Single PWR Spent Fuel Assembly Heat Transfer Data for Computer Code Evaluations

J. M. Bates

January 1986

**Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830**

**Pacific Northwest Laboratory
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PACIFIC NORTHWEST LABORATORY
operated by
BATTELLE
for the
UNITED STATES DEPARTMENT OF ENERGY
under Contract DE-AC06-76RLO 1830

Printed in the United States of America
Available from
National Technical Information Service
United States Department of Commerce
5285 Port Royal Road
Springfield, Virginia 22161

NTIS Price Codes
Microfiche A01

Printed Copy

Pages	Price Codes
001-025	A02
026-050	A03
051-075	A04
076-100	A05
101-125	A06
126-150	A07
151-175	A08
176-200	A09
201-225	A010
226-250	A011
251-275	A012
276-300	A013

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DATA FOR COMPUTER CODE EVALUATIONS

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Richland, Washington 99352

ABSTRACT

This document presents the descriptions and results of two separate heat transfer tests designed to investigate the dry storage of commercial PWR spent fuel assemblies.

Presented first are descriptions and selected results from the Fuel Temperature Test performed at the Engine Maintenance and Disassembly (EMAD) facility on the Nevada Test Site by Westinghouse Electric Corporation's Advanced Energy Systems Division. An actual spent fuel assembly from the Turkey Point Unit Number 3 Reactor with a decay heat level of 1.17 KW, was installed vertically in a test stand mounted canister/liner assembly. The boundary temperatures were controlled and the canister backfill gases were alternated between air, helium and vacuum to investigate the primary heat transfer mechanisms of convection, conduction and radiation. The assembly temperature profiles were experimentally measured using installed thermocouple instrumentation. For the tests reported, the imposed boundary condition modeled the conditions measured during actual in-ground Drywell testing. For the conditions tested, the peak temperatures obtained were 266°C for the vacuum backfill, 255°C for the air backfill, and 226°C for the helium backfill. Measured maximum temperatures for all backfills occurred at an elevation slightly above the active fuel midplane. The lower helium backfill temperatures indicate the higher thermal conductivity of the helium. The air backfill temperatures were skewed noticeably toward the top of the spent fuel assembly, showing air to be a better convector than helium. The higher vacuum backfill temperatures indicate that radiation alone is the least effective heat transfer method.

Also presented are the results from the Single Assembly Heat Transfer Test designed and fabricated by Allied General Nuclear Services, under contract to the Department of Energy, and ultimately conducted by the Pacific Northwest Laboratory (PNL). For this test, an electrically heated 15x15 rod assembly was used to model a single PWR spent fuel assembly. The electrically heated model fuel assembly permitted various "decay heat" levels to be tested; 1.0 KW and 0.5 KW were used for these tests. The model fuel assembly was positioned within a prototypic fuel tube and in

turn placed within a double-walled sealed cask. The complete test assembly could be positioned at any desired orientation (horizontal, vertical, and 25° from horizontal for the present work) and backfilled as desired (air, helium, or vacuum). Tests were run for all combinations of "decay heat", backfill, and orientation. Boundary conditions were imposed by temperature controlled guard heaters installed on the cask exterior surface.

Trends observed in the SAHTT data for vertical orientations were similar to those of the Fuel Temperature Tests and were basically independent of the modelled decay heat level (1.0 KW or 0.5 KW). Orientation had little effect on peak temperatures or their location (consistently near the axial centerline of the model assembly). The axial temperature profiles (i.e. the shape of the axial profile but not the peak temperature) for an air backfill shifted markedly with orientation, indicating the importance of convective heat transfer for this environment. Only very minimal orientation effects were observed for the helium and vacuum backfills.

For the 1.0 KW runs, the peak clad temperatures for the vacuum backfill were ~295°C, for the air backfill ~275°C, and for the helium backfill ~250°C. For the 0.5 KW runs, the peak temperatures were ~240°C for vacuum, ~230°C for air, and ~215°C for helium backfills. Orientation had little effect on the magnitudes of the peak temperatures.

It is intended that these test results be used for initial evaluations of thermal analysis computer codes that may eventually be used in multiassembly spent fuel storage analysis and design efforts. Anticipated results for multiassembly dry storage tests ongoing and planned at this time will provide additional bases of comparison that are needed to further support thermal code qualification for spent fuel storage.

ACKNOWLEDGEMENTS

Appreciation is extended to the DOE Richland Operations Field Office and to D. K. Kreid and the Monitored Retrievable Storage Program Office at PNL for sponsorship and support of this reporting effort. The efforts of J. M. Creer and the Commercial Spent Fuel Management Program Office at PNL in providing support and consultation during the Single Assembly Heat Transfer Testing activities are greatly appreciated. R. T. Anderson, J. E. Cottrell, G. A. Townes and craftsmen formerly of Allied General Nuclear Services, Barnwell, S.C., are also acknowledged for their contributions during the SAHTT design, fabrication, and initial testing. R. J. Bahorich and R. Unterzuber of Westinghouse, Advanced Energy Systems Division, were also extremely helpful in preparing the Fuel Temperature Test section of this report.

CONTENTS

	Page
ABSTRACT	111
ACKNOWLEDGEMENTS	v
LIST OF FIGURES.	xii
LIST OF TABLES	xv
LIST OF ACRONYMS	xviii
1.0 INTRODUCTION	1
2.0 CONCLUSIONS AND RECOMMENDATIONS	3
2.1 CONCLUSIONS.	3
2.2 RECOMMENDATIONS	5
3.0 FUEL TEMPERATURE TESTS	7
3.1 FTT OBJECTIVES	7
3.2 HARDWARE DESCRIPTIONS	7
3.2.1 Test Arrangement	7
3.2.2 Test Stand.	11
3.2.3 Seismic Restraint Fixture	12
3.2.4 Test Canister	12
3.2.5 Canister Closure Lid	16
3.2.6 Evacuation/Gas Backfill System.	19
3.2.7 Heaters and Heater Controls	21
3.2.8 Data Acquisition System	22
3.2.9 Thermocouples	22
3.2.10 PWR Spent Fuel Assembly	22
3.3 FTT OPERATIONS	27
3.3.1 Test Sequence	27
3.3.2 Phase III Testing (Fuel Assembly D15)	29

3.4	FTT RESULTS.	32
3.5	FTT DATA ACCURACIES	37
3.5.1	Quality Assurance	38
4.0	SINGLE ASSEMBLY HEAT TRANSFER TEST.	39
4.1	SAHTT OBJECTIVES	39
4.2	HARDWARE DESCRIPTIONS	40
4.2.1	Mechanical Equipment	42
4.2.1.1	Pressure/Vacuum Vessel (Cask).	42
4.2.1.2	Transition Piece/Fuel Tube	46
4.2.1.3	Cask Closure Lids	49
4.2.1.4	Electrically Heated Model Spent Fuel Assembly	52
4.2.1.5	Evacuation and Backfill System	55
4.2.2	Electrical Systems.	58
4.2.2.1	Cask Heater Power Supply and Control System	58
4.2.2.2	Model Fuel Assembly Power Supply and Control System	58
4.2.3	Instrumentation and Data Acquisition System.	59
4.2.3.1	Thermocouples	59
4.2.3.2	Portable Surface Temperature Probe	61
4.2.3.3	Absolute Pressure Gauge	61
4.2.3.4	Assembly Power Transducers	63
4.2.3.5	Data Loggers	64
4.3	SAHTT OPERATIONS	64
4.3.1	Pre-Test Checks	64
4.3.2	Operational Procedures	65
4.3.2.1	Cask Orientation	65

4.3.2.2	Cask Environment	66
4.3.2.3	Model Fuel Assembly Power Levels	66
4.3.2.4	Data Acquisition	66
4.3.3	Test Matrix	67
4.3.4	Post Test Checks	69
4.4	SAHTT RESULTS	69
4.4.1	Vacuum Backfill.	69
4.4.1.1	0.5 KW vs. 1.0 KW Model Fuel Assembly Power	70
4.4.1.2	Vacuum Backfill - Orientation Effects	74
4.4.2	Air Backfill	76
4.4.2.1	0.5 KW vs. 1.0 KW Model Fuel Assembly Power	76
4.4.2.2	Air Backfill - Orientation Effects.	80
4.4.3	Helium Backfill	85
4.4.3.1	0.5 KW vs. 1.0 KW Model Fuel Assembly Power	85
4.4.3.2	Helium Backfill - Orientation Effects	85
4.4.4	Backfill Comparisons	86
4.4.4.1	Vertical Orientation Comparisons	86
4.4.4.2	25° Angled Orientation Comparisons.	93
4.4.4.3	Horizontal Orientation Comparisons.	93
4.4.5	Effects of Imposed Boundary Conditions	97
4.4.5.1	Horizontal, Air, 0.5 KW w/o Guard Heat.	97
4.4.5.2	Vertical, Air, 0.5 KW w/o Guard Heat	100
4.4.6	Vacuum Sensitivity Check	100
4.4.7	Isothermal Helium Backfill	100
4.4.8	Fuel Assembly Peak Temperatures.	105
4.4.9	Data Repeatability Tests	105

4.5	SAHTT DATA ACURACIES	105
4.5.1	Quality Assurance	109
5.0	REFERENCES.	111
Appendix A	FTT Thermocouple Locations and Experimental Data	A-1
Appendix B	AGNS SAHTT Design Drawings	B-1
Appendix C	SAHTT Model Fuel Rod Resistance Measurements SAHTT Assembly Thermocouple Locations SAHTT Data Logger Channel Assignments	C-1
Appendix D	SAHTT Data and Selected Data Plots	D-1

LIST OF FIGURES

	<u>Page</u>
3-1 Fuel Temperature Test Assembly	8
3-2 Test Stand	9
3-3 Test Stand Cross Section.	10
3-4 Fuel Assembly Canister	13
3-5 Fuel Assembly Support Cage	14
3-6 Closure Lid Assembly.	17
3-7 Canister Lid Thermowell Identification	18
3-8 Evacuation/Gas Backfill System	20
3-9 PWR Fuel Assembly	23
3-10 Fuel Assembly D15 Measured and Predicted Decay Heat Values	26
3-11 Recommended Fuel Assembly Axial Heat Flux Profile	28
3-12 Drywell Axial Canister Profile Used for FTT Boundary Conditions	31
3-13 Canister and Center Thermowell Axial Temperature Profiles	33
3-14 Radial and Diagonal Temperature Profiles at Selected Axial Levels.	34
4-1 SAHTT Assembly	43
4-2 SAHTT Pressure/Vacuum Vessel (Cask)	44
4-3 Cask Mounted in Skid Assembly	45
4-4 Cask Inner Wall Thermocouples	47
4-5 Transition Piece/Fuel Tube	48
4-6 Fuel Tube Support Feet	50
4-7 Upper Closure Lid	51
4-8 Cross Section of 15x15 Electrically Heated Model Fuel Assembly	53
4-9 Electrically Heated Model Fuel Rod	54
4-10 Assembly Grid Spacer Axial Locations.	56
4-11 Evacuation/Gas Backfill System	57
4-12 SAHTT Assembly Thermocouple Locations	60
4-13 Modified Weld Pad for Assembly T/C Mounts	62
4-14 Axial Temperature Profiles for Vertical, Vacuum, 0.5 and 1.0 KW Conditions	71
4-15 Diagonal Temperature Profiles for Vertical, Vacuum, 0.5 and 1.0 KW Conditions	72
4-16 T/C Locations for Data Plane No. 6 Plots.	73
4-17 T/C Locations for Data Plane No. 9 Plots.	73
4-18 Orientation Effects on Axial Temperature Profiles for Vacuum, 1.0 KW, Vertical, Horizontal, and 25° Conditions	75
4-19 Annulus Convection Effects on Cask I.D. Temperatures for Horizontal, Vacuum, 1.0 KW Conditions	77
4-20 Orientation Effects on Diagonal Temperature Profiles for Vacuum, 1.0 KW, Vertical, Horizontal, and 25° Conditions	78
4-21 Axial Temperature Profiles for Vertical, Air, 0.5 and 1.0 KW Conditions	79

4-22	Diagonal Temperature Profiles for Vertical, Air, 0.5 and 1.0 KW Conditions	81
4-23	Orientation Effects on Axial Temperature Profiles for Air, 1.0 KW, Vertical, Horizontal, and 25° Conditions	82
4-24	Convection Effects on Cask I.D. Temperatures for Horizontal, Air, 1.0 KW Conditions	83
4-25	Orientation Effects on Diagonal Temperature Profiles for Air, 1.0 KW, Vertical, Horizontal, and 25° Conditions	84
4-26	Axial Temperature Profiles for Vertical, Helium, 0.5 and 1.0 KW Conditions	87
4-27	Diagonal Temperature Profiles for Vertical, Helium, 0.5 and 1.0 KW Conditions	88
4-28	Orientation Effects on Axial Temperature Profiles for Helium, 1.0 KW, Vertical, Horizontal, and 25° Conditions	89
4-29	Orientation Effects on Diagonal Temperature Profiles for Helium, 1.0 KW, Vertical, Horizontal, and 25° Conditions	90
4-30	Backfill Effects on Axial Temperature Profiles for Vertical, 1.0 KW, Vacuum, Air, and Helium Conditions	91
4-31	Backfill Effects on Diagonal Temperature Profiles for Vertical, 1.0 KW, Vacuum, Air, and Helium Conditions	92
4-32	Backfill Effects on Axial Temperature Profiles for 25°, 1.0 KW, Vacuum, Air, and Helium Conditions	94
4-33	Backfill Effects on Diagonal Temperature Profiles for 25°, 1.0 KW, Vacuum, Air, and Helium Conditions	95
4-34	Backfill Effects on Axial Temperature Profiles for Horizontal, 1.0 Kw, Vacuum, Air, and Helium Conditions	96
4-35	Backfill Effects on Diagonal Temperature Profiles for Horizontal, 1.0 KW, Vacuum, Air, and Helium Conditions	98
4-36	Axial Temperature Profiles for Horizontal, Air, and 0.5 KW Conditions With and Without Cask Guard Heat	99
4-37	Axial Temperature Profiles for Vertical, Air, and 0.5 KW Conditions With and Without Cask Guard Heat	101
4-38	Axial Temperature Profiles for Vertical, 0.5 KW Conditions with Different Cask Evacuation Pressures	102
4-39	Diagonal Temperature Profiles for Vertical, 0.5 KW Conditions with Different Cask Evacuation Pressures	103
4-40	Axial Temperature Profiles for Horizontal, Helium, and 0.0 KW Conditions (Guard Heat Only)	104
4-41	Diagonal Temperature Profile for Horizontal, Helium, and 0.0 KW Conditions (Guard Heat Only)	106
4-42	Data Repeatability for 25°, Vacuum, 1.0 KW Conditions	108
A-1	Thermowell and Canister Temperature Maps.	A-10

D-1	Cask Surface Temperature Measurement Locations	D-52
D-2	Axial Temperature Profiles - Run No. 1	D-53
D-3	Axial Temperature Profiles - Run No. 2	D-54
D-4	Axial Temperature Profiles - Run No. 2r1.	D-55
D-5	Axial Temperature Profiles - Run No. 2r2.	D-56
D-6	Axial Temperature Profiles - Run No. 2r3.	D-57
D-7	Axial Temperature Profiles - Run No. 3	D-58
D-8	Axial Temperature Profiles - Run No. 4	D-59
D-9	Axial Temperature Profiles - Run No. 5	D-60
D-10	Axial Temperature Profiles - Run No. 6	D-61
D-11	Axial Temperature Profiles - Run No. 7	D-62
D-12	Axial Temperature Profiles - Run No. 8	D-63
D-13	Axial Temperature Profiles - Run No. 9	D-64
D-14	Axial Temperature Profiles - Run No. 10	D-65
D-15	Axial Temperature Profiles - Run No. 11	D-66
D-16	Axial Temperature Profiles - Run No. 12	D-67
D-17	Axial Temperature Profiles - Run No. 13	D-68
D-18	Axial Temperature Profiles - Run No. 14	D-69
D-19	Axial Temperature Profiles - Run No. 15	D-70
D-20	Axial Temperature Profiles - Run No. 16	D-71
D-21	Axial Temperature Profiles - Run No. 17	D-72
D-22	Axial Temperature Profiles - Run No. 18	D-73
D-23	Axial Temperature Profiles - Run No. 19	D-74
D-24	Axial Temperature Profiles - Run No. 20	D-75
D-25	Axial Temperature Profiles - Run No. 21	D-76
D-26	Axial Temperature Profiles - Run No. 22	D-77
D-27	Orientation Effects on Axial Temperature Profiles for Vacuum, 0.5 KW, Vertical, Horizontal, and 25° Conditions	D-78
D-28	Orientation Effects on Diagonal Temperature Profiles for Vacuum, 0.5 KW, Vertical, Horizontal, and 25° Conditions	D-79
D-29	Orientation Effects on Axial Temperature Profiles for Air, 0.5 KW, Vertical, Horizontal, and 25° Conditions	D-80
D-30	Orientation Effects on Diagonal Temperature Profiles for Air, 0.5 KW, Vertical, Horizontal, and 25° Conditions	D-81
D-31	Orientation Effects on Axial Temperature Profiles for Helium, 0.5 KW, Vertical, Horizontal, and 25° Conditions	D-82
D-32	Orientation Effects on Diagonal Temperature Profiles for Helium, 0.5 KW, Vertical, Horizontal, and 25° Conditions	D-83
D-33	Backfill Effects on Axial Temperature Profiles for Vertical, 0.5 KW, Vacuum, Air, and Helium Conditions	D-84
D-34	Backfill Effects on Diagonal Temperature Profiles for Vertical, 0.5 KW, Vacuum, Air, and Helium Conditions	D-85
D-35	Backfill Effects on Axial Temperature Profiles for 25°, 0.5 KW, Vacuum, Air, and Helium Conditions	D-86

D-36	Backfill Effects on Diagonal Temperature Profiles for 25°, 0.5 KW, Vacuum, Air, and Helium Conditions	D-87
D-37	Backfill Effects on Axial Temperature Profiles for Horizontal, 0.5 KW, Vacuum, Air, and Helium Conditions	D-88
D-38	Backfill Effects on Diagonal Temperature Profiles for Horizontal, 0.5 KW, Vacuum, Air, and Helium Conditions	D-89

LIST OF TABLES

		<u>Page</u>
3-1	Turkey Point PWR Fuel Assembly Design Data	24
3-2	Assembly D15 Fuel Temperature Test Summary	30
3-3	Maximum Observed Temperatures for Fuel Temperature Tests 7, 8, and 9	35
4-1	SAHTT Equipment	41
4-2	SAHTT Test Matrix	68
4-3	Power, Backfill, and Orientation Effects on Measured Peak Clad Temperatures	107
A-1	Fuel Temperature Test Thermocouple Locations.	A-1
A-2	Fuel Temperature Test No. 7 Thermocouple Data	A-7
A-3	Fuel Temperature Test No. 8 Thermocouple Data	A-8
A-4	Fuel Temperature Test No. 9 Thermocouple Data	A-9
C-1	SAHTT Model Fuel Rod Resistance Measurements.	C-1
C-2	SAHTT Assembly T/C Locations.	C-3
C-3	SAHTT Data Logger Channel Assignments	C-7
D-1	SAHTT Thermocouple Data	D-1
D-2	SAHTT Cask Surface Temperatures	D-51

LIST OF ACRONYMS

AESD - Advanced Energy Systems Division
AGNS - Allied General Nuclear Services
ANSI - American National Standards Institute
BNFP - Barnwell Nuclear Fuel Plant
BWR - Boiling Water Reactor
CSFM - Commercial Spent Fuel Management
CWSFP - Commercial Waste and Spent Fuel Packaging
DOE - Department of Energy
EA - Environmental Assessment
E-MAD - Engine Maintenance, Assembly and Disassembly
EOHL - End of Heated Length
FTT - Fuel Temperature Test
LWR - Light Water Reactor
MRS - Monitored Retrievable Storage
MWD/MTU - Megawatt day per metric ton uranium
NBS - National Bureau of Standards
NWPA - Nuclear Waste Policy Act
PNL - Pacific Northwest Laboratory
PWR - Pressurized Water Reactor
SAHTT - Single Assembly Heat Transfer Tests
SFHPP - Spent Fuel Handling and Packaging Program
SFT-C - Spent Fuel Test at Climax
SOHL - Start of Heated Length
T/C - thermocouple
TPFT - Transition Piece Fuel Tube

1.0 INTRODUCTION

The United States Department of Energy (DOE) is preparing a proposal to Congress for the development of Monitored Retrievable Storage (MRS) facilities which, if approved, will be used for consolidation, packaging, and temporary storage of spent fuel and high level waste from commercial nuclear power operations. The proposal and a supporting Environmental Assessment will be delivered to Congress in January, 1986.

One of the requirements of the MRS facility designs is that the storage system (sealed storage casks or field drywells) must passively dissipate decay heat while maintaining temperatures of the stored materials below allowable limits. The ability to accurately predict the storage facility heat transfer characteristics is, therefore, an essential element of the design process since it potentially affects the degree of conservatism required in the design and ultimately the cost of the facility.

To be credible, especially in the licensing area, thermal performance predictions upon which the facility design is based must be supported by relevant test results and/or confirming calculations obtained with "qualified" computational techniques (computer codes). The qualification of a code for a given application generally involves the comparison of code predictions with the results of relevant experiments or tests. The credibility of a code is proportionally increased by the number of such comparisons that can be provided in its support.

The reported tests are two such data sets from heat transfer experiments relevant to MRS facility designs which have been selected by the MRS program to evaluate and qualify needed thermal analysis codes. Additional activities to develop other such data sets are currently underway in the DOE's Commercial Spent Fuel Management (CSFM) Program that will further support ongoing code qualification efforts.

This document provides detailed descriptions of the two selected data sets in sufficient detail to allow an analyst to set up and run a simulation which may then be compared for accuracy against the test results. The data will be used to evaluate codes used for MRS design evaluations. In addition, these data sets will be available for use by others to evaluate the applicability of thermal codes in other applications.

This document contains a general description of the purpose and nature of the two reported tests, a detailed description of the test assemblies, specifications of the relevant test conditions and complete tabular and graphical presentations of the experimental results. Described first are selected Fuel Temperature Tests (FTT) performed as part of the DOE's Spent Fuel Handling and Packaging Program (SFHPP) and Commercial Waste and Spent Fuel Packaging (CWSFP) Program. The work was performed by Westinghouse Electric Corporation's Advanced Energy Systems Division in the Engine Maintenance and Disassembly (EMAD) facility at the Nevada Test Site (see reference [1]). In these tests a single PWR spent fuel assembly was installed in a fully instrumented vertical steel canister containing different gases and with electric heaters on the liner which allowed imposition of controlled boundary temperatures. The primary objective of the tests was to provide spent fuel assembly internal temperature data for a variety of simulated dry storage conditions. The EMAD Fuel Temperature Tests have been fully reported in several previous documents (see references) and the description and data are repeated here primarily for the convenience of consolidating single assembly experimental data useful to the MRS program and associated code evaluation efforts.

The second test effort described herein is the Single Assembly Heat Transfer Test (SAHTT) first performed by Allied General Nuclear Services at their Barnwell Nuclear Fuel Plant for DOE's Commercial Spent Fuel Management (CSFM) Program and subsequently completed by PNL at DOE's Hanford Site. These tests used an electrically heated model fuel assembly to simulate a spent PWR fuel assembly. The objective was to assess the effects in dry storage of various storage atmospheres, orientations, controlled boundary temperatures, and decay heat levels. This documentation of the SAHTT program is the first published report of these tests.

2.0 CONCLUSIONS AND RECOMMENDATIONS

Based on thorough examination of the results from the FTT and SAHTT efforts, the following conclusions and recommendations are presented.

2.1 Conclusions

Fuel Temperature Tests:

1. For the 1.17 kW decay heat level of the vertical spent fuel assembly tested, measured peak fuel assembly temperatures were 266 °C for the vacuum backfill, 255 °C for the air backfill, and 226 °C for the helium backfill.
2. Helium backfill is a noticeably better radial heat conductor than air backfill and produced the lowest center thermowell-to-canister temperature differences in all tests.
3. Air backfill is a better axial heat convector than helium. Convection with air backfill produced canister and thermowell temperatures skewed toward the upper end of the assembly. The skewness was sufficiently great that fuel temperatures at the upper end exceeded those for the vacuum backfill.
4. Maximum center thermowell temperatures occurred at an elevation slightly above the active fuel midplane for all three backfills.
5. The 15 axial thermowell tubes provided in the test assembly for measuring temperatures within the spent fuel assembly reduced fuel assembly upper end temperatures by creating additional heat conduction paths which would not occur in an actual spent fuel assembly. However, this conduction path did not apparently offset peak temperatures.

Single Assembly Heat Transfer Tests:

1. The SAHTT tests were performed at two power levels; 0.5 and 1.0 KW. For the 1.0 KW runs the peak clad temperatures for the vacuum backfill were ~295°C, for the air backfill ~275°C, and for the helium backfill ~250°C. For the 0.5 KW runs the peak temperatures were ~240°C for vacuum, ~230°C for air, and ~215°C for helium backfills. Orientation had

little effect on the magnitude of measured peak temperatures.

2. Measured peak rod temperatures were consistently near the the axial centerline of the model fuel assembly's heated length regardless of backfill or orientation.

3. Temperature profiles were very similar for the two model fuel assembly power levels - only the magnitudes of the temperatures changed.

4. For the case of an evacuated cask, the measured peak fuel to wall temperature differences approximately doubled for a doubling of the fuel assembly power level. Further analysis of this effect may be needed since the increase in the observed temperature difference is greater than would be predicted based on simple radiation heat transfer effects.

5. Different gas backfills were also used in these tests. Radiation heat transfer in the vacuum environment was the least effective while the conduction dominant helium environment was the most effective heat transport media.

6. In air backfills, convective effects increase for higher fuel assembly power levels, i.e. larger differential temperatures induce greater degrees of convective heat transport.

7. Lateral temperature profiles show that radial heat transport is primarily via radiation in both the air and vacuum backfills (i.e. air is a relatively poor conductor and convection is a primarily axial mechanism). Flatter lateral profiles for helium backfills are evidence of more effective conduction heat transfer.

8. Different orientations (vertical, horizontal, and inclined) were also investigated in these tests. Axial temperature profiles shift markedly with orientation changes in an air backfill. However, the magnitudes of the measured peak temperatures are essentially unaffected. Minimal lateral convection is evident in the horizontal and inclined orientations.

9. No significant orientation effects were observed for evacuated cask testing. However, minor boundary temperature effects were observed due to convection within the air-filled annulus of the double walled cask

especially for the horizontal orientation.

10. Only very minimal orientation effects were observed under helium backfill test conditions.

11. Axial convection in the air backfill, vertical and inclined orientations resulted in significantly altered thermal profiles with temperatures greater than those of the vacuum backfill at the uppermost axial levels of the assembly.

12. For an air backfill in the horizontal orientation (where axial convection is minimized), available lateral convection and conduction combine to lower temperatures markedly below those for the vacuum backfill condition.

2.2 Recommendations

1. These test results should be used to assist in the design of single assembly dry storage systems, e.g. drywells, and should be used to aid instrumentation placements in dry storage system tests and demonstrations.

2. These test results should be used for initial evaluations of thermal analysis computer codes that may eventually be used in MRS and other spent fuel storage analysis and design efforts.

3. Limitations of these single assembly experiments and the related code comparison efforts must be realized. Extrapolation of the single assembly test results to multi-assembly spent fuel storage configurations should not be done. Evaluations of codes for multi-assembly analyses will require direct comparisons with results from multi-assembly spent fuel storage tests as they become available.

4. Tests should be conducted in multi-assembly system configurations to gain an understanding of the heat transfer phenomena associated with a number of assemblies and to provide a multi-assembly data base for computer code evaluations.

3.0 FUEL TEMPERATURE TESTS

Single assembly Fuel Temperature Tests (FTT), performed in a test stand in one of the E-MAD process cells, resulted in spent fuel assembly internal temperatures under simulated drywell and concrete silo dry storage conditions (see reference [1]). Temperature controlled electric resistance heaters were used to simulate liner temperature profiles (measured during in-ground Drywell tests) as controlled boundary conditions. This section describes selected Fuel Temperature Tests and includes test objectives, hardware descriptions, test operations, and test results.

3.1 FTT OBJECTIVES

The primary objective of the single assembly FTT was to provide spent fuel assembly internal temperature data under simulated dry storage conditions to verify that PWR spent fuel assemblies with a decay heat level of 1.0 KW could be stored in drywells and concrete silos at the Nevada Test Site without exceeding design temperature limits. Another objective was to provide spent fuel assembly internal temperature data to determine axial and radial temperature profiles of the canister and fuel cladding and thus aid in computer code evaluation.

3.2 HARDWARE DESCRIPTIONS

The following sections contain brief descriptions of the FTT test hardware. Additional detail can be obtained in reference [1].

3.2.1 Test Arrangement

The FTT hardware consisted of a main test assembly with a number of auxiliary systems and components. The main test assembly is illustrated in Figure 3-1. The test assembly consisted of: 1) a test stand which supported a representative storage cell liner, 2) a seismic restraint fixture providing test stand lateral support, 3) a test canister (representative of a storage canister), 4) a canister lid assembly containing instrumented tubes which were inserted into the spent fuel assembly, and 5) a PWR spent fuel assembly. Figures 3-2 and 3-3 show the relative dimensions, elevations, and

FIGURE 3-1. Fuel Temperature Test Assembly (from Unterzuber, ref [1])

FIGURE 3-2. Test Stand

FIGURE 3-3. Test Stand Cross Section (from Unterzuber, ref. [1])

configuration of the test assembly. Auxiliary equipment included: 1) an evacuation and backfill system, 2) test stand electric heater controls, 3) thermocouples and 4) a data acquisition system to record thermocouple data.

3.2.2 Test Stand

The FTT test stand (Figure 3.1) consists of a large tubular steel frame, a test stand lifting fixture, a storage cell liner, a series of band heaters, an insulation sheath along the length of the liner, an insulation plug at the bottom of the liner, thermal insulation, and a set of thermocouples. Each of the primary components is described below.

The liner (Figure 3.2 and 3.3) was a 508 cm (200 inch) long section of 45 cm (18 inch) diameter by 0.64 cm (0.25 inch) thick carbon steel pipe welded to the test stand I-beams. The liner was supported by four channels with pinned connections at both ends accommodating liner thermal expansion.

Electric band heaters were provided on the liner outside surface to impose desired axial temperature distributions on the liner and canister. A total of 34 band heaters, located along the liner's total length, were spaced 15.25 cm (6 inches) apart with the top band heater 5.1 cm (2 inches) below the liner top. The positions of the band heaters are illustrated in Figure 3-2.

The liner and band heaters were surrounded by 0.64 mm (0.025 inch) thick type 304 stainless steel insulation sheath. A 1.27 cm (0.5 inch) thick insulation blanket was wrapped around the sheath, covered with a layer of aluminized cloth and secured by 0.81 mm (0.032 inch) diameter wire. An insulation plug with an electric heater was installed in the liner bottom to impose the appropriate temperature conditions (see Figure 3-2). A tubular heater was located under the top plate and above the intermediate plate and insulation. Details of the insulation plug are provided in Figure 3-1.

A total of 71 thermocouples were attached to the test stand. Of these, fifty-five thermocouples were attached to the liner, six to the insulation sheath, five to the test stand frame, three to the outside of the insulation blanket, and two to the top plate of the insulation plug. Of the 71 thermocouples, 53 provided test temperature data (see Section 3.2.9) and 18 provided temperature feedback to the heater controllers (see Section 3.2.7).

The positions of all test stand data and liner band heater control thermocouples are tabulated in Table A-1, Appendix A. One of the two thermocouples placed on the insulation plug top plate provided data and the other provided feedback for the plug heater controller. Thermocouples along the length of the insulation sheath and on the insulation blanket provided data for evaluating test stand performance. The five thermocouples mounted on the test stand provided ambient temperature data.

3.2.3 Seismic Restraint Fixture

A test stand seismic restraint fixture (Figure 3.1) provided lateral seismic support. The seismic restraint fixture is a welded structure of carbon steel tubing, angle, and bar and was secured to the floor by bolts at four places. The restraint fixture is 305 cm (120 inches) high and 183 cm (72 inches) wide and consists of a rectangular frame to interface with the test stand and a support leg structure. Details of the support structure construction are available in reference [1].

3.2.4 Test Canister

The test canister (Figure 3.2 and 3.3) consisted of a 304 stainless steel canister body and a carbon steel upper support. The test canister can accommodate one PWR spent fuel assembly. Additional details of the canister are shown in Figure 3-4.

The canister body consists of a standard 35.56 cm (14 inch) outside diameter by 0.95 cm (0.375 inch) thick by 407 cm (160.4 inch) long pipe to which is welded a standard 16.51 cm (6.5 inch) high ellipsoidal end cap. The end cap had welded into it a cruciform formed of 1.91 cm (0.75 inch) thick horizontal plate with four 0.64 cm (0.25 inch) thick vertical gussets welded to the underside. The cruciform supports the bottom of the PWR fuel assembly. The cruciform plate is welded to a fuel assembly vertical support cage (Figure 3-5). This cage provided lateral support over the entire length of the PWR fuel assembly.

The test canister upper support structure consisted of a 15.2 cm (6 inch) long section of 40.6 cm (16 inch) outside diameter by 2.5 cm (1 inch) thick pipe welded to a 2.5 cm (1 inch) thick by 46.4 cm (18.25 inch) outside

WKNQ	QTY	DESCRIPTION	MATERIAL
1	4	CANNISTER TO LINER MOUNTING BRACKET	CARBON STEEL
2	1	TOP PLATE	
3	1	UPPER SUPPORT	304 SST
4	1	CANNISTER BODY 14" SCHED 30 PIPE	
5	1	CANNISTER BODY END CAP 14" SCHED 30	
6	2	SUPPORT WEB	
7	1	SUPPORT WEB	
8	1	BOTTOM CRUCIFORM PLATE	
9	1	FUEL ASSEMBLY SUPPORT FRAME	

NOTE

ALL DIMENSIONS ARE IN MILLIMETERS EXCEPT AS NOTED

FIGURE 3-4. Fuel Assembly Canister

FIGURE 3-5. Fuel Assembly Support Cage

diameter by 35.7 cm (14.06 inch) inside diameter ring. The 40.6 cm (16 inch) diameter pipe was welded to the canister body about 5.1 cm (2.00 inches) below the top of the body pipe. The 2.5 cm (1 inch) thick ring supported the entire test canister on top of the liner pipe. Welded to the outside of this ring were four square brackets with clearance holes for the bolts to hold the test canister in the liner. The ring has four threaded holes on the top surface for the closure lid holddown studs.

After the canister body was welded to the upper support, the top of the body was machined to have a 0.51 mm (0.02 inch) high "knife-edge" at a 34.7 cm (13.65 inch) diameter. A 1.5 mm (0.06 inch) thick copper gasket was seated on the canister body top. When clamped against the canister body "knife-edge" by the closure lid (which has a matching "knife-edge"), the gasket provided a positive seal.

A tubular heater was attached to the top of the canister support ring to impose the desired boundary temperatures. The heater was clamped against the canister by clips screwed into the canister support ring top surface. Also attached to the top of the support ring were the four closure lid holddown studs.

Twenty-four thermocouples on the test canister provided canister wall temperature data and heater control. One thermocouple, located on the top surface of the canister support ring, provided feedback to the canister lid heater controller. Another thermocouple was located on the outside diameter of the support ring and a third on the outside of the support pipe. Twenty thermocouples were located at five different elevations on the outside of the canister pipe. Eight thermocouples were equally spaced around the canister circumference at the fuel midplane elevation. Four thermocouples were equally spaced around the canister at elevations about 88.9 cm (35 inches) above and below the midplane. One thermocouple was located at the center of the ellipsoidal end cap. Table A-1, Appendix A, provides a tabulation of canister thermocouple locations.

All but four of the canister thermocouples were attached directly to the canister components by 0.25 mm (0.01 inch) thick by 0.64 cm (0.25 inch) wide straps spot welded approximately 1.27 cm (0.5 inches) above the thermocouple tip. The remaining four thermocouples were inserted into instrumentation

tubes typical of those on the Drywell storage canisters to determine the effects such instrumentation tubes have on canister temperature measurements.

3.2.5 Canister Closure Lid

The test canister closure lid assembly consisted of a 304 stainless steel canister lid plate, a carbon steel cover plate, fifteen 304 stainless steel thermowell tubes, an evacuation and backfill pipe, an insulation cover, insulation, two holddown bars, a tubular heater, and a network of thermocouples. The canister lid plate simulated the storage canister lid and provided a sealing surface to seal the test canister. The thermowells allowed for thermocouples to be placed in close proximity to the fuel cladding for fuel assembly temperature measurement and still maintain a canister pressure boundary. Details of the closure lid assembly are illustrated in Figure 3-6.

The canister lid was made of a 6.35 cm (2.5 inch) thick by 35.6 cm (14 inch) diameter plate. A 1.27 cm (0.5 inch) thick flange was formed by machining the lower 5.08 cm (2 inch) to a 33.9 cm (13.34 inch) diameter to interface with the inside of the canister body pipe. A "knife-edge" was machined into the lower side of the flange at a 34.7 cm (13.65 inch) diameter to provide a seal similar to that of the canister with the copper gasket placed between the canister and lid. The canister lid had fifteen 1.0 cm (0.39 inch) diameter penetrations into which were seal welded 0.95 cm (0.375 inch) diameter by 0.87 mm (0.032 cm) thick thermowell tubes. The tubes were positioned so as to be inserted into the PWR fuel assembly control rod guide thimble tubes and center instrumentation tube (see Figure 3-7). The tubes have five different lengths ranging from 336.6 to 346.7 cm (132.5 to 136.5 inches) with a set of three tubes having the same length (as specified in Figure 3-6) to simplify remote insertion into the fuel assembly. At the end of each tube was welded a 1.9 cm (0.75 inch) long plug with a spherical end. In addition to the thermowells, the lid had a 1.63 cm (0.64 inch) diameter hole into which was welded 1.59 cm (0.625 inch) outside diameter by 1.65 mm (0.065 inch) thick 304 stainless steel evacuation and backfill pipe. The pipe was 40.6 cm (16 inches) long and extended above the closure lid cover plate.

The closure lid cover plate (see Figure 3-6) consists of a 1.27 cm (0.5 inch) thick by 35.3 cm (13.88 inch) diameter plate which is supported above the canister lid by four 3.18 cm (1.25 inch) by 1.27 cm (0.5 inch) by 10.16 cm

FIGURE 3-6. Closure Ltd Assembly

FIGURE 3-7. Canister Lid Thermowell Identification (from Unterzuber, ref. [1])

(4.0 inch) long bars. These bars were welded to both the lid and cover plate. The cover plate has clearance holes provided above each thermowell to allow thermocouple routing and a clearance hole for the evacuation and backfill pipe. A thermocouple support bracket was welded to the top of the cover plate. A 0.80 cm (0.315 inch) diameter incoloy sheathed tubular heater was attached to the top of the cover plate by clips screwed into the plate. The heater was bent to form a 17.8 cm (7 inch) square and provided heat to the cover plate to impose the desired temperatures on the canister lid. Above the cover plate, an insulation cover was provided which supports a 1.3 cm (0.5 inch) thick layer of fiberglass insulation.

A total of 110 thermocouples were provided on the closure lid assembly. Of these, seven were placed in each of the 15 thermowells, two were attached to the closure lid, and three were attached to the cover plate. One of the three thermocouples on the cover plate provided feedback for the tubular heater controller; the other 109 thermocouples provided temperature data. The thermocouples on the closure lid and cover plates were secured by 0.25 mm (0.01 inch) thick by 6.4 mm (0.25 inch) wide spot welded straps located about 1.27 cm (0.5 inch) from the thermocouple tip. The thermocouples for each thermowell were assembled into a bundle and wire tied together to maintain tip position. The bundles were inserted into the thermowell tubes so the tips hang within the tube at the proper elevation. These thermocouples were secured to the cover plate at the thermocouple bracket by a thin plate screwed onto the bracket. The specific locations for each thermocouple on the closure lid assembly are tabulated in Table A-1, Appendix A.

3.2.6 Evacuation/Gas Backfill System

An evacuation/gas backfill system was provided for the FTT to allow the test canister to be filled with various gaseous media for fuel temperature response testing. The evacuation/gas backfill system is shown schematically in Figure 3-8. The system was attached to a flexible hose on the closure lid assembly pipe after the entire test stand was positioned in the process cell.

The evacuation and backfill system consisted of stainless steel tubing, six valves, three pressure gauges, a vacuum pump, a helium supply bottle with pressure regulator, and various fittings. A 14 m (45 foot) long section of flexible stainless steel hose was attached to an elbow on the closure lid

FIGURE 3-8. Evacuation/Gas Backfill System (from Unterzuber, ref. [1])

pipe. A quick disconnect fitting on the other end of the flexible hose remotely attached to a mating connector fitting which was mounted to a connector panel. From this connector a 1.27 cm (0.5 inch) diameter rigid tube was routed to the vacuum system. A pressure gauge was provided in this line to allow system pressure reading from the operator gallery. From the pressure gauge, four shutoff valves were interconnected with the vacuum pump line, the line to the helium bottle, and a vent to atmosphere to allow remote evacuation, backfill, and venting of the system. An additional line was routed to an adjacent hot cell to allow for gas sampling of the test canister.

3.2.7 Heaters and Heater Controls

A total of 37 heaters were attached to the test hardware. Thirty-four band heaters were strapped to the length of the liner and one tubular heater each was attached to the top of the liner lower insulation plug, the canister support ring, and the closure lid cover plate. High temperature radiation resistant wire connected these heaters to a set of temperature controllers.

The liner band heaters each have a 500 watt capacity at 120 volts AC. Adjacent pairs of the 34 band heaters were wired together to 17 individual controllers so that a different temperature could be imposed on the liner every 30.5 cm (12 inches) along the length of the liner. This allowed input of any desired axial temperature profile on the liner. The band heaters combined maximum power output was 17 KW. The canister lid tubular heater and the insulation plug tubular heater each had a 225 watt capacity at 120 volts AC; the canister support ring tubular heater had a capacity of 450 watts at 120 volts AC. The total heater capacity for the tubular heaters was 0.9 KW. Each of these heaters was wired separately to individual controllers.

The heater temperature controllers have a 90 to 315°C (200 to 600°F) variable temperature control setting, a 10 amp contact rating at 120 volts AC, a control accuracy of $\pm .5^{\circ}\text{C}$, and are designed for use with thermocouple sensors. A sensor protector de-energizes the load power if a control thermocouple fails.

3.2.8 Data Acquisition System

The data acquisition system for the FTT consisted of the arrays of thermocouples previously described, a data logger unit, and remote signal conditioning/multiplexing units. Remote attachment of the thermocouples and extension wire is made in the process cell to route the leads through the shield wall to multiplexer units located in the operator gallery. Signal cables are then routed through cable trays to the data logger unit.

The data logger can handle up to 1000 Type K thermocouples and with remote signal conditioning and multiplexing can include instrumentation up to 1500 m (5000 ft.) from the logger mainframe. The data logger unit is fitted with open circuit detection to allow ready determination of thermocouple failures. The digital readout at the console has identified engineering units selectable from the logger front panel. An integral printer is used for data output with header and engineering unit identification.

3.2.9 Thermocouples

All thermocouples were of Type K (chromel-alumel) with ungrounded junction enclosed in a 1.55 mm (0.062 inch) diameter 304 stainless steel sheath. Two 24 gauge Type K extension wires were brazed to the thermocouple wires and enclosed in a stainless steel transition boot. The transition boot was crimped onto the end of the thermocouple cable sheath and filled with epoxy. The sheathed thermocouple wire was used in areas where high temperatures could exist during testing.

3.2.10 PWR Spent Fuel Assembly

The PWR spent fuel assembly utilized in the FTT was an assembly acquired for the Spent Fuel Test at Climax (SFT-C) program (reference [2]) from the Florida Power and Light Turkey Point Unit Number 3. The fuel assembly chosen for testing in the Phase III test was fuel assembly D15. The basic PWR fuel assembly configuration and some specific details about fuel assembly D15 are provided in the remainder of this section.

A representative Turkey Point PWR fuel assembly is shown schematically in Figure 3-9. Table 3-1 provides selected design data for standard Turkey Point fuel assemblies. The fuel assembly is 409.7 cm (161.3 inches) long (prior to

FIGURE 3-9. PWR Fuel Assembly

TABLE 3-1

Turkey Point PWR Fuel Assembly Design Data

Vendor	Westinghouse Electric Corp.
Type (Rod Array)	15 x 15
Assembly Parameters	
Transverse Dimension	21.4 cm (8.426 in.)
Assembly Weight	652.73 kg (1439 lb)
Assembly Length	409.7 cm (161.3 in.)
Control Rod Guide Thimble Tubes	
Number	20
Upper OD	1.39 cm (0.546 in.)
Wall Thickness	0.43 mm (0.017 in.)
Material	Zr-4
Instrument Tubes	
Number	1
OD	1.39 cm (0.546 in.)
Wall Thickness	0.43 mm (0.18 in.)
Material	Zr-4
Spacer Grids	
Number	7
Material	Incone1 718
Spring Material	Incone1 718
Fuel Rods	
Number	204
Length	386.08 cm (152.0 in.)
OD	1.07 cm (0.422 in.)
Wall Thickness	0.62 mm (0.0243 in.)
Material	Zr-4
Fuel Length	365.76 cm (144.0 in.)
Top Nozzle Material	304 SS
Bottom Nozzle Material	304 SS
Plenum Springs	
Working Length	17.27 cm (6.80 in.)
Material	Incone1 718
Fuel Pellet	
Material	UO ₂
Enrichment	2.559 Weight % U ²³⁵
Density	92% Theoretical

irradiation) with a square cross section having a maximum distance across flats of 21.4 cm (8.43 inches) (including grids). The overall length is made up of a top nozzle, the fuel rods, and the bottom nozzle. The fuel rods consist of a 15 by 15 array of 10.72 mm (0.422 inch) diameter Zircaloy cladding containing uranium oxide pellets. The fuel rods are arranged in a square pattern with 14.30 mm (0.563 inches) between centers. The active fuel length is 365.7 cm (144 inches). The fuel rods are laterally constrained by a series of seven grids located along the length of the rods. The PWR fuel assembly is supported by the bottom nozzle when in the vertical position. The bottom nozzle has four square feet located at the corners of the assembly. These feet interfaced with the cruciform in the bottom of the test canister (see Figure 3-5). The PWR fuel assembly weighs approximately 657.7 kg (1450 pounds).

To enable measurement of temperatures in the center fuel assembly instrumentation tube using the FTT closure lid, a clearance hole had to be made through the fuel assembly top nozzle. This was accomplished prior to fuel shipment to E-MAD from the Battelle Columbus Laboratory (where fuel assembly D15 and other SFT-C fuel assemblies were nondestructively tested). A 7.62 cm (3 inch) diameter hole was cut into the fuel assembly top nozzle plate and a steel plug with a clearance hole in the center was installed in the hole in the nozzle plate. This hole provided the necessary access for closure lid central thermowell insertion.

Turkey Point PWR fuel assembly D15 was discharged on November 19, 1977 after a total of 851 effective full power days. The calculated burnup for this fuel assembly is 28,430 MWD/MTU. The initial uranium loading was 457 kilograms and the estimated power level at discharge was 896 KW. The calculated (using the ORIGEN2 computer code) nominal decay heat and calorimeter measured (see reference [3]) decay heat levels for fuel assembly D15 have been plotted for the period from June 1980 through July 1983 in Figure 3-10 for comparison. The decay heat levels for fuel assembly D15 were derived from the boiling water calorimetry measurements (see reference [3]) made on the assembly prior to (July 8, 1980) and after (January 5, 1981) the subject fuel temperature tests. Logarithmic interpolation between the calorimetry measured values resulted in a 1.17 KW decay heat for air test No. 7, 1.17 KW decay heat for vacuum test No. 8, and 1.16 KW for helium test No.

FIGURE 3-10. Fuel Assembly D15 Measured and Predicted Decay Heat Values

9 (see Figure 3-10). These values are subject to the same $\pm 5\%$ accuracy as the calorimeter measurements (see reference [1]).

The axial distribution of the decay heat in fuel assembly D15 that is recommended to be used in thermal analysis was inferred by interpretations of data given in reference [4]. In particular, a selected sample of individual fuel pin relative gamma vs. axial position plots were normalized to a relative flux vs. position. Gamma flux was then assumed directly proportional to decay heat flux. A plot of the resulting assumed relative heat flux versus axial position is shown in Figure 3-11.

3.3 FTT OPERATIONS

Details relating to the operations and performance of the FTT effort are presented in the following sections.

3.3.1 Test Sequence

The Fuel Temperature Test operations were divided into three separate test phases. The Phase I test consisted of test assembly electrical checkout and calibration using an electrically heated calibration assembly. The Phase II testing consisted of imposing various canister temperature profiles and canister internal atmospheres on the test assembly containing a PWR fuel assembly with a decay heat level of approximately 1.0 KW. The Phase III tests consisted of imposing various canister temperature profiles and canister internal atmospheres on the test assembly containing PWR fuel assembly D15 with a decay heat level of approximately 1.2 KW. The Phase III test plan included test runs with no band heater power, imposing the Electrically Heated Drywell Test canister profile, imposing the Drywell 5 canister profile, imposing the Spent Fuel Test at Climax (SFT-C) canister profile and imposing various uniform canister temperature profiles ranging from 176 to 316°C (350 to 600°F) (see reference [1]).

In this report, the results of only three selected tests (air, helium and vacuum internal atmospheres for the Drywell 5 canister profile boundary conditions, i.e., Tests 7, 8, and 9 conducted in December, 1980) are presented. These tests provide an extensive array of both fuel bundle and

FIGURE 3-11. Recommended Fuel Assembly Axial Heat Flux Profile

storage canister temperatures for a variety of backfill media wherein the primary heat transfer mechanisms of radiation (vacuum), conduction (helium) and convection (air) were investigated.

3.3.2 Phase III Testing (Fuel Assembly D15)

Phase III test operations consisted of installing spent fuel assembly D15 into the test stand canister, placing the test assembly in the process cell for testing, and conducting a series of simulated storage cell thermal tests and uniform canister temperature tests with either air, helium, or vacuum inside the test canister. Fuel assembly installation and test assembly completion were performed remotely in the E-MAD Hot Bay. In addition to the FTT operations, calorimetry of the spent fuel assembly was performed prior to and after test operations using the boiling water calorimeter located in the Hot Bay. Results from the boiling water calorimeter runs were interpolated to give decay heat levels for the spent fuel assembly at the time of the FTT. Details of the calorimetry procedure and results are contained in references [3], [5], and [6].

For each of the backfill media of the subject tests indicated in Table 3-2, the heater controllers were set to provide a predetermined liner temperature profile. Once the test assembly temperatures stabilized, the heater controllers were adjusted to impose the desired canister temperature profile within $\pm 2.8^{\circ}\text{C}$ ($\pm 5^{\circ}\text{F}$) (Figure 3-12). The test assembly was allowed to reach thermal stabilization, and final temperatures were recorded. Thermal stabilization was determined by examining the center thermowell fuel midplane thermocouple temperature readings versus time. The stabilization criterion was that temperatures not vary by more than $\pm 0.6^{\circ}\text{C}$ ($\pm 1^{\circ}\text{F}$) in a 24 hour period. Data logger printouts during the tests were made every four hours.

The evacuation and backfill system affected the canister backfill media changes. For the air backfill tests, the vent valve was left open to the atmosphere. The helium backfill was maintained at 6.9 ± 3.5 KPA (1.0 ± 0.5 psig) during each of the helium tests by the preset helium bottle supply pressure. Overpressure was relieved by opening the vent valve. For either of these two backfills, the test canister was evacuated prior to filling. The vacuum tests were conducted with the vacuum pump running constantly. The system pressure was maintained at about -610 mm (-24 inches) of mercury for

TABLE 3-2

Assembly D15 Fuel Temperature Test Summary

<u>Test Conditions</u>	<u>Backfill</u>	<u>Date Completed</u>
Band Heaters Off	Air	9/26/80
Band Heaters Off	Vacuum	9/30/80
Band Heaters Off	Helium	10/3/80
350°F Uniform Canister Profile	Air	10/8/80
400°F Uniform Canister Profile	Air	10/10/80
500°F Uniform Canister Profile	Air	10/17/80
500°F Uniform Canister Profile	Vacuum	10/20/80
500°F Uniform Canister Profile	Helium	10/22/80
400°F Uniform Canister Profile	Helium	10/27/80
400°F Uniform Canister Profile	Vacuum	10/31/80
450°F Uniform Canister Profile	Vacuum	11/3/80
450°F Uniform Canister Profile	Helium	11/5/80
450°F Uniform Canister Profile	Air	11/7/80
550°F Uniform Canister Profile	Air	11/12/80
550°F Uniform Canister Profile	Vacuum	11/14/80
550°F Uniform Canister Profile	Helium	11/17/80
600°F Uniform Canister Profile	Helium	11/20/80
Drywell Canister Profile (Test 7)	Air	12/8/80
Drywell Canister Profile (Test 8)	Vacuum	12/10/80
Drywell Canister Profile (Test 9)	Helium	12/14/80
Electrically Heated Drywell Canister Profile	Helium	12/19/80
SFT-C Canister Profile	Helium	12/22/80
SFT-C Canister Profile	Vacuum	12/27/80
Electrically Heated Drywell Canister Profile	Vacuum	12/31/80
Band Heaters Off	Air	1/5/81

FIGURE 3-12. Drywell Axial Canister Profile used for FTT Boundary Conditions

all vacuum testing. This low pressure was sufficient to effectively eliminate free convection effects, however the gas conductivity is essentially unaffected.

3.4 FTT RESULTS

The results of the FTT are shown in Figures 3-13 and 3-14. Figure 3-13 presents the axial temperature profiles imposed on the canister and the center thermowell axial temperatures for all three backfill media. The temperatures measured in the center thermowell are considered representative of the peak fuel clad temperatures. This is based on an estimated 2.8 to 3.9°C (5 to 7°F) maximum temperature difference between fuel clad and measured thermowell temperature (see Section 3.5). Figure 3-14 presents three sets of radial and diagonal thermowell temperature curves for the top, middle and bottom elevation thermocouples. Table 3-3 summarizes the maximum temperatures recorded for each test. A complete cross sectional map of canister and thermowell temperature readings for the three backfill media (at an elevation near the active fuel midplane) are provided in Figure A-1 in Appendix A.

The axial temperature profiles in Figure 3-13 show that the helium backfill test center thermowell temperatures are the lowest of the three backfills. This is due to the higher thermal conductivity of the helium. The air backfill test center thermowell temperatures are skewed toward the top of the fuel assembly showing air to be a better convective medium than helium. The vacuum backfill test center thermowell temperatures are highest of the three temperatures (except near the top) showing that radiation alone is the least effective method of heat transfer. The maximum thermowell temperatures occurred at the elevation slightly above the active fuel midplane for all three backfill tests. The air backfill test canister temperatures near the top of the canister are higher than the vacuum and helium backfill canister temperatures due to the axial heat convection within the canister.

A comparison of the three sets of lateral temperature profiles shown in Figure 3-14 provides additional confirmation of the heat transfer mechanisms present for each backfill. The three sets of curves represent thermowell data for the center position, for two radially opposite positions, and for a pair of diagonally opposite positions at elevations 76.2 cm (30 inches), 200.7 cm (79 inches) (near midplane) and 355.6 cm (140 inches) above the bottom of the

FIGURE 3-13. Canister and Center Thermowell Axial Temperature Profiles

FIGURE 3-14. Radial and Diagonal Temperature Profiles at Selected Axial Levels

TABLE 3-3

Maximum Observed Canister and Center Thermowell Temperatures
for Fuel Temperature Tests 7, 8, and 9

Test No.	Backfill	Decay Heat Level (KW)	Canister Temp (°C)	Center Thermowell Temperature (°C)
7	Air	1.17	161	255
8	Vacuum	1.17	159	266
9	Helium	1.16	159	226

active fuel. For the vacuum backfill where radiation transfers most of the heat from the fuel rods to the canister, the radial and diagonal profiles are the steepest from center to outer row. In addition, the lateral profiles do not vary along the length of the fuel assembly when end effects are neglected. The bottom and midplane elevation profiles in Figure 3-14 show the vacuum backfill to be the steepest and nearly constant; however the top elevation profiles show a very flat vacuum backfill profile which has a shape similar to the helium backfill profile. This top profile indicates that heat was being transferred to the canister by more than just radiation in the radial direction and probably by axial conduction along the 15 thermowell tubes.

For the helium backfill, the radial and diagonal profiles were expected to be the flattest of the three since the primary mode of heat transfer to the canister was by conduction in the radial direction. At all three elevations, the helium backfill profile is the flattest. The profiles at the bottom and midplane elevations are nearly identical whereas the top elevation profile is much flatter. The top elevation profile shows a more uniform heat transfer (as compared to the lower elevations) across the fuel assembly width due to axial conduction to the canister closure lid. It is hypothesized that axial conduction in the helium and the 15 thermowell tubes is responsible for the relatively flat profile near the top of the assembly.

With air as the canister backfill, the primary modes of heat transfer are convection and radiation. The radial and diagonal profiles were expected to be somewhat flatter than those for the vacuum backfill and yet steeper than the helium backfill profiles since the conductivity of air is much less than helium. The lower and midplane elevation profiles in Figure 3-14 show this to be the case. The top elevation air backfill profiles are very similar to those at the midplane elevation; however, they are different from the vacuum and helium backfill profiles and are at a higher temperature. This is due to the dominance of convection. The air backfill convects a large portion of the heat from the lower part of the fuel assembly to the top which causes the fuel rod temperatures at the top to be hotter than the vacuum backfill. Air is such a good convective medium that heat from the fuel rods is transferred to the air and as the air heats up it becomes less dense and rises through the fuel assembly. As heat from the air is lost to the canister body, the air cools and becomes more dense and flows downward in the annulus between the

fuel assembly and canister. The top elevation air backfill profiles are nearly identical to the vacuum backfill profiles at the lower two elevations indicating that there is also significant radial heat transfer across the fuel rod bundle which is assumed to be by radiation.

3.5 FTT DATA ACCURACIES

Differences between the actual temperature of the fuel cladding and the temperatures measured during the FTT were due to three factors: 1) the positional and measurement accuracy of the test thermocouples, 2) the effect of test temperature measurement configuration, and 3) the effects of the different heat transfer mechanisms present. The accuracy of the ungrounded Type K thermocouples used is typically $\pm 1.1^{\circ}\text{C}$ ($\pm 2^{\circ}\text{F}$) based on calibration data provided by the manufacturer and traceable to NBS standards.

Test hardware configurations and test data were examined for positional uncertainties and other effects on temperature measurements. The estimated test thermocouple and fuel assembly active fuel position tolerances are provided in reference [1]. An evaluation of the temperature measurement uncertainty due to thermocouple position uncertainty was made using the axial temperature profiles for both sets of imposed drywell canister profile tests. The differences in thermocouple-measured temperature and that at the elevation noted for the thermocouple tip ranged from less than $+0.01$ to 0.6°C (± 0.01 to $\pm 1.1^{\circ}\text{F}$) with most of the differences being less than $\pm 0.3^{\circ}\text{C}$ ($\pm 0.5^{\circ}\text{F}$). An examination of temperature data for the eight thermocouples spaced 45° apart around the canister circumference showed a consistent variation from side to side (see temperature maps in Figure A-1). This canister circumferential temperature variation, the positioning of four canister thermocouples in instrumentation tubes, and the low internal resistances determined by thermocouple electrical checks (last two noted on Table A-1) should also be taken into account when using the test data presented herein.

Due to the test measurement configuration, the temperature measured by any thermowell thermocouple was representative of an average temperature of the eight surrounding fuel rods and not of any particular fuel rod. For the center thermowell, all eight surrounding fuel rods were expected to be at about the same temperature. However, for the other fourteen thermowells, the fuel rod temperatures were expected to vary due to their distance from the

centerline of the fuel assembly. This is evidenced by the test data as shown in the radial and diagonal temperature profiles in Figure 3-14. The extent of the difference between surrounding fuel rod temperatures could not be evaluated using the Fuel Temperature Test. The effects of heat transfer mechanisms present for each backfill media have been evaluated analytically. The details of the analysis are provided in reference [1]. The following paragraph summarizes the results of the analysis.

The effect of convection in helium and air backfills was evaluated to estimate the difference between fuel cladding temperature and that measured in the thermowell. The axial convection of heat by air and helium was found to produce a small temperature difference since these backfill gases can effectively heat or cool the thermowell and instrument or guide tube relative to the fuel rod. The effect of the vacuum backfill was not analyzed since there is no axial convection present. The results of the analysis show that for the air backfill tests, the measured temperatures were estimated to differ from the average surrounding fuel rod temperatures by a maximum of 3.6°C (6.5°F) at the lowest thermocouple. For the helium backfill tests, the maximum calculated temperature differences were between 0.6 and 1.1°C (1.0 and 2.0°F).

Overall, the FTT recorded thermowell data are judged to be between -0.6 and $+2.2^{\circ}\text{C}$ (-1.0 and $+4.0^{\circ}\text{F}$) of the actual fuel clad temperatures for the helium and vacuum backfills and between 1.7 and 4.7°C (3.0 and 8.5°F) above the actual fuel clad temperatures for an air backfill. The other recorded data from thermocouples attached to test components are judged to be within $\pm 1.1^{\circ}\text{C}$ ($\pm 2.0^{\circ}\text{F}$) of the actual temperatures.

3.5.1 Quality Assurance

A complete set of quality assurance records for the FTT effort were compiled. These records include but are not limited to the project plan, the quality assurance plan document, specific test plans, test procedures, final and as-built design drawings and associated records, raw data records for each test, and instrumentation continuity and calibration records. All quality assurance related records will be maintained for future use in licensing, code qualification and related areas.

4.0 SINGLE ASSEMBLY HEAT TRANSFER TEST

This section presents information on the Single Assembly Heat Transfer Tests (SAHTT) performed at the Pacific Northwest Laboratory (PNL) using an electrically heated model of a PWR spent fuel assembly. The SAHTT runs were performed as part of DOE's Commercial Spent Fuel Management (CSFM) Program managed by PNL. The test hardware was designed and assembled by Allied General Nuclear Services (AGNS) at the Barnwell Nuclear Fuel Plant (BNFP), Barnwell, South Carolina where initial test runs were performed. Following a review of test data generated during initial testing at AGNS, wherein discrepancies in the data were observed, the test hardware was transferred to PNL for a re-testing effort because operations at BNFP had been discontinued.

4.1 SAHTT OBJECTIVES

The SAHTT was intended to investigate the heat transfer characteristics of spent light water reactor (LWR) fuel under simulated dry storage conditions. Simulated fuel cladding temperatures were measured as functions of the fuel decay heat levels, cask orientation, cask backfill gases, and boundary temperature conditions. These test conditions are similar to a variety of expected spent fuel dry storage conditions. The test data are intended to be used in evaluating predictions of various thermal analysis computer codes used to model spent fuel dry storage systems.

A secondary objective of the SAHTT was to separately examine the relative contributions of each of the primary heat transfer mechanisms - conduction, convection, and radiation in a typical PWR spent fuel assembly. Of particular interest was the relative effect of natural convection of air or helium on the magnitude and location of peak clad temperatures. Very few documented determinations of the effects of fuel orientation, gas type, and temperature on free convection had previously been made for the relatively low heat generation rates typical of spent PWR fuel (0.5 to 1.0 KW).

The following criteria were applied during the course of testing:

- Assembly Configuration - The fuel assembly geometry physically and thermally simulated a PWR fuel assembly with a 15x15 rod matrix and a uniform axial

heated length of 365.8 cm (144 inches). The electrically heated model fuel assembly was positioned within a rectangular Brooks & Perkins stainless steel/BoralTM fuel tube of the type used in reactor fuel storage pools.

- Decay Heat Rate - The model assembly heat generation rate was maintained constant during each test run at 0.5 KW or 1.0 KW and continuously monitored by a set of electronic power transducers connected to the power supply.
- Thermal Equilibrium - Final data collection for a particular test condition was performed only after clear evidence of thermal equilibrium was obtained. Steady state conditions were assured by monitoring selected assembly centerline thermocouples.
- Backfill Environment - The cask cavity was completely evacuated (<25 mm Hg absolute pressure) between changes of cask backfill gas (air and helium). An absolute pressure gauge was used to monitor cask internal pressure. Vacuum tests were performed at 79.2 to 88.9 mm Hg absolute pressure, a vacuum level sufficient to suppress convection effects. Air environments were maintained at ambient atmospheric pressure by means of a vent line. Helium fill pressures were maintained at a positive pressure (25 ± 10 mm Hg) to preclude any in-leakage of air. Ultra high purity grade helium was used.
- Thermocouples/Instrumentation - All primary instrumentation was calibrated and certified traceable to NBS and/or ANSI standards.

4.2 HARDWARE DESCRIPTIONS

The purpose of this section is to describe the various hardware components used in the SAHTT. The equipment can be categorized in three general groups; mechanical, electrical, and instrument/data acquisition system as denoted in Table 4-1.

The complete equipment arrangement is outlined in the Electrical, Instrument, and Piping arrangement drawing included in Appendix B. PNL's later revisions to the original arrangement as designed by AGNS will be included in the discussions below.

TABLE 4-1. SAHTT Equipment

MECHANICAL EQUIPMENT

- Pressure/Vacuum Vessel (Cask)
- Transition Piece/Fuel Tube
- Cask Closure Lid
- Electrically Heated Model Spent Fuel Assembly
- Evacuation/Gas Backfill System

ELECTRICAL SYSTEMS

- Cask Heater Power Supply and Control System
- Model Fuel Assembly Power Supply and Control System

INSTRUMENTATION/DATA ACQUISITION SYSTEM

- Thermocouples
- Portable Temperature Probe
- Absolute Pressure Gauge
- Assembly Power Transducers
- Data Loggers

4.2.1 Mechanical Equipment

Description of the single assembly storage cask, the 15x15 electrically heated model fuel assembly, the transition piece/fuel tube, the cask closure lid, and the evacuation/gas backfill control system are presented. The test assembly is shown in Figure 4-1. Descriptions of each of the primary components follow.

4.2.1.1 Pressure/Vacuum Vessel (Cask)

A steel cylindrical vessel comprises the containment and pressure boundary for the SAHTT equipment. Dimensional details of the cask body are shown in Figure 4-2. The cask was fabricated from two steel cylinders with a 12.7 mm (0.5 inch) thick, 711.2 mm (28 inch) diameter outer wall of carbon steel and a 6.4 mm (0.25 inch) thick, 457.2 mm (18 inch) diameter inner wall of 300 series stainless steel. The resultant inner cavity is 444.4 mm (17.5 inch) in diameter and 482.6 cm (190 inches) long. One end of the cask has a bolted carbon steel closure lid, through which the bulk of various internally mounted thermocouple leads were routed. Either end of the annular cask body is fitted with thick, solid carbon steel collars into which were machined several stepped faces suitable for closure flange mounting. These collars are also fitted with sets of lifting trunnions which permitted mounting of the cask assembly in a skid/support assembly (see Figure 4-3) and handling/lifting of the cask for tests in inclined and vertical positions.

The nominal 114.3 mm (4.5 inch) wide, full length cylindrical annulus formed between the inner and outer cask walls can be either gas filled or evacuated via a 19 mm (3/4 inch) diameter standpipe connection. For the SAHTT, the standpipe was plugged and the annulus filled with air at 1 atmosphere pressure.

Clamped to the O.D. of the exterior wall of the cask vessel were three electrical resistance heaters (3.0 KW total power) which were spirally wound in parallel along the length of the cask barrel. The heaters were connected to a temperature feedback controller and used to maintain a specified cask interior wall boundary temperature (approximately 200°C) independent of the model fuel bundle power level. To minimize heat losses, an insulating blanket of two 25 mm (1 inch) thick layers (51 mm or 2 inch total) of Kaowool ceramic

FIGURE 4-1. SAHTT Assembly

FIGURE 4-2. SAHTT Pressure/Vacuum Vessel (Cask)

FIGURE 4-3. Cask Mounted in Skid Assembly

fiber covered the cask barrel and spirally wound heaters.

The cask O.D. heaters, which cycled on-off in response to a set-point temperature controller were found in initial testing to effect the applied voltage level when wired in parallel with the model 15x15 rod assembly power source (as shown in the AGNS drawing, Appendix B). To alleviate this problem, the "guard" heater circuitry was revised to be supplied from a separate 220V, single phase circuit. To maintain an acceptable load on the single phase circuit, the individual 2 KW heaters were wired with two series-wired heaters in parallel with the third heater. At 220V, this configuration yielded 3 KW available heat.

To measure cask temperatures, 20 thermocouples at 4 radial positions and 5 axial levels were positioned along the inner wall of the cask cavity. The T/C's for each axial level were first fixed to a stainless steel circular band, which was in turn spot welded to the cask inner wall (see Figure 4-4). The indicated radial positions were selected to determine effects of cask orientation on boundary temperatures. T/C No. 78 at position C of the central band (near cask axial center) was used as temperature feedback to the cask guard heater set-point controller. The heaters were thus auto regulated to maintain a constant temperature at this point (to within the approximately 3°C dead-band of the controller).

4.2.1.2 Transition Piece/Fuel Tube

The transition piece/fuel tube (TPFT) assembly serves the functions of: 1) supporting the model fuel bundle assembly within the cask containment vessel, and 2) containing the fuel bundle within a Brooks & Perkins standard PWR fuel tube. Dimensional details of the TPFT are shown in Figure 4-5. Position of the TPFT within the SAHTT assembly can be seen in Figure 4-1.

The fuel tube is a rectangular 22.9 cm (9.000 inch) I.D., 5.33 mm (0.210 inch) nominal wall, stainless steel tube fabricated with a layer of BoralTM neutron poison. The BoralTM is clad by inner and outer walls of stainless steel as shown in the enlarged view of Figure 4-5. The inner stainless clad is 0.81 mm (0.032 inches) thick, the outer clad is 2.67 mm (0.105 inches). The fuel tube is 408.6 cm (160-7/8 inches) long and the outer surface is corrugated with 1.27 mm (0.050 inch) high dimples on 16.5 cm (6.5 inch)

BAND No	AXIAL DISTANCE FROM BOTTOM END OF CASK	TC No
1	333.4 ± 5 MM	58-59-60-61
2	1476.4 ± 10 MM	62-63-64-65
3	2619.4 ± 16 MM	66-67-68-69-78
4	3762.4 ± 10 MM	70-71-72-73
5	4892.7 ± 6 MM	74-75-76-77

FIGURE 4-4. Cask Inner Wall Thermocouples

centers along the length of the tube.

The transition piece (allowing for a transition between the square cross section of the fuel tube and the circular cask) has a two-step cylindrical barrel. The smaller diameter barrel contains two circumferential rows of twenty-five 25.4 mm (1 inch) diameter holes (50 total), equally spaced around the barrel, with the two rows offset by one-half pitch. The holes permit gas to flow between the fuel tube interior (the model fuel assembly) and exterior (the annulus between the fuel tube and the cask inner wall). The open area of the flow holes approximates the flow area of a fuel assembly end fitting. The larger diameter portion of the TPFT barrel forms the mounting flange for the fuel assembly bolt-up. The model fuel assembly, when mounted to the TPFT and cask, rests completely within the fuel tube, centered to within ± 3.8 mm (± 0.150 inch) by the flat bar style spacers. The fuel tube extends approximately 12.7 mm (1/2 inch) beyond the end of the heater rods after assembly.

The TPFT had four support feet attached to the open end of the fuel tube (see Figure 4-6) to permit concentric location and support of the fuel tube within the cask cavity. Post test disassembly and inspection revealed the support feet had not been fully extended, and when in a horizontal position the fuel tube/bundle axial centerline was 1.25-2 cm (0.5-0.8 inches) offset at the open end of the fuel tube.

4.2.1.3 Cask Closure Lids

The fuel bundle mounting flange in combination with the TPFT assembly bolted in place to form the lower cask closure lid. The upper closure was formed by a flanged cylinder 17.8 cm (7 inches) thick by 47.6 cm (18.75 inches) in diameter (see Figure 4-7 for dimensional details). A central penetration was provided in the upper lid for instrumentation leads (approximately 80 stainless steel sheathed thermocouples exit the cask interior through the upper lid). The penetration cavity was sealed by potting with high temperature silicon sealant contained by steel plates (see Alternate T/C Transition Detail, AGNS drawing No. SK-3834200-E1, Appendix B).

FIGURE 4-6. Fuel Tube Support Feet

FIGURE 4-7. Upper Closure Lid

4.2.1.4 Electrically Heated Model Spent Fuel Assembly

The model fuel assembly (Figure 4-8) was designed and built to be physically and thermally characteristic of a typical 15x15 commercial light water reactor PWR spent fuel assembly. The test heater assembly was originally fabricated by Wachter Associates (now U. S. Tool & Die, Co.) in 1974-1975 for transport cask testing conducted by AGNS. With a total power range of 0-15 KW, the assembly consists of 214, 10.7 mm (0.42 inch) nominal diameter, independently powered, resistance element tubular heater units.

The heater pins (Figure 4-9) have a 366 cm (144 inch) heated length. The 0.5 mm (0.020 inch) diameter ni-chrome wire elements were wound in a 3.8 mm (0.150 inch) diameter coil, with 7 coils/cm (18 coils/inch). The cold end conductors are 4.8 mm (3/16 inch) diameter, type 304 stainless steel, solid wire. The heater units are single ended with the 0.9 mm (0.035 inch) thick cladding wall being the return ground path for each heater circuit. The heating elements and cold end conductors are electrically insulated from the cladding by a compacted magnesium-oxide (MgO) powder fill within the sheath.

Also included in the 15x15 assembly were 11 unheated 12.7 mm (0.500 inch) O.D. pins simulating control rod guide tubes. The positions of the heated and unheated tubes are shown in Figure 4-8. The unheated pins were solid 304 stainless steel except for those located at positions 0-5 and 0-11 (pin coordinates as shown on Figure 4-8). These unheated pins were formed from 12.7 mm (0.500 inch) O.D. by 1.65 mm (0.065 inch) wall stainless steel tubing.

Prior to the start of testing all heater pins were checked for electrical continuity and measured for resistance uniformity. These measurements indicated each heater rod had a resistance of 160 ± 5 ohms (see Appendix C). The heater at position N-7 was failed (open-circuit). In order to create a half-symmetry (about the $\phi=0$ centerline) of heated rod locations within the model assembly, the rods at locations A-5, A-11, and B-7 were disconnected from the assembly power supply (for a total of 15 unheated rods in the 225 rod array).

The 214, 422 cm (166 inch) long heater rods extend through a 5.1 cm (2

FIGURE 4-8. Cross Section of 15x15 Electrically Heated Model Fuel Assembly

FIGURE 4-9. Electrically Heated Model Fuel Rod

inch) thick, 45.7 cm (18 inch) diameter flat-plate flange. The flange was gasketed and bolted to the transition piece (see Section 4.2.1.4) and constituted the closure head for one end of the cask (see Figure 4-1). The unheated pins at locations H-8, O-5, and O-8 also penetrate the mounting flange, where all pins were sealed by a 2.5 cm (1 inch) thick potting of hard-set epoxy compound. The potting material assured a leak-tight seal around all pins penetrating the closure flange. The flange was fitted with vent line connections, whereby the cask internal atmosphere could be controlled (via vacuum pump evacuation, helium supply connections, or atmospheric venting). The flange was also fitted with several sealed penetrations through which were routed several of the internally mounted thermocouple leads. The 15x15 assembly's square cross section was maintained by a series of grid spacers fitted along the length of the assembly (see Figure 4-10 for axial locations). Spacers at location numbers 3, 6, 7, and 8 were fabricated by arrays of 222.2 x 25.4 x 3.2 mm (8.75 x 1 x 0.125 inch) stainless steel flat bar. Spacers at locations 1, 2, 4, and 5 were of the more conventional "egg-crate" design commonly used on PWR fuel assemblies.

The model fuel bundle was extensively instrumented by an array of 57 thermocouples, distributed over 7 separate axial data planes. Positions and identification of all thermocouples are presented in section 4.2.3. Also see Appendix B for the AGNS-SAHT drawing "Assembly and T/C Layout", (drawing No. SK-3834200-M15).

4.2.1.5 Evacuation and Backfill System

The evacuation/gas backfill system permitted controlled changes, monitoring, and maintenance of the cask inner cavity atmosphere. The system included the following components in addition to the piping and valves shown in Figure 4-11.

- Vacuum Pumps - Two small capacity 0.37 KW (1/2 H.P.) vacuum pumps were connected in parallel to the cask evacuation/vent line. Both pumps were run continuously during vacuum testing. An air bleed valve was set to maintain cask internal pressure at 79.2 to 88.9 mm (3.1 to 3.5 inches) Hg absolute pressure. The vacuum pumps were also used to evacuate the cask prior to any change in fill gas (helium to air or air to helium) to preclude fill gas mixing.

FIGURE 4-10. Assembly Grid Spacer Axial Locations

FIGURE 4-11. