

TEST TYPE:	UL 580 - CONSTRUCTION NO: 588
TESTING AUTHORITY:	UNDERWRITERS LABORATORIES
TEST NAME:	WIND UPLIFT
TEST DATE:	
TEST COMPLETED BY:	GREG REZEK
TESTING LABORATORY	UNDERWRITERS LABORATORIES
PANEL TYPE:	1 1/2 IN MECHANICAL LOCK W/ CLIP
PANEL WIDTH:	16"
CLIP SPACING:	36"
DECKING CONSTRUCTION:	5/8" PLYWOOD

OBJECT: THE OBJECT OF THIS INVESTIGATION WAS THE CLASSIFICATION, FOR UPLIFT PURPOSES, OF THE PANEL IDENTIFIED ABOVE. THE CLASSIFICATION IS TO BE AUTHORIZED FOR ANY MANUFACTURER WHO PURCHASES A ROLLFORMER CAPABLE OF FORMING THE ABOVE PROFILES, FROM SCHLEBACH, INC. AND REQUESTS CLASSIFICATION.

THE OBJECT OF THIS INVESTIGATION WAS TO DEVELOP TEST DATA WITH RESPECT TO THE UPLIFT RESISTANCE, PER UL 580, OF ROOF DECK CONSTRUCTIONS UTILIZING THE SPECIFIC METAL ROOF DECK PANELS AND ROOF DECK FASTENERS (PANEL CLIPS) WHERE USED, IDENTIFIED ABOVE. THIS DEVELOPED DATA CAN BE USED AS A BASIS FOR THE PROMULGATION OF CLASSIFICATION UPON SUBSEQUENT SUBMITTAL BY VARIOUS MANUFACTURERS THAT DEMONSTRATE THEIR ABILITY TO PRODUCE THE SAME PRODUCT(S).

THE SAID MANUFACTURER WILL HAVE PURCHASED ROLLFORMING EQUIPMENT FROM YOUR COMPANY, SCHLEBACH INC WHICH IS IDENTICAL TO THE EQUIPMENT WHICH WAS USED TO MANUFACTURE THE PANELS WHICH ARE DESCRIBED IN THIS REPORT.

AT THE TEST SPONSOR'S REQUEST AFTER THE UL 580 TEST WAS COMPLETED FOR EACH ASSEMBLY THE ASSEMBLY WAS TESTED IN ACCORDANCE WITH THE UL 1897 STANDARD.

DESCRIPTION OF MATERIALS

THE MATERIALS USED FOR THE WOOD DECK AND SUPPORTS TOGETHER WITH THE FASTENERS ARE AS FOLLOWS.

PERIPHERAL SUPPORTS - THE SUPPORTS USED AT THE PERIPHERY OF THE TEST ASSEMBLIES WERE 2 IN BY 10 IN LUMBER NO.2 GRADE.

WOOD JOISTS - THE JOISTS WERE 2 INCH BY 10 INCH, NO. 2 GRADE LUMBER.

JOIST HANGERS - THE HANGERS USED AT THE ENDS OF THE JOISTS FOR SUPPORT AND ATTACHMENT TO THE PERIPHERAL SUPPORTS WERE SEAT TYPE. FABRICATED FROM NO. 18 MSG COATED STEEL.

FASTENERS (SCREWS) THE FASTENERS USED TO ATTACH THE PERIPHERAL SUPPORTS TO THE TEST FRAME WERE 5/8 INCH MACHINE BOLTS. FASTENERS USED TO ATTACHÉ THE JOIST HANGERS TO THE PERIPHERAL SUPPORTS AND THE JOIST HANGERS WERE COARSE THREAD, NO. 2 PHILLIPS DRIVE BUGLE HEAD, STEEL SCREWS 2 1/2 INCH LONG. FASTENERS USED TO ATTACH THE PLYWOOD DECKING TO THE JOISTS AND PERIPHERAL SUPPORTS WERE THE SAME TYPE AS THOSE USED FOR THE JOIST HANGERS.

ROOFING FELT - THE FELT USED OVER THE PLYWOOD DECK WAS A 30LB TYPE.

DESCRIPTION OF MATERIALS FOR ROOF PANELS

THE METAL ROOF DECK PANELS AND CLIP PANELS WHERE USED IN EACH ASSEMBLY WERE USED AS FOLLOWS:

METAL ROOF DECK PANELS - THE PANELS USED N TEST ASSEMBLY NO. 2 WERE 16 IN WIDE AND 1 1/2 INCH HIGH AT THE FEMALE RIB. HEY WERE FABRICATED FROM NO. 24 MSG COATED STEEL. THE PAE3NL IS IDENTIFIED AS 1 1/2 INCH MECHANICAL LOCK BY THE TEST SPONSOR.

