



AMERICAN BUREAU OF SHIPPING

Two World Trade Center, 106th Floor
New York, New York 10048

REPORT NO.: M26104 DATE: 15 DECEMBER 1998 PORT: MOBILE, AL

STATEMENT OF FACT FIKE INC. FM 200 FIRE SUPPRESSION TEST

THIS IS TO CERTIFY THE UNDERSIGNED SURVEYOR TO THIS BUREAU DID, AT THE REQUEST OF FIKE, INC., WITNESS THE TESTING OF FM200 FIRE EXTINGUISHING SYSTEM. IN ACCORDANCE WITH INTERNATIONAL MARITIME ORGANIZATION (IMO) GUIDELINES FOR THE APPROVAL OF EQUIVALENT FIXED GAS FIRE EXTINGUISHING SYSTEMS. AS REFERRED TO IN SOLAS 74, FOR MACHINERY SPACES AND CARGO-PUMP ROOM (MSC/CIR 848 D & D 8 JUNE 1998).

THE TESTS WERE CONDUCTED AT THE UNITED STATES COAST GUARD (USCG) FIRE AND SAFETY DETACHMENT ABOARD THE T/V "STATE OF MAINE" LOCATED AT LITTLE SAND ISLAND IN MOBILE, AL FROM 8 DECEMBER TO 11 DECEMBER 1998. THE TESTS WERE CONDUCTED IN A TEST COMPARTMENT LOCATED ON THE 4TH DECK OF THE NUMBER SIX CARGO HOLD. THE TEST COMPARTMENT WAS CONSTRUCTED TO MEET THE SPECIFICATIONS OF THE IMO PROTOCOL.

THE TEST COMPARTMENT WAS INSTRUMENTED TO MEASURE THE THERMAL CONDITIONS, AS WELL AS THE NUMEROUS GASEOUS CONCENTRATIONS: CARBON MONOXIDE, CARBON DIOXIDE, AND OXYGEN. FIVE VIDEO CAMERAS WERE USED TO RECORD TESTS. THERMO COUPLES WERE USED TO DETERMINE TEST FIRE STATUSES, AS WELL AS CYLINDER TEMPERATURE. PRESSURE SENSORS WERE USED TO DETERMINE CYLINDER DISCHARGE DURATION.

THE FOLLOWING IS A BRIEF OF THE TESTS AND SUBSEQUENT RESULTS. TEST NOTES AND RESULTS MENTIONED HERE ARE BASED ON THE RAW DATA AVAILABLE ON THE SITE. A COMPLETE TEST REPORT WILL PUBLISHED AT A FUTURE DATE BY THE UNITED STATES COAST GUARD RESEARCH AND DEVELOPMENT CENTER.

WITNESSES TO THE TESTS

DAVE BEENE	USCG FIRE & SAFETY TEST DET.
JOHN SCHAEFER	FIKE, INC.
BRAD STILLWELL	FIKE INC.
DR. SOONIL NAM	FACTORY MUTUAL
CHARLES WORTHEY	LRS
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FIKE TEST NO. 1 TUESDAY, 8 DECEMBER 1998

THIS WAS IMO TEST NO. 1. THIS TEST CONSISTED OF EIGHT (8) TELLTALE FIRES IN THE EIGHT (8) CORNERS OF THE IMO COMPARTMENT AND THE AGENT WAS DISCHARGED AT THE AMBIENT TEMPERATURE OF 70° F. THE MANIFOLD CONSISTED OF THREE (3) INCH PIPING REDUCED TO TWO (2)

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INCH PIPING INSIDE THE TANK AND TEE REDUCED TO ONE AND ONE HALF (1 1/2) INCH PIPING TO THE FOUR (4) NOZZLES. THE NOZZLES WERE 360° DISTRIBUTION TYPE WITH TWELVE (12) ORIFICES EACH, WITH EACH ORIFICE BEING .4129 INCHES IN DIAMETER. EACH OF THE TELL-TALES WERE LIT IN 4 INCH ID (100mm) BY 2 INCH HIGH (50mm) STEEL CANS FILLED WITH APPROXIMATELY FOUR (4) OF HEPTANE. THE UPPER FOUR TELLTALE FIRES WERE LOCATED 6 INCHES BELOW THE OVERHEAD AND TWO INCHES FROM THE BULKHEADS. THE LOWER FOUR WERE LOCATED ON THE DECK AND 2 INCHES FROM THE BULKHEADS. THE FM200 CYLINDER WAS 9.286 CUBIC FOOT CAPACITY WITH 606 POUNDS OF AGENT PROVIDING 65.2 LBS. CUBIC FOOT (FT³) OF FILL DENSITY, THE AGENT WAS DISCHARGED AT THE DESIGN CONCENTRATION OF 7% WHICH IS 83% OF THE TOTAL CONCENTRATION.

RESULTS: THE AGENT WAS DISCHARGED IN THE REQUIRED 13 SECONDS. THE FIRES WERE EXTINGUISHED WITHIN 24 SECONDS OF COMPLETION OF DISCHARGE FOR A TOTAL OF 37 SECONDS FROM BEGINNING OF DISCHARGE TO FINAL EXTINGUISHMENT. THE TEST FAILED DUE TO DISCHARGE TIME.

FIKE TEST NO. 2 TUESDAY, 8 DECEMBER 1998

THIS TEST WAS A RETEST OF IMO TEST NO. 1. ALL OF THE TEST PARAMETERS WERE THE SAME AS TEST NO. 1 WITH THE FOLLOWING TWO EXCEPTIONS. THE CYLINDER CONTAINING THE AGENT WAS 14.325 CUBIC FOOT CAPACITY PROVIDING 42.5 LBS/FT³ OF FILL DENSITY AND THE CYLINDER WAS AT THE AMBIENT TEMPERATURE OF 75°F. THE SAME AMOUNT, 606 LBS., OF AGENT WAS USED PROVIDING THE 7% CONCENTRATION AS TEST NO. 1.

RESULTS: THIS TEST PASSED PROVIDING THE 10 SECOND DISCHARGE TIME AND 24 SECONDS FROM THE END OF DISCHARGE TO TOTAL FIRE EXTINGUISHMENT FOR A TOTAL OF 34 SECONDS FROM BEGINNING OF DISCHARGE TO EXTINGUISHMENT.

FIKE TEST NO. 3 TUESDAY, 8 DECEMBER 1998

THIS WAS IMO TEST NO. 4 WHICH SIMULATES A LARGE OBSTRUCTED BILGE FIRE USING A TYPICAL FUEL. A FOUR (4) SQUARE METER PAN FIRE CENTRALLY LOCATED UNDER AN ENGINE MOCKUP. THE PAN WAS FUELED WITH DIESEL FUEL AND ONE HALF GALLON OF HEPTANE TO AID COMBUSTION. THE AGENT WAS DISCHARGED AT AMBIENT TEMPERATURE OF 80°F THROUGH THE SAME MANIFOLD USED IN FIKE TESTS 1 AND 2. THE NOZZLES WERE CHANGED TO 4-INCH PIPE NOZZLES WITH 12, .4375 INCH DIAMETER ORIFICES EACH. THE CYLINDER USED WAS THE 14.325 CUBIC FOOT CYLINDER CONTAINING 741 LBS. OF AGENT PROVIDING 51.2 LBS PER CUBIC FOOT OF FILL DENSITY.



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RESULTS: THIS TEST DID NOT MEET THE IMO STANDARD DUE THE DISCHARGE DURATION. THE DISCHARGE DURATION WAS 15 SECONDS WITH TOTAL EXTINGUISHMENT OCCURRING 11 SECONDS LATER FOR A TOTAL TEST DURATION OF 26 SECONDS.

FIKE TEST NO. 4 WEDNESDAY, 9 DECEMBER 1998

THIS WAS IMO TEST NUMBER 1 WITH THE LOW TEMPERATURE AGENT DISCHARGE. EIGHT (8) TELLTALE FIRES WERE LOCATED IN THE 8 CORNERS OF THE COMPARTMENT AS TEST NUMBER 1 ON 8 DECEMBER 1998. FOUR NOZZLES OF 360° CONFIGURATION WITH 12 ORIFICES OF .4129 INCH DIAMETER PER ORIFICE WERE USED. THE AGENT FROM A 14.325 CUBIC FOOT CYLINDER PROVIDING 42.5 LBS. PER CUBIC FOOT OF FILL DENSITY AND 606 LBS. OF AGENT WAS RELEASED PROVIDING 7% CONCENTRATION.

RESULT: THIS TEST DID NOT CONFORM TO AN IMO REQUIREMENT. THEREFORE, A PASS OR FAIL RESULT IS NOT PROVIDED. A 12 SECOND DISCHARGE DURATION AND 39 SECOND EXTINGUISHMENT TIME FROM END OF DISCHARGE TO TOTAL EXTINGUISHMENT FOR A TOTAL TEST CYCLE OF 51 SECONDS WAS OBSERVED.

NOTE: PRIOR TO FIKE TEST NO.5 THE PIPE MANIFOLD WAS MODIFIED TO AID IN THE DISCHARGE DURATION. PREVIOUSLY THE MANIFOLD HAD BEEN THREE (3) INCH PIPE THROUGHOUT THE COMPARTMENT BULKHEAD WHICH WAS REDUCED TO TWO (2) INCH. THE 2 INCH THEN WAS TEED OFF FOR THE MAIN RUN THIS WAS REDUCED AT THE TEES FOR THE INDIVIDUAL NOZZLES TO 1 1/2 INCH PIPE. THE NOZZLES WERE ALSO 1 1/2 PIPE SIZE.

THE MODIFICATIONS WERE TO CHANGE THE ORIGINAL 2 INCH PIPE TO 2 1/2 INCH PIPE AND FROM THE MAIN RUN TO THE NOZZLES THE PIPE WAS CHANGED TO 2 INCH PIPE. THE NOZZLES WERE ALSO CHANGED TO 2 INCH PIPE SIZE.

THIS CONFIGURATION COMMENCED PRIOR TO FIKE TEST NO.5 AND REMAINED THROUGH THE CONCLUSION OF THE TESTING.

FIKE TEST NO. 5 THURSDAY, 10 DECEMBER 1998

THE TEST WAS IMO TEST NUMBER 1. IN ADDITION TO THE EIGHT TELLTALE FIRES IN THE EIGHT CORNERS THERE WERE TELLTALES PLACED ABOVE (1) AND (1) BELOW THE ENGINE MOCK UP. THE NOZZLES WERE CHANGED TO 180 DEGREES DISTRIBUTION CONFIGURATION WITH 11 ORIFICES PER NOZZLE AND ORIFICE SIZE .5470 INCH. THE CYLINDER USED WAS 606 LBS. OF AGENT AT 42.5 LBS. PER CUBIC FOOT FILL DENSITY. THE AGENT WAS 7% CONCENTRATION. THE CYLINDER WAS 70 DEGREES FAHRENHEIT.

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RESULTS: THE DISCHARGE DURATION WAS 9.5 SECONDS WITH FIRE EXTINGUISHMENT 33 SECONDS AFTER THE END OF THE DISCHARGE. THIS TEST DID NOT MEET THE STANDARD DUE TO THE EXTINGUISHMENT PERIOD.

NOTE: THE FIRE EXTINGUISHMENT PERIOD OBSERVED WAS FOR THE 8 REQUIRED TELLTALES ONLY.

FIKE TEST NO. 6 THURSDAY, 10 DECEMBER 1998

THIS WAS IMO TEST 2A. THIS FIRE CONSISTED OF A .25 SQUARE METER PAN FIRE, A LOW PRESSURE HEPTANE SPRAY FIRE, AND A HIGH PRESSURE DIESEL SPRAY FIRE. FOR THIS TEST THE AGENT WAS DISCHARGED THROUGH THE MANIFOLD USING FOUR (4) 360 DEGREE CONFIGURATION NOZZLES. EACH NOZZLE HAD 12 ORIFICES MEASURING .500 INCH PER ORIFICE. THE CYLINDER WAS AT 70 DEGREES FAHRENHEIT. THE PAN FIRE WAS CENTRALLY LOCATED UNDER THE ENGINE MOCK-UP SIMULATING A SMALL OBSTRUCTED BILGE FIRE. THE LOW PRESSURE SPRAY IMPINGED ON A 25mm (1 INCH) STEEL ROD LOCATED ON TOP OF THE ENGINE MOCK-UP. THE HEATED ROD WAS DESIGNED TO ACT AS A REIGNITION SOURCE. THE HIGH PRESSURE SPRAY WAS ALSO LOCATED ON TOP OF THE ENGINE MOCK-UP.

RESULTS: THE AGENT DISCHARGE TIME WAS 9.7 SECONDS WITH TOTAL FIRE EXTINGUISHMENT IN 20 SECONDS AFTER THE END OF DISCHARGE. NO REIGNITION WAS OBSERVED. THIS TEST MET THE IMO STANDARD.

FIKE TEST NO. 7 THURSDAY 10 DECEMBER 1998

THIS WAS IMO TEST NO.3 AND CONSISTED OF A LOW PRESSURE HEPTANE SPRAY FIRE, A WOOD CRIB FIRE, AND A 2 SQUARE METER DIESEL PAN FIRE. THE AGENT WAS DISCHARGED AT 75 DEGREES FAHRENHEIT AT 8.6% CONCENTRATION, AND 741 LBS. OF AGENT DISCHARGED FROM A 14.325 CUBIC FOOT CYLINDER, PROVIDING 51.2 LBS./FT³ OF FILL DENSITY. THE 4 NOZZLES USED WERE 360 DEGREES DISTRIBUTION THROUGH 12 ORIFICES PER NOZZLE MEASURING .5000 INCH DIAMETER PER ORIFICE. THE WOOD CRIB WAS DRIED AND TESTED FOR MOISTURE, READING 10%, PRIOR TO THE TEST.

RESULT: THE AGENT DISCHARGE TIME WAS 9.5 SECONDS WITH ALL FIRES EXTINGUISHED WITHIN 30 SECONDS FROM THE COMPLETION OF DISCHARGE. THIS TEST MET THE IMO REQUIREMENTS.

FIKE TEST NO. 8 FRIDAY 11 DECEMBER 1998

THIS WAS IMO TEST NO. 4 AND A REPEAT OF FIKE TEST NO.3 CONDUCTED ON 8 DECEMBER 1998, ALL TEST PARAMETERS WERE THE SAME AS THE ABOVE MENTIONED TEST WITH THE EXCEPTION OF THE

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LARGER MANIFOLD AND NOZZLE CONFIGURATION. THE RESULTING NOZZLES USED WERE 2 INCH PIPE SIZE WITH 12 ORIFICE 360 DEGREE DISTRIBUTION PATTERN. THE ORIFICE SIZE WAS .5000 INCH DIAMETER PER ORIFICE. THE TANK WAS AT 70 DEGREES FAHRENHEIT DISPENSING 8.6% CONCENTRATION OF AGENT AT 51.2 LBS. PER SQUARE FOOT OF FILL DENSITY.

RESULTS: THE DISCHARGE DURATION WAS 9.5 SECONDS WITH AN ADDITIONAL 3.0 SECONDS OF EXTINGUISHMENT PERIOD. THIS TEST RESULT MET IMO STANDARDS

FIKE TEST NO. 9 FRIDAY, 11 DECEMBER 1998

THIS WAS IMO TEST NO.4 AND A REPEAT OF FIKE TEST NO. 1 OF 8 DECEMBER 1998. ALL TEST PARAMETERS WERE THE SAME AS THE ABOVE MENTIONED TEST WITH THE EXCEPTION OF THE UTILIZATION OF THE LARGER MANIFOLD AND NOZZLES. THE NOZZLES USED WERE OF 2 INCH PIPE SIZE WITH THE 12 ORIFICE 360 DEGREE DISTRIBUTION PATTERN. THE ORIFICE SIZE WAS .500 INCH PER ORIFICE. THE CYLINDER TEMPERATURE WAS 70 DEGREES FAHRENHEIT.

RESULTS: THE DISCHARGE DURATION WAS 9.5 SECONDS WITH AN ADDITIONAL 20 SECONDS FOR FIRE EXTINGUISHMENT. THESE TEST RESULT MET IMO STANDARDS.

REFERENCES:

- 1.) INTERNATIONAL MARITIME ORGANIZATIONS "GUIDELINES FOR THE APPROVAL OF EQUIVALENT FIXED GAS FIRE EXTINGUISHING SYSTEMS" AS REFERRED TO IN SOLAS 74, FOR MACHINERY SPACES AND CARGO PUMP - ROOMS (MSC/CIR 848 8 JUNE 1998)
- 2.) TESTS METHOD FOR FIRE TESTING OF FIXED GAS - FIRE EXTINGUISHING SYSTEMS AS REFERRED TO IN SOLAS 74, FOR MACHINERY SPACES AND CARGO PUMP - ROOMS (CMS/CIR 848 8 JUNE 1998)
- 3.) GASEOUS AGENT EVALUATION TESTING FOR MACHINERY SPACES, FACTORY MUTUAL RESEARCH CORPORATION - FIKE, NOVEMBER 1998
- 4.) RAW TABULATED DATA PROVIDED BY U. S. C. G. TEST FACILITY.



MARC SCHWARTZ, SURVEYOR

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