	9382-B	8754-B	64+
K	KV-8542-J	9382-B	8754-B	63+
867			KV#	
A	M-618*	None	9384-A	10
B	M-618*	None	9384-B	10
C	M-618*	None	9384-C	19
D	M-618*	None	9384-D	16
E	M-618*	None	9384-E	13
F	M-618*	None	9384-F	6
G	M-618*	None	9384-G	10
H	M-618*	None	9384-H	11
J	M-618*	M-618*	9384-B	14
K	M-618*	M-618*	9384-D	17
868			KV#	
A	M-618*	None	9384-A	16
B	M-618*	None	9384-B	11
C	M-618*	None	9384-C	9
D	M-618*	None	9384-D	25+
E	M-618*	None	9384-E	30+
F	M-618*	None	9384-F	15
G	M-618*	None	9384-G	32+
H	M-618*	None	9384-H	22+
J	M-618*	M-618*	9384-B	30+
K	M-618*	M-618*	9384-D	25+

* Bondmaster M-618 was used.

TABLE IV (continued)

PEEL-PULL ADHESIONS - AVERAGE, 90 DEGREE PULL, POUNDS PER INCH WIDTH

Substrate = Polyester glass fiber laminate

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
874		KV#	KV#	
A	N-15	8579	9407	
B	KV-8510-K	8579	9407	46+
C	KV-8534-G	8579	9407	44+
D	KV-8536-D	8579	9407	41
E	KV-8542-J	8579	9407	46+
F	KV-8544-J	8579	9407	28+
G	KV-8512-A	8579	9407	61+
H	KV-8512-B	8579	9407	65+
J	KV-8582	8579	9407	49+
K	KV-8583	8579	9407	51+
881			KV#	
A	N-15	M-618*	9384-E	26
B	KV-8510-K	M-618*	9384-E	27
C	KV-8534-G	M-618*	9384-E	34
D	KV-8536-D	M-618*	9384-E	23+
E	KV-8542-J	M-618*	9384-E	24
F	KV-8544-J	M-618*	9384-E	26+
G	KV-8512-A	M-618*	9384-E	20
H	KV-8512-B	M-618*	9384-E	24
J	KV-8582	M-618*	9384-E	31
K	KV-8583	M-618*	9384-E	33
882			KV#	
A	N-15	M-618*	9384-G	14
B	KV-8510-K	M-618*	9384-G	9
C	KV-8534-G	M-618*	9384-G	20
D	KV-8536-D	M-618*	9384-G	19
E	KV-8542-J	M-618*	9384-G	6
F	KV-8544-J	M-618*	9384-G	16
G	KV-8512-A	M-618*	9384-G	10
H	KV-8512-B	M-618*	9384-G	18
J	KV-8582	M-618*	9384-G	13
K	KV-8583	M-618*	9384-G	8
883				
A	N-15	M-618*	9384-E	26
B	KV-8510-K	M-618*	9384-E	25
C	KV-8534-G	M-618*	9384-E	26
D	KV-8536-D	M-618*	9384-E	29
E	KV-8542-J	M-618*	9384-E	27
F	KV-8544-J	M-618*	9384-E	28+
G	KV-8512-A	M-618*	9384-E	10
H	KV-8512-B	M-618*	9384-E	23+
J	KV-8582	M-618*	9384-E	17
K	KV-8583	M-618*	9384-E	12

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
884		KV#	KV#	
A	N-15	8587	9425	59+
B	KV-8510-K	8587	9425	60+
C	KV-8534-G	8587	9425	69+
D	KV-8536-D	8587	9425	61+
E	KV-8542-J	8587	9425	56+
F	KV-8544-J	8587	9425	45+
G	KV-8512-A	8587	9425	65+
H	KV-8512-B	8587	9425	62+
J	KV-8582	8587	9425	62+
K	KV-8583	8587	9425	52+
885			KV#	
A	N-15	None	9425	69+
B	KV-8510-K	None	9425	50+
C	KV-8534-G	None	9425	36
D	KV-8536-D	None	9425	49+
E	KV-8542-J	None	9425	49+
F	KV-8544-J	None	9425	44+
G	KV-8512-A	None	9425	66+
H	KV-8512-B	None	9425	75+
J	KV-8582	None	9425	69+
K	KV-8583	None	9425	69+
888		KV#	KV#	
A	N-15	8587	9431	50+
B	KV-8510-K	8587	9431	26+
C	KV-8534-G	8587	9431	51+
D	KV-8536-D	8587	9431	21+
E	KV-8542-J	8587	9431	32+
F	KV-8544-J	8587	9431	52+
G	KV-8512-A	8587	9431	53+
H	KV-8512-B	8587	9431	63+
J	KV-8582	8587	9431	59+
K	KV-8583	8587	9431	58+

* Bondmaster M-618 was used.

TABLE IV (continued)