ROOF DECK FASTENERS (PANEL CLIPS) - THE PANEL CLIPS USED AT THE AIDES OF THE PANELS FOR ATTACHMENT OF THE PANELS TO THE PLYWOOD DECKING WERE A TWO PART ASSEMBLY CONSISTING OF A BASE AND AN UPPER TAB. THE BASE WAS 5 INCH LONG AND HAS A 3/4 INCH HORIZONTAL LEG AND A 3/4 INCH VERTICAL LEG. THE BASE WAS FABRICATED FROM NO. 18 MSG THICK COATED STEEL. THE UPPER TAB WAS 1 3/4 INCH WIDE AND 1 1/2 INCH HIGH AND WAS FORMED TO FIT OVER THE VERTICAL LEG OF THE BASE AND THE MALE RIB OF THE PANEL. THE UPPER TAB WAS FABRICATED FROM NO. 23 MSG THICK COATED STEEL. THE CLIPS ARE IDENTIFIED AS "STANDING SEAM CLIPS" BY THE TEST SPONSOR.

FASTENERS (SCREWS) THE FASTENER USED TO ATTACH THE PANEL CLIPS TO THE PLYWOOD DECKING WERE NO. 10 - 12 BY 1 IN LONG. NO.2 PHILLIPS DRIVE, WAFER HEAD, COATED STEEL SCREWS. FASTENERS USED AT THE PERIPHERARY OF THE ASSEMBLY WERE THE SAME TYPE.

CONSTRUCTION OF TEST ASSEMBLIES:

THE ROOF DECK ASSEMBLIES WERE CONSTRUCTED IN THE TEST FRAME IN ACCORDANCE WITH THE METHODS INDICATED BY THE SUBMITTER.

THE WOOD DECK SUB-ASSEMBLIES WERE CONSTRUCTED IN THE SAME MANNER, FOR ALL THREE CONSTRUCTIONS, AS FOLLOWS:

THE 2 IN. BY 10 IN. PERIPHERAL SUPPORTS WERE LOCATED ADJACENT TO THE WALLS OF THE TEST FRAME AND FASTENED TO THEM USING 5/8 IN. MACHINE BOLTS DRIVEN THROUGH THE LUMBER INTO MACHINE NUTS WELDED TO THE STEEL FRAME. THE SUPPORTS FORMED A CONTINUOUS SHELF AROUND THE TEST FRAME. THE JOIST HANGERS WERE INSTALLED AT A

SPACING OF .24 IN. OC. USING THE NO. 8 BY 1 1/2 IN. COARSE THREAD SCREWS DRIVEN INTO THE PERIPHERAL SUPPORTS. THE JOISTS WERE THEN SLIPPED INTO THE JOIST HANGERS AND FASTENED TO THEM USING THE NO. 8 SCREWS WITH THREE SCREWS USED ON EACH SIDE OF EACH JOIST.

THE PLYWOOD DECK WAS INSTALLED IN THE ASSEMBLY USING THE NO. 8 BY 2 1/2 IN. LONG COARSE THREAD SCREWS DRIVEN INTO THE JOISTS WITH THE SCREWS SPACED 6 IN. OC. AT THE BUTT ENDS AND 12 IN. OC. IN THE FIELD. THE DECKING WAS ATTACHED TO THE PERIPHERAL SUPPORTS USING THE NO. 8 SCREWS SPACED 6 IN. OC. THROUGHOUT. ALL JOINTS WERE THEN SEALED WITH A ONE PART SEALANT FEATHERED OUT FROM THE JOINT. A LAYER OF FELT WAS PLACED OVER THE PLYWOOD DECK AND FASTENED TO IT USING STAPLES IN A RANDOM SPACING. A LAYER OF PLASTIC SHEETING WAS THEN PLACED OVER THE FELT.

INSTALLATION OF ROOF DECK PANELS

A FULL LENGTH PANEL CUT TO A WIDTH OF APPROXIMATELY 3 IN. AND WITH THE MALE RIB INTACT WAS PLACED IN THE ASSEMBLY ADJACENT TO THE SOUTH WALL OF THE TEST FRAME. PANEL CLIPS WERE SLIPPED OVER THE MALE RIB OF THE PANEL AT A SPACING OF 36 IN. OC. AND FASTENED TO THE PLYWOOD DECK USING TWO NO. 10-12 WAFER-HEAD SCREWS FOR EACH CLIP. A FULL WIDTH PANEL, 10 FT. LONG WAS PLACED IN THE ASSEMBLY ADJACENT TO THE FIRST PANEL WITH THE FEMALE RIB SNAPPED OVER THE MALE RIB OF THE FIRST PANEL AND INCLUDING THE UPPER TAB OF THE PANEL CLIPS. THE PANEL CLIPS WERE FASTENED TO THE PLYWOOD DECK IN THE SAME MANNER AS FOR THE FIRST PANEL. A TOTAL OF SIX MORE FULL WIDTH, 10 FT. LONG PANELS WERE INSTALLED IN THE ASSEMBLY IN THE SAME MANNER AS USED FOR THE FIRST PANEL SECTION. A FINAL SECTION OF PANEL, 10 FT. LONG AND CUT TO A WIDTH OF APPROXIMATELY 8 IN. WITH THE FEMALE RIB INTACT WAS INSTALLED IN THE ASSEMBLY WITH THE RIB SNAPPED OVER THE MALE RIB OF THE PREVIOUS PANEL. THE PANELS WERE THEN FASTENED AT THEIR PERIPHERY WITH THE FASTENERS SPACED 6 IN. OC. AT THE NORTH AND SOUTH WALLS AND WITH FOUR FASTENERS USED AT THE PANEL ENDS.

TEST RECORD GENERAL

UPLIFT TESTS:

THE UPLIFT TESTS WERE CONDUCTED IN ACCORDANCE WITH THE STANDARD UL580 ENTITLED "TESTS FOR UPLIFT RESISTANCE OF ROOF ASSEMBLIES".

METHOD

THE STANDARD TEST EQUIPMENT OF UNDERWRITERS LABORATORIES, INC. FOR ROOF DECK CONSTRUCTIONS WAS USED FOR EACH UPLIFT TEST.

FOUR DEFLECTION TARGETS WERE MOUNTED ON TOP OF THE CENTRAL PANEL FOR EACH ASSEMBLY; AT THE PANEL MID-SPAN (ONE BETWEEN THE RIBS AND ONE OVER A RIB), AND AT THE PANEL QUARTER SPAN (ONE BETWEEN THE RIBS AND ONE OVER A RIB).

THROUGHOUT EAS TEST, OBSERVATIONS WERE MADE OF THE CONTROL OF POSITIVE AND NEGATIVE PRESSURES AND OF THE BEHAVIOR OF THE TOP AND UNDER SURFACES OF THE ASSEMBLY.

RESULTS

GENERAL NOTES—THE ACTION OF THE ROOF DECKS UPON APPLICATION OF THE STEADY PRESSURES (PHASES I, II, IV, AND V) WAS UPWARD BOWING BETWEEN POINTS OF ATTACHMENT WITH THE PURLINS FOLLOWING THE SAME PATTERN.

THE ACTION OF THE JOISTS AND PANELS DURING THE OSCILLATING PERIOD OF THE TESTS (PHASE III) WAS A RISING AND SETTING OF THE MEMBERS. THE DEGREE TO WHICH THE MEMBERS DEFLECTED DURING EACH PHASE CAN BE DETERMINED FROM THE READINGS PRECEDING THE SPECIFIC TEST NOTES. ALL DIMENSIONS CITED IN THE SPECIFIC TEST NOTES ARE APPROXIMATE.

“1-1/2 IN. STANDING SEAM”

30 LB/FT² UPLIFT

DEFLECTION IN INCHES

TARGET LOCATIONS				
PHASE	1/4 SPAN PANEL <u>OVER</u> <u>RIBS</u>	MID-SPAN PANEL <u>OVER</u> <u>RIB</u>	1/4 SPAN PANEL <u>BETWEEN</u> <u>RIBS</u>	MID-SPAN PANEL <u>BETWEEN</u> <u>RIBS</u>
I	0.14	0.22	0.60	0.89
II	0.28	0.37	0.95	1.36
III				
MINIMUM	0.28	0.37	1.02	1.34
MAXIMUM	0.33	0.43	1.05	1.49
IV	0.22	0.32	0.82	1.17
V	0.40	0.48	1.21	1.67

SPECIFIC TEST OBSERVATIONS

PHASE I – THE PANELS ARE BOWING BETWEEN THE RIBS APPROXIMATELY 2/5 TO 1/2 THE HEIGHT OF THE RIBS. THE RIBS ARE BOWING LENGTHWISE SLIGHTLY. NO CHANGES ARE OBSERVED ON THE UNDERSURFACE.

PHASE II – THE PANEL BOWING HAS INCREASED FROM THAT OBSERVED DURING PHASE I TO APPROXIMATELY 2/3 THE HEIGHT OF THE RIBS. THE RIBS ARE ALSO BOWED AND CURVED LENGTHWISE TO A GREATER EXTENT THAN PHASE I AND THERE IS SOME ROTATION PRESENT. ON THE UNDERSURFACE, THERE ARE NO CHANGES OBSERVED. THE PLYWOOD IS TIGHT AGAINST THE UPPER SURFACE OF THE JOISTS.

PHASE III – AT 18 MIN., THE ASSEMBLY IS IN A BREATHING MOTION WITH THE PANELS MOVING IN THE AREAS BETWEEN THE RIBS FROM A MAXIMUM OF APPROXIMATELY 2/3 THE HEIGHT OF THE RIBS TO APPROXIMATELY 1/2 THE HEIGHT OF THE RIBS. THE RIBS ARE ALSO MOVING LENGTHWISE WITH SOME ROTATION PRESENT. THERE IS LITTLE CHANGE IN POSITION AT PRESSURE CHANGES. ON THE UNDERSURFACE, THE JOISTS ARE MOVING AND BOWING SLIGHTLY WITH THE PLYWOOD TIGHT AGAINST THE UPPER SURFACE OF THE

JOISTS. AT 65 MIN., NO CHANGES ARE OBSERVED IN THE CONDITION OR ACTION OF THE ASSEMBLY FROM THE PREVIOUS PHASE III OBSERVATIONS. AT THE END OF PHASE III, THE ASSEMBLY HAS RETURNED ABOUT TO PRE-TEST CONDITIONS BUT WITH SOME RESIDUAL BOWING PRESENT IN THE PANEL FLAT AREAS BETWEEN THE RIBS. THERE ARE SOME DISHED AREAS PRESENT BUT THERE ARE NO SHARP CREASES IN THE FLAT AREAS OF THE PANELS. THE RIBS APPEAR INTACT WITH NO CHANGE. ON THE UNDERSURFACE, THE PLYWOOD IS TIGHT AGAINST THE UPPER SURFACE OF THE JOISTS.

PHASE IV – THE PANELS ARE BOWING ABOUT THE SAME AS OBSERVED DURING PHASE I.

PHASE V – THE PANEL BOWING BETWEEN THE RIBS IS ABOUT THE SAME AS OBSERVED DURING PHASE III MAXIMUM PRESSURE. THE RIBS ARE BOWED MORE THAN OBSERVED DURING PHASE III MAXIMUM PRESSURE AND ARE CURVED ABOUT THE SAME AS THE PHASE. THERE ARE SLIGHT WRINKLED AREAS PRESENT IN THE FLAT AREAS OF THE PANELS ADJACENT TO THE RIBS. ON THE UNDERSURFACE THE JOISTS ARE BOWING TO A GREATER EXTENT THAN OBSERVED DURING PHASE III MAXIMUM PRESSURE. THE PLYWOOD IS TIGHT AGAINST THE UPPER SURFACE OF THE JOIST.

PHASE IV – THE PANELS ARE BOWING ABOUT THE SAME AS OBSERVED DURING PHASE I.

PHASE V – THE PANEL BOWING BETWEEN THE RIBS IS ABOUT THE SAME AS OBSERVED DURING PHASE III MAXIMUM PRESSURE. THE RIBS ARE BOWED MORE THAN OBSERVED DURING PHASE III MAXIMUM PRESSURE AND ARE CURVED ABOUT THE SAME AS THE PHASE. THERE ARE SLIGHT WRINKLED AREAS PRESENT IN THE FLAT AREAS OF THE PANELS ADJACENT TO THE RIBS. ON THE UNDERSURFACE THE JOISTS ARE BOWING TO A GREATER EXTENT THAN OBSERVED DURING PHASE III MAXIMUM PRESSURE. THE PLYWOOD IS TIGHT AGAINST THE UPPER SURFACE OF THE JOISTS.

POST TEST – AT THE END OF THE CLASS 30 TEST, THE ASSEMBLY HAS RETURNED ABOUT TO PRETEST CONDITIONS WITH SLIGHT RESIDUAL BOWING PRESENT IN THE FLAT AREAS OF THE PANELS BETWEEN THE RIBS. THERE ARE ALSO SOME SLIGHT WRINKLES OR DISHED AREA PRESENT IN THE FLAT AREAS OF THE PANELS. THE RIBS ARE CURVED ABOUT THE SAME AS PRIOR TO THE START OF THE CLASS 30 TEST. ON THE UNDERSURFACE. THE PLYWOOD IS TIGHT AGAINST THE UPPER SURFACE OF THE JOISTS. THE JOISTS ARE BOWING SLIGHTLY.

60 LB/FT² UPLIFT

DEFLECTION IN INCHES

TARGET LOCATIONS				
PHASE	<u>1/4 SPAN PANEL OVER RIBS</u>	<u>MID-SPAN PANEL OVER RIB</u>	<u>1/4 SPAN PANEL BETWEEN RIBS</u>	<u>MID-SPAN PANEL BETWEEN RIBS</u>
I	0.19	0.22	0.85	1.26
II	0.42	0.46	1.30	1.83
III				
MINIMUM	0.49	0.32	1.37	1.86
MAXIMUM	0.59	0.64	1.50	2.07
IV	0.34	0.42	1.10	1.56
V	0.61	0.65	1.57	2.12

SPECIFIC TEST OBSERVATIONS

PHASE I - THE PANEL BOWING IS APPROXIMATELY $\frac{1}{2}$ THE HEIGHT OF THE RIBS. OTHER CONDITIONS ARE ABOUT THE SAME AS OBSERVED DURING PHASE III MAXIMUM PRESSURE, CLASS 30.

PHASE II - THE PANEL BOWING HAS INCREASED FROM THAT OBSERVED DURING PHASE I WITH A MAXIMUM BOWING OF THE AREA BETWEEN THE RIBS ABOUT EVEN WITH THE UPPER SURFACE OF THE RIBS IN ONE OR TWO PANELS. THE RIBS ARE ROTATED TO A GREATER EXTENT THAN OBSERVED DURING PREVIOUS PHASES. THEY ARE ALSO CURVED SLIGHTLY. THEY ARE WRINKLES WHICH ARE MORE NOTICEABLE ADJACENT TO THE RIBS THAN OBSERVED DURING PREVIOUS PHASES. THE LOCATION OF THE PANEL CLIPS IS MORE NOTICEABLE. ON THE UNDERSURFACE, THE PLYWOOD IS TIGHT AGAINST THE UPPER SURFACE OF THE JOISTS. THE JOISTS ARE BOWING ABOUT THE SAME AS OBSERVED DURING PHASE V 30.

PHASE III - AT 14 MIN, THE ASSEMBLY IS IN A BREATHING MOTION WITH A MAGNITUDE OF BOWING BOTH AT MINIMUM AND MAXIMUM PRESSURES GREATER THAN OBSERVED DURING PHASE III CLASS 30. THE MAXIMUM BOWING IS ABOUT EVEN WITH THE UPPER SURFACE OF THE RIBS WITH THE MINIMUM APPROXIMATELY $\frac{3}{4}$ THE HEIGHT OF THE RIB. WRINKLES ADJACENT TO THE RIBS ARE MUCH MORE NOTICEABLE. THE RIBS ARE ROTATED AND CURVED MORE THAN OBSERVED PREVIOUSLY. ON THE UNDERSURFACE, THE JOISTS ARE MOVING AND BOWING TO A GREATER EXTENT THAN OBSERVED DURING PHASE III MAXIMUM OR MINIMUM PRESSURES. THE PLYWOOD IS TIGHT AGAINST THE UPPER SURFACE OF THE JOISTS. IN SOME AREAS IT APPEARS THAT THE PLYWOOD IS RAISED SLIGHTLY FROM THE UPPER SURFACE OF THE JOISTS. AT 58 MIN., THE ASSEMBLY IS IN A BREATHING MOTION WITH THE MAGNITUDE OF BOWING AND MOVEMENT ABOUT THE SAME AS OBSERVED DURING THE PREVIOUS PHASE III OBSERVATION. THE WRINKLE AREAS APPEAR TO BE MORE NOTICEABLE THAN THE PREVIOUS PHASE III OBSERVATIONS. ALSO, THE RIBS APPEAR TO BE ROTATED SLIGHTLY MORE. THE WRINKLES DO NOT APPEAR TO BE EXTENDING UPWARD INTO THE VERTICAL SEGMENT OF THE RIBS. ON THE UNDERSURFACE, THE CONDITIONS ARE ABOUT THE SAME AS OBSERVED PREVIOUSLY. AT THE END OF PHASE III, THE ASSEMBLY HAS RETURNED ABOUT TO PRE-TEST CONDITIONS BUT WITH THE RESIDUAL BOWING GREATER THAN OBSERVED PRIOR TO THE START OF THE CLASS 60 TEST. ALSO, THE RIBS ARE ROTATED SLIGHTLY MORE AND THERE ARE MORE NOTICEABLE DISHED AREAS PRESENT IN THE FLAT AREAS OF THE PANELS ADJACENT TO THE RIBS. ON THE UNDERSURFACE, THE JOISTS HAVE RETURNED TO ABOVE PRE-TEST CONDITIONS. THE PLYWOOD IS TIGHT AGAINST THE UPPER SURFACE OF THE RIBS WITH SOME AREAS AWAY SLIGHTLY.

PHASE IV - THE PANEL BOWING HAS INCREASED FROM THAT OBSERVED DURING PHASE III AND IS ABOUT THE SAME AS OBSERVED DURING PHASE III MAXIMUM PRESSURE. THE WRINKLES ADJACENT TO THE RIBS APPEAR TO BE MORE DEFINED HOWEVER, ON THE UNDERSURFACE THE JOISTS ARE IN ABOUT THE SAME CONDITION AS DURING PHASE III MAXIMUM PRESSURE.

PHASE V - THE ASSEMBLY IS IN ABOUT THE SAME CONDITIONS AS OBSERVED DURING PHASE III WITH THE PANELS RAISED SLIGHTLY HIGHER THAN THAT PHASE. THE WRINKLES ARE SLIGHTLY MORE NOTICEABLE.

POST TEST - AT THE END OF THE CLASS 60 TEST, THE ASSEMBLY HAS ONCE AGAIN RETURNED ABOUT TO PRE-TEST CONDITIONS BUT WITH RESIDUAL BOWING GREATER AND WITH THE WRINKLE MORE DEFINED AND MORE NUMEROUS THAN PRIOR TO THE START OF THE CLASS 60 TEST. ON THE UNDERSURFACE, THE JOISTS RETURNED ABOUT TO PRE-TEST CONDITIONS WITH THE PLYWOOD BASICALLY TIGHT THE UPPER SURFACE OF THE JOISTS. AT THE ONE AREA MENTIONED PREVIOUSLY, THE PLYWOOD IS AWAY FROM THE UPPER SURFACE OF THE JOISTS TO THE SAME EXTENT AS OBSERVED PREVIOUSLY.

90 LB/FT² UPLIFT

DEFLECTION IN INCHES

TARGET LOCATIONS				
PHASE	<u>1/4 SPAN PANEL OVER RIBS</u>	<u>MID-SPAN PANEL OVER RIB</u>	<u>1/4 SPAN PANEL BETWEEN RIBS</u>	<u>MID-SPAN PANEL BETWEEN RIBS</u>
I	0.34	0.36	1.21	1.70
II	0.65	0.72	1.75	2.36
III				
MINIMUM	0.60	0.62	1.66	2.23
MAXIMUM	0.66	0.71	1.74	2.56
IV	0.44	0.48	1.39	1.91
V	0.84	0.85	1.95	2.60

SPECIFIC TEST OBSERVATIONS

PHASE I - THE CONDITION OF THE ASSEMBLY IS ABOUT THE SAME AS OBSERVED DURING PHASE IV CLASS 30.

PHASE II - THE PANEL BOWING HAS INCREASED FROM THAT OBSERVED DURING PHASE I AND IS GREATER THAN OBSERVED DURING PHASE V CLASS 60. THE CENTER OF THE AREA BETWEEN THE RIBS IS ABOUT EVEN OR SLIGHTLY OVER THE TOPS OF THE RIBS IN SOME PANELS. THE RIBS ARE ROTTED SLIGHTLY MORE THAN OBSERVED DURING PREVIOUS PHASES. THE WRINKLES ADJACENT TO THE RIBS ARE MORE DEFINED AND MORE NUMEROUS. ON THE UNDERSTATE THE JOISTS ARE BOWING TO A GREATER EXTENT THAN OBSERVED DURING PHASE V CLASS 60. THE PLYWOOD IS TIGHT AGAINST THE UPPER SURFACE OF THE JOISTS EXCEPT IN THE AREA AS NOTED. THE CLIPS ARE MORE NOTICEABLE THAN OBSERVED PREVIOUSLY. THERE ARE SLIGHT WRINKLES IN SOME VERTICAL PIECES OF THE RIBS.

PHASE III - AT 15 MIN., THE ASSEMBLY IS IN A BREATHING MOTION WITH THE MAGNITUDE OF BOWING ABOUT THE SAME AS OBSERVED DURING PHASE V AT MAXIMUM PRESSURE AND SLIGHTLY LESS AT MINIMUM PRESSURE. THE RIBS ARE BOWING TO A GREATER EXTENT THAN OBSERVED DURING PHASE II. THE WRINKLES ADJACENT TO THE RIBS ARE MORE DEFINED WITH LITTLE CHANGE IN CONFIGURATION AT PRESSURE CHANGES. THE JOISTS ARE BOWING ABOUT THE SAME AS OBSERVED DURING PHASE III CLASS 60 WITH SLIGHT MOVEMENT PRESENT. ALL FASTENERS APPEAR TO BE HOLDING BUT THE PLYWOOD TIGHT AGAINST THE UPPER SURFACE OF THE JOISTS EXCEPT IN THE ONE AREA PREVIOUS PHASES. AT 57 MIN., THE ASSEMBLY IS IN A SAME CONDITION AS OBSERVED DURING PREVIOUS PHASE III OBSERVATIONS. AT THE END OF PHASE V, THE RESIDUAL BOWING IS GREATER WITH SLIGHT ROTATION AND CURVING PRESENT. THE LOCATIONS OF THE CLIPS ARE MORE DEFINED. THE WRINKLES ARE BASICALLY OUT OF THE AREAS ADJACENT TO

THE RIBS. ON THE UNDERSURFACE, THE PURLINS HAVE RETURNED ABOUT TO PRE-TEST CONDITIONS. THE AREA WITH THE OPENING IS ABOUT THE SAME AS PRIOR TO THE START OF THE CLASS 90 TEST.

PHASE IV - THE CONDITION OF THE ASSEMBLY IS ABOUT THE SAME AS OBSERVED DURING PHASE II.

PHASE V - THE PANEL BOWING HAS INCREASED FROM THAT OBSERVED DURING PHASE IV WITH THE MAXIMUM BOWING APPROXIMATELY 1 1/2 TIMES THE HEIGHT OF THE RIBS AT THE CENTER AREAS. THE RIBS ARE ROTATED SLIGHTLY MORE THAN OBSERVED PREVIOUSLY WITH WRINKLES EXTENDED UPWARD INTO THE VERTICAL SEGMENTS OF THE RIBS FROM THE SIDE WRINKLES. THE CLIP LOCATIONS ARE MORE OBVIOUS. ON THE UNDERSURFACE, THE PLYWOOD APPEARS TO BE SLIGHTLY AWAY FROM THE UPPER SURFACE OF THE DECK IN MORE AREAS THAN OBSERVED PREVIOUSLY. THE PLYWOOD AT THE DISHED AREA IS OPENED SLIGHTLY MORE THAN OBSERVED PREVIOUSLY.

POST TEST - AT THE END OF THE CLASS 90 TEST, THE ASSEMBLY RETURNED ABOUT TO PRE-TEST CONDITIONS WITH THE RESIDUAL BOWING SLIGHTLY GREATER AT THE START OF THE CLASS 90 TEST. THE LOCATIONS OF THE PANEL CLIPS ARE MORE OBVIOUS THAN PRIOR TO THE START OF THE CLASS 90 TEST. SLIGHT WRINKLES STILL REMAIN IN THE ASSEMBLY ADJACENT TO THE RIBS. THE PLYWOOD WAS IN MOST AREAS TIGHT AGAINST THE UPPER SURFACE OF THE JOISTS BUT WITH SOME OPENINGS PRESENT. THESE OPENINGS WERE SLIGHT WITH THE EXCEPTION OF THE ONE AREA MENTIONED PREVIOUSLY TOWARD THE EAST WALL AT ETH CENTER IN THE FIRST JOIST. THE ASSEMBLY IS CONSIDERED TO HAVE ATTAINED A CLASS 90 UPLIFT RATING.

UPLIFT RESISTANCE PROPERTIES:

UL580

IT IS JUDGED THAT THE ROOF DECK ASSEMBLIES, CONSTRUCTED OF THE MATERIALS AND IN THE MANNER HEREIN DESCRIBED WILL AFFORD A CLASS 90 UPLIFT TEST. THREE NEW CONSTRUCTIONS WILL BE DESCRIBED AS THE RESULT OF THIS UPLIFT TEST PROGRAM. THEY ARE IDENTIFIED AS FOLLOWS:

CONSTRUCTION NO. 588 WHICH WILL UTILIZE "1 1/2 IN. STANDING SEAM"
PANELS

UL 1897

IT IS FURTHER JUDGED THAT THE ROOF DECK ASSEMBLY CONSTRUCTED OF THE MATERIALS AND IN THE MANNER DESCRIBED IN TEST ASSEMBLY NO. 2, HAS ATTAINED A 105 PSF UPLIFT RATING. THE MODE OF FAILURE WAS BUCKLING OF THE SIDE RIBS.

SECONDARY SUPPORTS, (BEAMS, PURLINS, JOISTS, BULB TEES, LATERAL BRACING, ETC.) CONNECTIONS OF THESE ASSEMBLIES TO THE MAIN STRUCTURAL MEMBERS, (GIRDERS, COLUMNS, ETC.) AND CONSTRUCTION DETAILS ALONG THE EDGES OF THE ROOF OR AROUND ROOF OPENING (SKY LIGHT PANELS, MECHANICAL EQUIPMENT, CHIMNEYS, ETC.) HAVE NOT BEEN EVALUATED.

PRACTICABILITY:

THE MATERIALS USED IN THE TEST ASSEMBLIES CAN BE READILY INSTALLED BY QUALIFIED WORKMEN WITH TOOL AND METHODS COMMONLY USED FOR CONSTRUCTION WORK OF A SIMILAR NATURE.

THE MATERIALS AND INSTALLATION PROCEDURES DESCRIBED IN THIS REPORT ARE JUDGED TO BE SIGNIFICANT FACTORS IN THE UPLIFT RESISTANCE OF THE CONSTRUCTIONS.

CONFORMITY:

THE ASSEMBLIES WERE TESTED IN ACCORDANCE WITH THE STANDARD UL 580 ENTITLED "TEST FOR UPLIFT RESISTANCE OF ROOF ASSEMBLIES" AND THE STANDARD UL 1897 ENTITLED "UPLIFT TESTS FOR ROOF COVERINGS SYSTEMS".

CLASSIFICATION AND FOLLOW-UP SERVICE:

THE METAL ROOF DECK PANELS AND PANEL CLIPS, DESCRIBED HEREIN, ARE JUDGED TO BE ELIGIBLE FOR CLASSIFICATION AND FOLLOW-UP SERVICE OF UNDERWRITERS LABORATORIES, INC. UNDER THE SERVICE, A MANUFACTURER WHO IS CAPABLE OF MANUFACTURING ANY OF THE PANELS DESCRIBED HEREIN IS AUTHORIZED TO USE THE LABORATORIES CLASSIFICATION MARKING ON SUCH PRODUCTS WHICH COMPLY WITH THE FOLLOW-UP SERVICE PROCEDURE AND OTHER APPLICABLE REQUIREMENTS OF UNDERWRITERS LABORATORIES, INC. ONLY THOSE PRODUCTS WHICH PROPERLY BEAR THE LABORATORIES CLASSIFICATION MARKING ARE CONSIDERED AS CLASSIFIED BY UNDERWRITERS LABORATORIES, INC.

THE CLASSIFICATION MARKING TO BE USED ON THE METAL ROOF DECK PANELS IS ILLUSTRATED BELOW:

**METAL ROOF DECK PANELS
CLASSIFIED BY
UNDERWRITERS LABORATORIES INC
AS TO UPLIFT RESISTANCE ONLY
CLASS 90
AS SHOWN BY CONSTRUCTION NO 588**

THE CLASSIFICATION MARKING TO BE USED ON THE PANEL CLIPS IS ILLUSTRATED BELOW:

**ROOF DECK FASTENERS
CLASSIFIED BY
UNDERWRITERS LABORATORIES INC
AS TO UPLIFT RESISTANCE ONLY
CLASS 90
AS SHOWN BY CONSTRUCTION NO 588**

SUMMARY:

THE ROOF DECK CONSTRUCTIONS SHOWN IN D587, D588, AND D589 DESCRIBED BELOW WILL SERVE TO SUMMARIZE THE RESULTS OF THE DATA DEVELOPED DURING THIS PRELIMINARY INVESTIGATION. WE HAVE RESERVED

CONSTRUCTION NOS. 587, 588, AND 589 FOR THESE ASSEMBLIES. WHEN THERE ARE CLASSIFIED PANELS AND PANEL CLIPS AVAILABLE FOR THESE ASSEMBLIES. WE WILL ESTABLISH THE ABOVE AND ESTABLISH CLASSIFICATION FOR YOUR PANELS AND PANEL CLIPS.

FILE NC4291-1,4,5

GUIDE TGKXX
ROOF DECK CONSTRUCTIONS

DATE:
D588-B CARD

PART 2 - DESCRIPTION OF NUMBERED ITEMS
CONSTRUCTION NO. 588
UPLIFT - CLASS 90

FIRE NOT INVESTIGATED

1. **METAL ROOF DECKS PANELS** - No. 24 MSG THICK COATED STEEL; WIDTH 16 IN. WIDE, RIB HEIGHT 1 ³/₄ IN AT THE FEMALE RIB. PANELS CONTINUOUS OVER THREE OR MORE SPANS WITH NO END-LAPS. A BEAD OF SEALANT MAY BE USED AT PANEL RIBS.

FUTURE CLASSIFIED COMPANY - PANEL NAME STANDING SEAM PROFILE

2. **ROOF DECK FASTENERS (PANEL CLIPS)** - TWO PART ASSEMBLY; BASE 6 IN. LONG WITH A ³/₄ IN. HORIZONTAL LEG AND A ³/₄ IN. VERTICAL LEG. FABRICATED FROM NO. 18 MSG COATED STEEL. UPPER TAB 1 ¹/₃₄ IN. WIDE AND 1 ¹/₂ IN. HIGH FORMED TO FIT OVER LEG OF BASE THE MALE RIB OF PANEL. UPPER TAB FABRICATED FROM NO. 24 MSG COATED STEEL.

FUTURE CLASSIFIED COMPANY - CLIP NAME

3. **PANEL FASTENERS (SCREWS)** - FASTENERS USED TO ATTACH THE PANEL CLIPS TO THE PLYWOOD DECK WERE NO. 10-12 BY 1 IN. LONG, NO. 2 PHILLIPS DRIVE WAFER HEAD PLATED STEEL SCREWS. TWO SCREWS USED PER CLIP.
4. **PLYWOOD DECK** - NOMINAL 5/8 IN. 1(19/32 IN. ACTUAL) PLYWOOD, APA RATED. FASTENED TO SUPPORTS (JOISTS) USING NO. 8 BY 2 ¹/₂ IN. LONG, NO. 2 PHILLIPS DRIVE, COARSE THREAD, BUGLE HEAD, STEEL SCREWS. SPACED 6 IN. OC. AT THE BUTT ENDS AND 12 IN. OC. IN THE FIELD. ALL JOINTS TO BE SEALED WITH A ONE PART URETHANE SEALANT FEATHERED OUT FROM THE JOINT.
5. **JOISTS** - GRADED DIMENSIONAL LUMBER, NO. 2 OR BETTER. SPACED 24 IN. OC. MAX.
6. **JOIST HANGERS** - (NOT SHOWN) NO. 18 MSG COATED STEEL, OPEN SEAT TYPE.
7. **Roofing Felt** - No. 30 organic or glass fiber felt installed per manufacturer's instructions.