PEEL-PULL ADHESIONS - AVERAGE, 90 DEGREE PULL, POUNDS PER INCH WIDTH

Substrate = Polyester glass fiber laminate

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
889			KV#	
A	N-15	None	9431	41
B	KV-8510-K	None	9431	61+
C	KV-8534-G	None	9431	39
D	KV-8536-D	None	9431	22+
E	KV-8542-J	None	9431	63+
F	KV-8544-J	None	9431	56+
G	KV-8512-A	None	9431	65+
H	KV-8512-B	None	9431	39+
J	KV-8582	None	9431	63+
K	KV-8583	None	9431	55+
890		KV#	KV#	
A	N-15	8587	9433	40+
B	KV-8510-K	8587	9433	57+
C	KV-8534-G	8587	9433	63+
D	KV-8536-D	8587	9433	35+
E	KV-8542-J	8587	9433	48+
F	KV-8544-J	8587	9433	59+
G	KV-8512-A	8587	9433	49+
H	KV-8512-B	8587	9433	48+
J	KV-8582	8587	9433	65+
K	KV-8583	8587	9433	63+
891				
A	N-15	None	9433	33
B	KV-8510-K	None	9433	61+
C	KV-8534-G	None	9433	29
D	KV-8536*D	None	9433	49+
E	KV-8542-J	None	9433	
F	KV-8544-J	None	9433	46+
G	KV-8512-A	None	9433	40+
H	KV-8512-B	None	9433	61+
J	KV-8582	None	9433	58+
K	KV-8583	None	9433	55+
897			KV#	
A	N-15	M-168*	9384-F	32
B	KV-8510-K	M-168*	9384-F	15
C	KV-8534-G	M-618*	9384-F	25
D	KV-8536-D	M-618*	9384-F	19
E	KV-8542-J	M-618*	9384-F	15
F	KV-8544-J	M-618*	9384-R	30+
G	KV-8512-A	M-618*	9384-F	17
H	KV-8512-B	M-618*	9384-F	15
J	KV-8582	M-618*	9384-F	14
K	KV-8583	M-618*	9384-F	17+
900		KV#	KV#	
A	N-15	8587	9431	60+
B	KV-8510-K	8587	9431	69+
C	KV-8534-G	8587	9431	70+
D	KV-8536-D	8587	9431	43+
E	KV-8542-J	8587	9431	70+
F	KV-8544-J	8587	9431	51+
G	KV-8512-A	8587	9431	72+
H	KV-8512-B	8587	9431	65+
J	KV-8582	8587	9431	67+
K	KV-8583	8587	9431	67+
901			KV#	
A	N-15	None	9431	54+
B	KV-8510-K	None	9431	59+
C	KV-8534-G	None	9431	40
D	KV-8536-D	None	9431	55+
E	KV-8542-J	None	9431	78+
F	KV-8544-J	None	9431	82+
G	KV-8512-A	None	9431	79+
H	KV-8512-B	None	9431	80+
J	KV-8582	None	9431	65+
K	KV-8583	None	9431	71+
904		KV#	KV#	
A	N-15	8587	9433	35+
B	KV-8510-K	8587	9433	47+
C	KV-8534-G	8587	9433	51+
D	KV-8536-D	8587	9433	31+
E	KV-8542-J	8587	9433	62+
F	KV-8544-J	8587	9433	63+
G	KV-8512-A	8587	9433	53+
H	KV-8512-B	8587	9433	53+
J	KV-8582	8587	9433	47+
K	KV-8583	8587	9433	64+

* Bondmaster M-618 was used.

TABLE IV (continued)

PEEL-PULL ADHESIONS - AVERAGE, 90 DEGREE PULL, POUNDS PER INCH WIDTH

Substrate = Polyester glass fiber laminate

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
905			KV#	
A	N-15	None	9433	34
B	KV-8510-K	None	9433	59+
C	KV-8534-G	None	9433	29
D	KV-8536-D	None	9433	57+
E	KV-8542-J	None	9433	70+
F	KV-8544-J	None	9433	65+
G	KV-8512-A	None	9433	41
H	KV-8512-B	None	9433	67+
J	KV-8582	None	9433	53
K	KV-8583	None	9433	53+
908		KV#	KV#	
A	N-15	8589	9441	27+
B	KV-8510-K	8589	9441	57+
C	KV-8534-G	8589	9441	55+
D	KV-8536-D	8589	9441	33+
E	KV-8542-J	8589	9441	56+
F	KV-8544-J	8589	9441	46+
G	KV-8512-A	8589	9441	68+
H	KV-8512-B	8589	9441	68+
J	KV-8582	8589	9441	64+
K	KV-8583	8589	9441	64+
909			KV#	
A	N-15	None	9441	11
B	KV-8510-K	None	9441	46+
C	KV-8534-G	None	9441	66
D	KV-8536-D	None	9441	46+
E	KV-8542-J	None	9441	76+
F	KV-8544-J	None	9441	74+
G	KV-8512-A	None	9441	77+
H	KV-8512-B	None	9441	69+
J	KV-8582	None	9441	73+
K	KV-8583	None	9441	67+
923			KV#	
A	N-15	None	9449	15
B	KV-8510-K	None	9449	33+
C	KV-8534-G	None	9449	26
D	KV-8536-D	None	9449	27
E	KV-8542-J	None	9449	25
F	KV-8544-J	None	9449	15
G	KV-8512-A	None	9449	80+
H	KV-8512-B	None	9449	64+
J	KV-8582	None	9449	80+
K	KV-8583	None	9449	73+

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
932		KV#	KV#	
A	N-15	8589	9443	27
B	KV-8510-K	8589	9443	36
C	KV-8534-G	8589	9443	53
D	KV-8536-D	8589	9443	53+
E	KV-8542-J	8589	9443	37+
F	KV-8544-J	8589	9443	27
G	KV-8512-A	8589	9443	62+
H	KV-8512-B	8589	9443	49
J	KV-8582	8589	9443	70+
K	KV-8583	8589	9443	57+
933			KV#	
A	N-15	None	9443	16
B	KV-8510-K	None	9443	46+
C	KV-8534-G	None	9443	75+
D	KV-8536-D	None	9443	31
E	KV-8542-J	None	9443	56+
F	KV-8544-J	None	9443	41
G	KV-8512-A	None	9443	80+
H	KV-8512-B	None	9443	71+
J	KV-8582	None	9443	83+
K	KV-8583	None	9443	87+
934		KV#	KV#	
A	N-15	8589	9455	24
B	KV-8510-K	8589	9455	22
C	KV-8534-G	8589	9455	59+
D	KV-8536-D	8589	9455	23+
E	KV-8542-J	8589	9455	33
F	KV-8544-J	8589	9455	21
G	KV-8512-A	8589	9455	39+
H	KV-8512-B	8589	9455	37+
J	KV-8582	8589	9455	34+
K	KV-8583	8589	9455	42+
935			KV#	
A	N-15	None	9455	70+
B	KV-8510-K	None	9455	27+
C	KV-8534-G	None	9455	58+
D	KV-8536-D	None	9455	43+
E	KV-8542-J	None	9455	48+
F	KV-8544-J	None	9455	23+
G	KV-8512-A	None	9455	57+
H	KV-8512-B	None	9455	61+
J	KV-8582	None	9455	57+
K	KV-8583	None	9455	66+

TABLE IV (continued)

PEEL-PULL ADHESIONS - AVERAGE, 90 DEGREE PULL, POUNDS PER INCH WIDTH

Substrate = Polyester glass fiber laminate

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
956		KV#	KV#	
A	KV-8582	8587	9412-A	65+
B	KV-8582	8587	9412-B	66+
C	KV-8582	8587	9412-C	72+
D	KV-8582	8587	9412-D	52+
E	KV-8582	8587	9412-E	60+
F	KV-8582	8587	9412-F	55+
G	KV-8582	8587	9412-G	69+
H	KV-8582	8587	9412-H	34
J	N-15	8587	9412-B	27
K	N-15	8587	9412-G	22
959		KV#	KV#	
A	N-15	8589	9441	32
B	KV-8510-E	8589	9441	59+
C	KV-8534-G	8589	9441	55
D	KV-8536-D	8589	9441	46+
E	KV-8542-J	8589	9441	44+
F	KV-8543	8589	9441	53
G	KV-8544-J	8589	9441	45
H	KV-8590	8589	9441	30
J	KV-8512-A	8589	9441	68+
K	KV-8582	8589	9441	66+
960		KV#	KV#	
A	KV-8582	8587	9414-A	69+
B	KV-8582	8587	9414-B	83+
C	KV-8582	8587	9414-C	71+
D	KV-8582	8587	9414-D	57+
E	KV-8582	8587	9414-E	56+
F	KV-8582	8587	9414-F	58+
G	KV-8582	8587	9414-G	78+
H	KV-8582	8587	9414-H	50
J	N-15	8587	9414-B	47
K	N-15	8587	9414-G	56
961				
A	KV-8582	None	9414-A	78+
B	KV-8582	None	9414-B	61+
C	KV-8582	None	9414-C	78+
D	KV-8582	None	9414-D	66+
E	KV-8582	None	9414-E	64+
F	KV-8582	None	9414-F	46+
G	KV-8582	None	9414-G	56+
H	KV-8582	None	9414-H	33+
J	N-15	None	9414-B	56+
K	N-15	None	9414-G	26
962		KV#	KV#	
A	KV-8582	8587	9416-A	66+
B	KV-8582	8587	9416-B	75+
C	KV-8582	8587	9416-C	68
D	KV-8582	8587	9416-D	64+
E	KV-8582	8587	9416-E	58+
F	KV-8582	8587	9416-F	61+
G	KV-8582	8587	9416-G	66+
H	KV-8582	8587	9416-H	33+
J	N-15	8587	9416-B	33
K	N-15	8587	9416-G	41
963			KV#	
A	KV-8582	None	9416-A	57+
B	KV-8582	None	9416-B	76+
C	KV-8582	None	9416-C	84+
D	KV-8582	None	9416-D	71+
E	KV-8582	None	9416-E	57+
F	KV-8582	None	9416-F	72+
G	KV-8582	None	9416-G	74+
H	KV-8582	None	9416-H	42
J	N-15	None	9416-B	26
K	N-15	None	9416-G	21
964		KV#	KV#	
A	KV-8582	8587	9418-A	54
B	KV-8582	8587	9418-B	65
C	KV-8582	8587	9418-C	67
D	KV-8582	8587	9418-D	52
E	KV-8582	8587	9418-E	43
F	KV-8582	8587	9418-F	73+
G	KV-8582	8587	9418-G	56
H	KV-8582	8587	9418-H	50
J	N-15	8587	9418-B	28
K	N-15	8587	9418-G	54
965				
A	KV-8582	None	9418-A	94+
B	KV-8582	None	9418-B	64+
C	KV-8582	None	9418-C	99+
D	KV-8582	None	9418-D	61+
E	KV-8582	None	9418-E	66+
F	KV-8582	None	9418-F	73+
G	KV-8582	None	9418-G	66+
H	KV-8582	None	9418-H	56+
J	N-15	None	9418-B	11
K	N-15	None	9418-G	24

TABLE IV (continued)

PEEL-PULL ADHESIONS - AVERAGE, 90 DEGREE PULL, POUNDS PER INCH WIDTH

Substrate = Polyester glass fiber laminate

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
987		KV#	KV#	
A	KV-8582	None	9431	42
B	KV-8582	None	9441	81+
C	KV-8582	9431	9441	38+
D	KV-8582	9441	9431	46+
E	N-15	None	9431	47+
F	N-15	None	9441	29
G	N-15	9431	9441	34+
H	N-15	9441	9431	25+
J	KV-8544-J	9431	9441	55+
K	KV-8544-J	9441	9431	60+
1001		KV#	KV#	
A	KV-8542-J	8587	10702-A	66+
B	KV-8542-J	8587	10702-B	65+
C	KV-8542-J	8587	10702-C	53+
D	KV-8542-J	8587	10702-D	47+
E	KV-8542-J	8587	10702-E	46+
F	KV-8542-J	8587	10702-F	51+
G	KV-8542-J	8587	10702-G	44+
H	KV-8542-J	8587	10702-H	50+
J	N-15	8587	10702-A	61+
K	KV-8582	8587	10702-A	61+
1003		KV#	KV#	
A	KV-8542-J	8587	10704-A	28
B	KV-8542-J	8587	10704-B	46+
C	KV-8542-J	8587	10704-C	36+
D	KV-8542-J	8587	10704-D	25
E	KV-8542-J	8587	10704-E	39
F	KV-8542-J	8587	10704-F	28
G	KV-8542-J	8587	10704-G	29
H	KV-8542-J	8587	10704-H	34
J	N-15	8587	10704-A	54+
K	KV-8582	8587	10704-A	41+
1005				
A	KV-8542-J	8587	10706-A	55+
B	KV-8542-J	8587	10706-B	85+
C	KV-8542-J	8587	10706-C	68+
D	KV-8542-J	8587	10706-D	61+
E	KV-8542-J	8587	10706-E	48+
F	KV-8542-J	8587	10706-F	57+
G	KV-8542-J	8587	10706-G	57+
H	KV-8542-J	8587	10706-H	87+
J	N-15	8587	10706-A	55
K	KV-8582	8587	10706-A	55+
1007		KV#	KV#	
A	KV-8542-J	8587	10708-A	55+
B	KV-8542-J	8587	10708-B	66+
C	KV-8542-J	8587	10708-C	67+
D	KV-8542-J	8587	10708-D	42+
E	KV-8542-J	8587	10708-E	48+
F	KV-8542-J	8587	10708-F	50+
G	KV-8542-J	8587	10708-G	35+
H	KV-8542-J	8587	10708-H	51+
J	N-15	8587	10708-B	20
K	KV-8582	8587	10708-B	64+
1029		KV#	KV#	
A	N-15	8600	10702-A	35
B	KV-8510-K	8600	10702-A	44
C	KV-8534-G	8600	10702-A	67+
D	KV-8536-D	8600	10702-A	83+
E	KV-8542-J	8600	10702-A	82+
F	KV-8544-J	8600	10702-A	76+
G	KV-8512-A	8600	10702-A	44+
H	KV-8512-B	8600	10702-A	78+
J	KV-8582	8600	10702-A	72+
K	KV-8583	8600	10702-A	55+

TABLE V

PEEL-PULL ADHESIONS TO METAL SUBSTRATES - INTRODUCTION

The test procedures utilized in obtaining the peel-pull adhesions to various metallic substrates were substantially the same as those used in obtaining the adhesions to polyester glass fiber laminates as set forth on Page 127.

Excellent peel-pull adhesions were obtained with many of the coating systems in the instance of sandblasted steel, sandblasted stainless steel and plain aluminum. It was found difficult to obtain good adhesions with the aluminum and magnesium alloys used. In the case of the aluminum and magnesium alloys, it was usually found necessary to subject the metal to some form of surface treatment - an eight minute dip in Alodine 1200 was generally found quite satisfactory.

The peel-pull adhesions of approximately 800 coating systems over metal substrates were determined as regards their peel-pull adhesion. In the interest of brevity, only the more interesting or promising adhesion systems (numbering 311) are listed in the Table.

NOTES

1. In Series K-740 (Page 152) where an asterisk (*) appears alongside of the Tie-Cement, a coat of Tie-Cement KV-8846 was first applied to the Primer and then followed by the application of the indicated Tie-Cement.

2. In Series K-898 (Page 152) the "M-618" has reference to a Bondmaster Cement manufactured by the Rubber & Asbestos Corporation.

3. In Series K-1009 and K-1010 (Page 153) the double asterisk (**) indicates that the specimens in question were not tested as regards their peel-pull adhesion but were sent on to the Cornell Aeronautical Laboratory for tests on the "whirling arm".

TABLE V

PEEL-PULL ADHESIONS - AVERAGE, 90 DEGREE PULL, POUNDS PER INCH WIDTH

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
329	Substrate = Plain Aluminum			
A	KV-8510-D	KV-8746-B	KV-8741	42
B	KV-8510-D	KV-8746-B	N-79	44
C	KV-8510-D	KV-8746-B	KV-8732-C	40
D	KV-8510-D	KV-8746-B	KV-8734-C	40+
E	KV-8510-D	KV-8746-B	KV-8734-F	24
F	KV-8510-C	KV-8746-B	KV-8741	30
G	KV-8510-C	KV-8746-B	N-79	32
H	KV-8510-C	KV-8746-B	KV-8732-C	35
J	KV-8510-C	KV-8746-B	KV-8734-C	29
K	KV-8510-C	KV-8746-B	KV-8734-F	13
330	Substrate = Plain Aluminum			
A	KV-8510-D	KV-8746-B	KV-8741	31
B	KV-8510-D	KV-8746-B	N-79	34
C	KV-8510-D	KV-8746-B	KV-8732-C	36
D	KV-8510-D	KV-8746-B	KV-8734-C	40+
E	KV-8510-D	KV-8746-B	KV-8734-F	16
F	KV-8510-C	KV-8746-B	KV-8741	27
G	KV-8510-C	KV-8746-B	N-79	36
H	KV-8510-C	KV-8746-B	KV-8732-C	23
J	KV-8510-C	KV-8746-B	KV-8734-C	18
K	KV-8510-C	KV-8746-B	KV-8734-F	17
697	Substrate = Plain Aluminum			
A	KV-8510-E	KV-8746-B	KV-8846	20
B	KV-8532-H	KV-8746-B	KV-8846	17
C	KV-8542-J	KV-8746-B	KV-8846	31
D	KV-8544-A	KV-8746-B	KV-8846	Nil
E	KV-8544-J	KV-8746-B	KV-8846	Nil
F	N-15	KV-8746-B	KV-8846	92
G	N-100-1	KV-8746-B	KV-8846	Nil
H	Bostik 1007	KV-8746-B	KV-8846	Nil
J	KV-8536-D	KV-8746-B	KV-8846	Nil
K	N-15	KV-8542-J	KV-8846	27
723	Substrate = Plain Aluminum			
A	N-15	KV-8746-B	KV-8846	64+
B	N-15	KV-8746-B	KV-8846	55
C	N-15	KV-8746-B	KV-8872-C	59+
D	N-15	KV-8746-B	KV-8872-C	46
E	N-15	KV-9308-A	KV-8846	27
F	N-15	KV-9308-A	KV-8846	33
G	N-15	KV-8746-B	KV-9302-A	30
H	N-15	KV-8746-B	KV-9302-A	56+
J	N-15	KV-8826-D	KV-8782-E	53+
K	N-15	KV-8826-D	KV-8782-E	54
740-A	Substrate = Plain Aluminum			
A	KV-8542-J	KV-8746-B	KV-8732-B	68
B	KV-8542-J	KV-8746-B	KV-8741	70
C	KV-8542-J	KV-8746-B	KV-8762-B	28
D	KV-8542-J	KV-8746-B	KV-8774-A	47
E	KV-8542-J	KV-8746-B	KV-8846	20
F	KV-8542-J	KV-8746-B	KV-9302-D	42
G	KV-8542-J	KV-8756-B*	KV-8378-C	57
H	KV-8542-J	KV-8756-B*	KV-8754-B	47
J	KV-8542-J	KV-8756-B*	KV-8782-E	50
K	KV-8542-J	KV-8756-B*	KV-8870-F	69
741-A	Substrate = Plain Aluminum			
A	N-15	KV-8746-B	KV-8732-B	77
B	N-15	KV-8746-B	KV-8741	85+
C	N-15	None	N-79	75
D	N-15	KV-8756-B*	KV-8870-F	39
E	KV-8510-E	None	KV-8846	55
310	Substrate = Stainless Steel			
A	KV-8506-N	KV-8722-H	N-29	46
B	KV-8506-N	KV-8722-H	KV-8741	24
C	KV-8506-N	KV-8722-H	N-29	59
D	KV-8506-N	KV-8722-H	KV-8741	9
E	KV-8506-N	KV-8722-H	N-29	66
F	KV-8506-N	KV-8722-H	KV-8741	20
G	KV-8506-N	KV-8722-H	N-29	63
H	KV-8506-N	KV-8722-H	KV-8741	58+
J	KV-8506-N	KV-8722-H	N-29	54+
K	KV-8506-N	KV-8722-H	KV-8741	52+
326	Substrate = Stainless Steel			
A	KV-8506-N	KV-8704-G	KV-8741	37+
B	KV-8506-N	KV-8746-A	KV-8741	34+
C	KV-8506-N	KV-8704-G	KV-8741	41+
D	KV-8506-N	KV-8746-A	KV-8741	53+
E	KV-8506-N	KV-8704-G	KV-8741	50+
F	KV-8506-N	KV-8746-A	KV-8741	52+
G	KV-8506-N	KV-8704-G	KV-8741	52+
H	KV-8506-N	KV-8746-A	KV-8741	57+
J	KV-8506-N	KV-8704-G	KV-8741	56+
K	KV-8506-N	KV-8746-A	KV-8741	58+

* A coat of Tie-Cement KV-8846 was first applied to the primer followed by the application of the indicated second Tie-Cement.

TABLE V (continued)

PEEL-PULL ADHESIONS - AVERAGE, 90 DEGREE PULL, POUNDS PER INCH WIDTH

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
1034	Substrate - Magnesium			
A	N-15	KV-8600	KV-9431	17
B	KV-8510-K	KV-8600	KV-9431	7
C	KV-8534-G	KV-8600	None	**
D	KV-8536-D	KV-8600	None	**
E	KV-8542-J	KV-8600	KV-9431	13
F	KV-8544-J	KV-8600	None	**
G	KV-8512-A	KV-8600	KV-9431	5
H	KV-8512-B	KV-8600	None	**
J	KV-8582	KV-8600	KV-9431	35
K	KV-8583	KV-8600	KV-9431	16
1035	Substrate - Magnesium			
A	N-15	KV-8600	KV-9431	14
B	KV-8510-K	KV-8600	KV-9431	29
C	KV-8534-G	KV-8600	KV-9431	39
D	KV-8536-D	KV-8600	KV-9431	43
E	KV-8542-J	KV-8600	KV-9431	28
F	KV-8544-J	KV-8600	KV-9431	58+
G	KV-8512-A	KV-8600	KV-9431	44+
H	KV-8512-B	KV-8600	KV-9431	44+
J	KV-8582	KV-8600	KV-9431	27
K	KV-8583	KV-8600	KV-9431	63+
1036	Substrate - Magnesium			
A	N-15	KV-8600	KV-9431	51+
B	KV-8510-K	KV-8600	KV-9431	35
C	KV-8534-G	KV-8600	None	**
D	KV-8536-D	KV-8600	None	**
E	KV-8542-J	KV-8600	KV-9431	44
F	KV-8544-J	KV-8600	KV-9431	15
G	KV-8512-A	KV-8600	KV-9431	30+
H	KV-8512-B	KV-8600	None	**
J	KV-8582	KV-8600	KV-9431	54+
K	KV-8583	KV-8600	KV-9431	63
1050	Substrate - Magnesium			
A	KV-8582	KV-8600	KV-9431	45+
B	KV-8582	KV-8600	KV-9443	41
C	KV-8582	KV-8600	KV-9425	57
E	KV-8583	KV-8600	KV-9431	50
F	KV-8583	KV-8600	KV-9443	63+
G	KV-8583	KV-8600	KV-9425	56

* One Coat

** No Panel

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
286	Substrate - Steel			
A	KV-8502-C	KV-8366-D	KV-8741	51
B	KV-8502-C	KV-8374-C	KV-8741	56
C	KV-8502-C	KV-8704-G	KV-8741	59+
D	KV-8502-C	KV-8704-B	KV-8741	54+
E	KV-8502-C	KV-8716-H	KV-8741	61+
F	KV-8502-K	KV-8366-D	KV-8741	46
G	KV-8502-K	KV-8374-C	KV-8741	59+
H	KV-8502-K	KV-8704-G	KV-8741	57+
J	KV-8502-K	KV-8712-G	KV-8741	54+
K	KV-8502-K	KV-8716-H	KV-8741	52+
417	Substrate - Steel			
A	KV-8510-E	KV-8746-B	KV-8732-B	70+
B	KV-8510-E	KV-8746-B	KV-8732-C	70+
C	KV-8510-E	KV-8746-B	KV-8734-C	64+
D	KV-8510-E	KV-8746-B	KV-8734-B	86+
E	KV-8510-E	KV-8746-B	KV-8762-B	81+
F	KV-8510-E	None	KV-8732-B	35
G	KV-8510-E	None	KV-8732-C	39
H	KV-8510-E	None	KV-8734-C	75+
J	KV-8510-E	None	KV-8760-B	83+
K	KV-8510-E	None	KV-8762-B	75+
629	Substrate - Steel			
A	KV-8532-H	KV-8746-B	KV-8782-A*	30
B	KV-8532-H	KV-8746-B	KV-8782-A*	25
C	KV-8534-G	KV-8746-B	KV-8782-A*	24
D	KV-8534-G	KV-8746-B	KV-8782-A*	25
E	KV-8536-D	KV-8746-B	KV-8782-A*	27
F	KV-8536-D	KV-8746-B	KV-8782-A*	26
G	KV-8538-B	KV-8746-B	KV-8782-A*	24
H	KV-8538-B	KV-8746-B	KV-8782-A*	20
J	KV-8538-F	KV-8746-B	KV-8782-A*	18
K	KV-8538-F	KV-8746-B	KV-8782-A*	19
651	Substrate - Steel			
A	KV-8510-E	None	KV-8846	55
B	KV-8532-D	None	KV-8846	76+
C	KV-8532-G	None	KV-8846	80+
D	KV-8532-H	None	KV-8846	75+
E	KV-8536-E	None	KV-8846	84+
F	KV-8538-B	None	KV-8846	85+
G	KV-8542-J	None	KV-8846	72+
H	KV-8544-A	None	KV-8846	86+
J	KV-8544-H	None	KV-8846	42
K	KV-8544-J	None	KV-8846	79+

TABLE V (continued)

PEEL-PULL ADHESIONS - AVERAGE, 90 DEGREE PULL, POUNDS PER INCH WIDTH

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
313	Substrate = 24ST Aluminum (Air-Foils)			
A	KV-8502-C	KV-8704-G	KV-8741	12
B	KV-8502-K	KV-8704-G	KV-8741	16
C	KV-8506-N	KV-8704-G	KV-8741	54
D	KV-8502-C	KV-8722-H	KV-8741	19
E	KV-8502-K	KV-8722-H	KV-8741	20
F	KV-8506-N	KV-8722-H	KV-8741	53
G	KV-8502-C	KV-8722-H	N-79	58
H	KV-8502-K	KV-8722-H	N-79	57+
J	KV-8506-N	KV-8722-H	N-79	54
K	KV-8506-N	None	N-79	54
711	Substrate = 24ST Aluminum (Air-Foils)			
A	KV-8510-E	KV-8746-B	N-79	52
B	KV-8510-E	KV-8746-B	KV-8846	41+
C	KV-8510-E	KV-8746-B	KV-9302-A	49+
D	KV-8510-E	KV-8704-G	N-79	52+
E	KV-8510-E	KV-8704-G	KV-8846	36+
F	KV-8510-E	KV-8704-G	KV-9302-A	78+
G	KV-8510-E	KV-8722-H	N-79	45+
H	KV-8510-E	KV-8722-H	KV-8846	47+
J	KV-8510-E	KV-8722-H	KV-9302-A	55+
K	KV-8510-E	KV-9308-A	KV-8846	49
712	Substrate = 24ST Aluminum (Air-Foils)			
A	KV-8532-H	KV-8746-B	N-79	37+
B	KV-8532-H	KV-8746-B	KV-8846	51+
C	KV-8532-H	KV-8746-B	KV-9302-A	59+
D	KV-8532-H	KV-8704-G	N-79	52+
E	KV-8532-H	KV-8704-G	KV-8846	68+
F	KV-8532-H	KV-8704-G	KV-9302-A	50+
G	KV-8532-H	KV-8722-H	N-79	61+
H	KV-8532-H	KV-8722-H	KV-8846	41+
J	KV-8532-H	KV-8722-H	KV-9302-A	60+
K	KV-8532-H	KV-9308-A	KV-8846	53
740	Substrate = 24ST Aluminum (Air-Foils)			
A	KV-8542-J	KV-8746-B	KV-8732-B	60+
B	KV-8542-J	KV-8746-B	KV-8741	68+
C	KV-8542-J	KV-8746-B	KV-8762-B	81+
D	KV-8542-J	KV-8746-B	KV-8774-A	71+
E	KV-8542-J	KV-8746-B	KV-8846	79+
F	KV-8542-J	KV-8746-B	KV-9302-D	66+
G	KV-8542-J	KV-8756-B*	KV-8378-C	44+
H	KV-8542-J	KV-8756-B*	KV-8754-B	50+
J	KV-8542-J	KV-8756-B*	KV-8782-E	52+
K	KV-8542-J	KV-8756-B*	KV-8870-F	47+

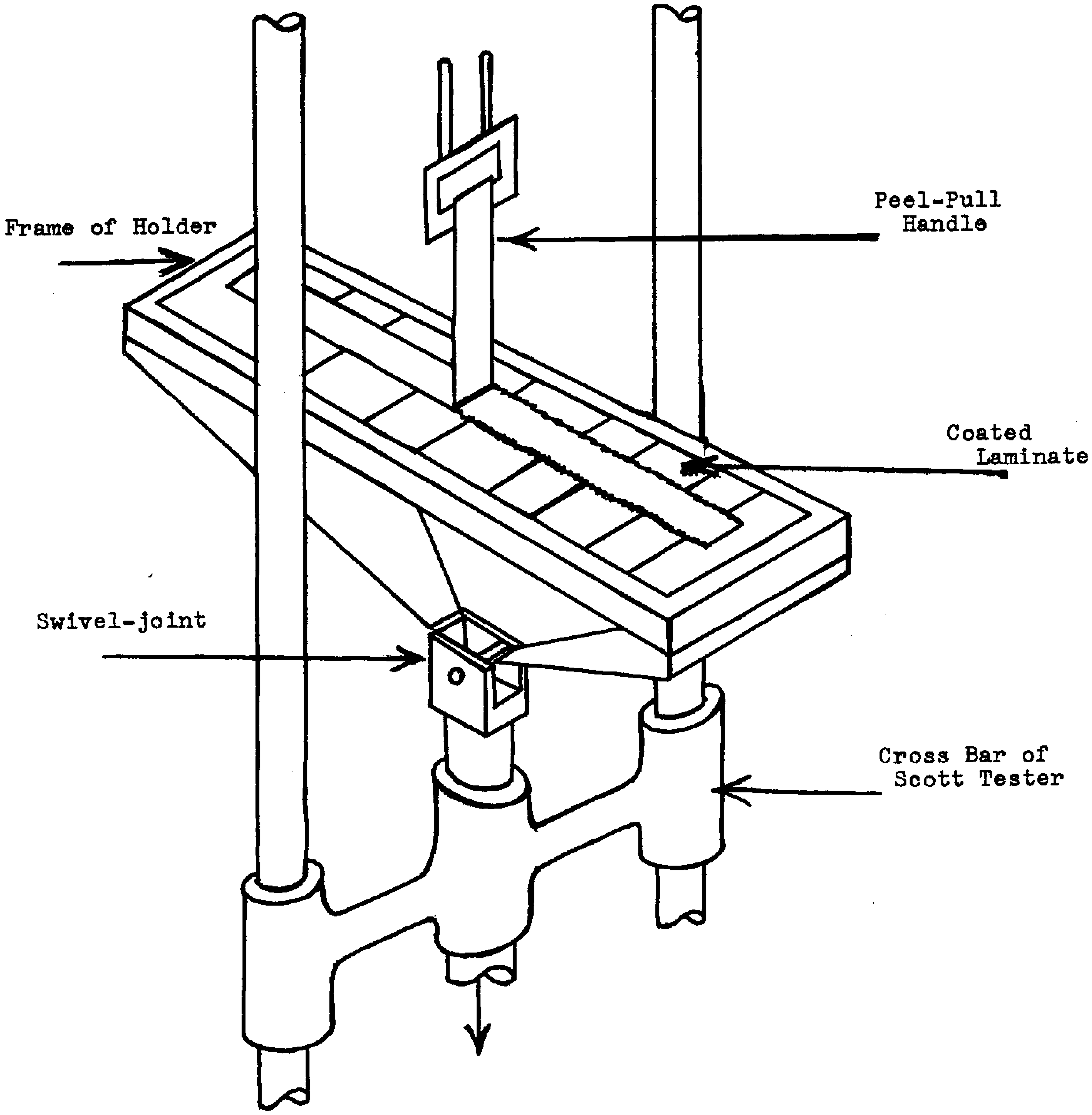
K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
769	Substrate = 24ST Aluminum (Air-Foils)			
A	KV-8510-K	KV-8746-B	KV-8732-B	28+
B	KV-8510-K	KV-8746-B	KV-8741	44+
C	KV-8510-K	KV-8746-B	KV-8762-B	45+
D	KV-8510-K	KV-8746-B	KV-8774-B	25+
E	KV-8510-K	KV-8746-B	KV-8846	37+
F	KV-8510-K	KV-8746-B	KV-9306-D	33+
G	KV-8510-K	KV-8756-B*	KV-8378-C	37
H	KV-8510-K	KV-8756-B*	KV-8754-B	36+
J	KV-8510-K	KV-8756-B*	KV-8782-E	35+
K	KV-8510-K	KV-8756-B*	KV-8870-F	28+
779	Substrate = 24ST Aluminum (Air-Foils)			
A	KV-8542-J	KV-8746-B	KV-9318-D	41+
B	KV-8542-J	KV-8746-B	KV-9318-D	21
C	KV-8552-E	KV-8746-B	KV-9318-D	32+
D	KV-8552-E	KV-8746-B	KV-9318-D	35+
E	KV-8542-J	KV-8746-B	KV-9320-D	40+
F	KV-8542-J	KV-8746-B	KV-9320-D	41+
G	KV-8552-E	KV-8746-B	KV-9320-D	39+
H	KV-8552-E	KV-8746-B	KV-9320-D	43+
J	N-15	KV-8746-B	KV-9318-D	36+
K	N-15	KV-8746-B	KV-9320-D	31+
804	Substrate = 24ST Aluminum (Air-Foils)			
A	KV-8552-E	KV-8746-B	KV-9324-G	55
B	KV-8552-E	KV-8746-B	KV-9324-G	40
C	KV-8552-E	KV-8746-B	KV-9326-C	44
D	KV-8552-E	KV-8746-B	KV-9326-C	32
E	KV-8552-E	KV-8746-B	KV-9326-E	43
F	KV-8552-E	KV-8746-B	KV-9326-E	43
G	KV-8552-E	KV-8746-B	KV-9326-G	36
H	KV-8552-E	KV-8746-B	KV-9326-G	40
J	KV-8552-E	KV-8746-B	KV-9328-B	29
K	KV-8552-E	KV-8746-B	KV-9328-B	30
898	Substrate = 24ST Aluminum (Air-Foils)			
A	N-15	M-618*	KV-9384-E	Nil
B	KV-8510-K	M-618*	KV-9384-E	Nil
C	KV-8534-G	M-618*	KV-9384-E	Nil
D	KV-8536-D	M-618*	KV-9384-E	Nil
E	KV-8542-J	M-618*	KV-9384-E	Nil
F	KV-8544-J	M-618*	KV-9384-E	Nil
G	KV-8512-A	M-618*	KV-9384-E	Nil
H	KV-8512-B	M-618*	KV-9384-E	20
J	KV-8582	M-618*	KV-9384-E	Nil
K	KV-8583	M-618*	KV-9384-E	17

TABLE V (continued)

PEEL-PULL ADHESIONS - AVERAGE, 90 DEGREE PULL, POUNDS PER INCH WIDTH

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
913	Substrate = 24ST Aluminum (Air-Foils)			
A	KV-8512-A	KV-8587	KV-9405	31
B	KV-8512-A	KV-8587	KV-9407	48+
C	KV-8512-A	KV-8587	KV-9409	40+
D	KV-8512-A	KV-8587	KV-9425	36+
E	KV-8512-A	KV-8587	KV-9427	37+
F	KV-8512-A	KV-8587	KV-9431	44+
G	KV-8512-A	KV-8587	KV-9433	32+
H	KV-8512-A	KV-8587	KV-9434	31
J"	KV-8512-A	KV-8587	KV-9435	32
K	KV-8512-A	KV-8587	KV-9438	28
960	Substrate = 24ST Aluminum (Air-Foils)			
A	KV-8582	KV-8589	KV-9431	33
B	KV-8582	KV-8589	KV-9433	34
C	KV-8582	None	KV-9433	21
D	KV-8582	None	KV-9431	20
E	KV-8582	KV-8589	KV-9441	29
F	KV-8582	KV-8589	KV-9443	49
G	KV-8582	KV-8589	KV-9436	37
H	KV-8582	KV-8589	KV-9449	44+
J	KV-8582	KV-8589	KV-9451	31
K	KV-8582	KV-8589	KV-9455	37
961	Substrate = 24ST Aluminum (Air-Foils)			
A	KV-8582	KV-8589	KV-9431	22+
B	KV-8582	KV-8589	KV-9433	17
C	KV-8582	None	KV-9431	30
D	KV-8582	None	KV-9433	18
E	KV-8582	KV-8589	KV-9409	21
F	KV-8582	KV-8589	KV-9441	18
G	KV-8582	KV-8589	KV-9443	23
H	KV-8582	None	KV-9409	33+
J	KV-8582	None	KV-9441	20
K	KV-8582	None	KV-9443	20
976	Substrate = 24ST Aluminum (Air-Foils)			
A	KV-8582	KV-8587	KV-9472-A	31
B	KV-8582	KV-8587	KV-9472-B	40+
C	KV-8582	KV-8587	KV-9472-C	33+
D	KV-8582	KV-8587	KV-9472-D	42+
E	KV-8582	KV-8587	KV-9472-E	35
F	KV-8582	KV-8587	KV-9472-F	41
G	KV-8582	KV-8587	KV-9472-G	35
H	KV-8582	KV-8587	KV-9472-H	32
J	KV-8582	2xKV-8587	KV-9472-B	48
K	KV-8582	3xKV-8587	KV-9472-B	39+

K.-No.	Primer	Tie-Cement	Body Coat	Peel-Pull #/in.
978	Substrate = 24ST Aluminum (Air-Foils)			
A	KV-8582	KV-8587	KV-9472-A	45+
B	KV-8582	KV-8587	KV-9472-B	40+
C	KV-8582	KV-8587	KV-9472-C	33+
D	KV-8582	KV-8587	KV-9472-D	33+
E	KV-8582	KV-8587	KV-9472-E	33+
F	KV-8582	KV-8587	KV-9472-F	36+
G	KV-8582	KV-8587	KV-9472-G	31+
H	KV-8582	KV-8587	KV-9472-H	35
J	KV-8582	2xKV-8587	KV-9472-B	44+
K	KV-8582	3xKV-8587	KV-9472-B	40+
991	Substrate = 24ST Aluminum (Air-Foils)			
A	KV-8542-J	KV-8589	KV-9431	40
B	KV-8542-J	KV-8589	KV-9431	37
C	KV-8544-J	KV-8589	KV-9431	38
D	KV-8544-J	KV-8589	KV-9431	28
E	KV-8552-E	KV-8589	KV-9431	36
F	KV-8552-E	KV-8589	KV-9431	33+
G	KV-8582	KV-8589	KV-9431	31+
H	KV-8582	KV-8589	KV-9431	40
J	N-15	KV-8589	KV-9431	13
K	N-15	KV-8589	KV-9431	9
1009	Substrate = 24ST Aluminum (Air-Foils)			
A	KV-8542-J	KV-8587	N-79	37
B	KV-8542-J	KV-8587	N-79	**
C	KV-8542-J	KV-8587	KV-9431	38
D	KV-8542-J	KV-8587	KV-9431	**
E	KV-8542-J	KV-8587	KV-10702-A	37
F	KV-8542-J	KV-8587	KV-10702-A	**
G	KV-8542-J	KV-8587	KV-10702-B	55+
H	KV-8542-J	KV-8587	KV-10702-B	**
J	KV-8542-J	KV-8587	KV-10702-C	26
K	KV-8542-J	KV-8587	KV-10702-C	**
1010	Substrate = 24ST Aluminum (Air-Foils)			
A	KV-8542-J	KV-8587	KV-10702-H	32
B	KV-8542-J	KV-8587	KV-10702-H	**
C	KV-8542-J	KV-8587	KV-10706-B	36
D	KV-8542-J	KV-8587	KV-10706-B	**
E	KV-8542-J	KV-8587	KV-10706-C	52+
F	KV-8542-J	KV-8587	KV-10706-C	**
G	KV-8542-J	KV-8587	KV-10706-H	33+
H	KV-8542-J	KV-8587	KV-10706-H	**
J	KV-8542-J	KV-8587	KV-10704-B	37+
K	KV-8542-J	KV-8587	KV-10704-B	**



Peel-Pull Test Specimen Holder Setup

APPENDIX

LIST OF MATERIALS AND THEIR SOURCES

Name	Composition or Function	Supplier
Acetylene Black	Conductive Carbon Black	Shawingan Products Corp.
Amyl Acetate	Solvent	Kessler Chemical Co.
Amsco Solv	Solvent	American Mineral Spirits Co.
201 Basic Silicate White Lead	Activator & Stabilizer	The Eagle Picher Company
BLE, Liquid	Antioxidant	Naugatuck Chemical Div.
Cab-o-sil	Silica Pigment	Godfrey L. Cabot, Inc.
Calcium Silicate	Pigment	Columbia-Southern Chem. Co.
Chromium Oxide X-1134	Pigment	Imperial Paper & Color Corp.
Di ortho tolyl guanidine	Curing Agent	Monsanto Chemical Co.
Dyphos	Activator	National Lead Co.
Dythal	Stabilizer	National Lead Co.
Eagle Sublimed Blue Lead	Activator	National Lead Co.
Ethyl Amyl Ketone	Solvent	Shell Chemical Corp.
Ethylene Dichloride	Solvent	Carbon & Carbide Chem. Co.
Methyl Ethyl Ketone	Solvent	Shell Chemical Corp.
Gaco KV-5502-A	Stabilizing Agent	Gates Engineering Co.
Gaco KV-5502-G	Stabilizing Agent	Gates Engineering Co.
Gaco KV-7102-A	Curing Agent	Gates Engineering Co.
Gaco KV-7103-A	Curing Agent	Gates Engineering Co.
Gaco KV-7108-A	Curing Agent	Gates Engineering Co.
Gaco KV-7108-B	Curing Agent	Gates Engineering Co.
Gaco KV-7108-C	Curing Agent	Gates Engineering Co.
Gaco KV-7108-D	Curing Agent	Gates Engineering Co.
Gaco KV-7108-F	Curing Agent	Gates Engineering Co.
Gaco KV-7108-G	Curing Agent	Gates Engineering Co.
Gaco KV-7108-J	Curing Agent	Gates Engineering Co.
Gaco KV-7108-R	Curing Agent	Gates Engineering Co.
Gaco KV-7108-S	Curing Agent	Gates Engineering Co.
Gaco KV-7108-W	Curing Agent	Gates Engineering Co.
Gaco KV-7109	Curing Agemt	Gates Engineering Co.
Gaco MB 845	Stabilizer	Gates Engineering Co.
Gaco MB 5545	Stabilizer	Gates Engineering Co.
Gaco N 39	Curing Agent	Gates Engineering Co.
Gaco N 79	Radome Coating	Gates Engineering Co.
Gaco Primers	Various	Gates Engineering Co.
Gaco Tie-Cement	Various Tie-Cements	Gates Engineering Co.
Goodyear 23-56	Radome Coating	Goodyear Tire & Rubber Co.
GR-S 1011	Butadiene-Styrene	Naugatuck Chemical Div.
Hipar	Antioxidant	R.T. Vanderbilt Company
Hi-Sil	Pigment	Columbia-Southern Chem. Co.
Hycar 1001	Copolymer, butadiene/ acrylonitrile	B.F.Goodrich Chem. Co.
Hycar 2202	Brominated Butyl Rubber	B.F.Goodrich Chem. Co.
Hycar 4021	Polyacrylic Rubber	B.F.Goodrich Chem. Co.
Hypalon 20	Chlorosulfonated Polyethylene	DuPont
Ionol	Antioxidant	Shell Chemical Corp.

APPENDIX (continued)

LIST OF MATERIALS AND THEIR SOUCES

Name	Composition or Function	Supplier
Isopropanol	Solvent	Carbon & Carbide Chem. Co.
Kel-F Elastomer 3700	Copolymer of Chlorotrifluroethylene and Vinylidenefluoride	M.W. Kellogg Company
Kel-F Elastomer 5500	Ditto	M.W. Kellogg Company
Lead Linoleate	Activator	Harshaw Chemical Co.
Litherage	Curing Agent	National Lead Company
Magnesia	Curing Agent	General Magnesite & Magnesia Co.
Methyl Isobutyl Ketone	Solvent	Shell Chemical Company
Micro-Mica C-3000	Water Ground Mica	English Mica Company
Mineral Spirits	Solvent	Modern Mineral Solvents Corp.
Modsols #5,12 & 51	Solvent	Modern Mineral Solvents Corp.
Monastral Green	Coloring Matter	DuPont
Natural Rubber (Smoked Sheet)		Import House
Neoprene All Types	Polychloroprene	DuPont
NA 22	Curing Agent	DuPont
Neozone D	Antioxidant	DuPont
2-Nitropropane	Solvent	Commercial Solvents Corp.
Normasal	Activator	National Lead Company
Parlon	Chlorinated Rubber	Hercules Powder Company
Plumb-O-Sil	Activator & Stabilizer	National Lead Company
Santowhite Crystals	Antioxidant	Monsanto Chemical Company
Stabilite Resin	Hydrogenated Rosin	Hercules Powder Company
Statex # 125	Conductive Carbon Black	Binney & Smith Company
Thermax	Carbon Black	R.T. Vanderbilt Company
Thiokol LP-2	Polyfunctional Mercaptan	Thiokol Corporation
Thiokol LP-3	Polyfunctional Mercapten	Thiokol Corporation
Thiokol LP-8	Polyfunctional Mercaptan	Thiokol Corporation
Titanium Dioxide R 110	Pigment	DuPont
Titanium Dioxide R610	Pigment	DuPont
Titanium Dioxide O-220	Pigment	American Cyanamid Co.
Toluene	Solvent	Sun Oil Company
Trimal	Curing Agent	National Lead Company
Vistanex	Polyisobutylene	Enjay Company, Inc.
Vulcan (SC)	Conductive Carbon Black	Godfrey L. Cabot, Inc.
Vulcan XC-12	ditto	Ditto
Xylene	Solvent	Sun Oil Company
Zinc Oxide	Curing Agent	St. Joseph Lead Co.
Zirconium Dioxide	Pigment	Titanium Zirconium Co.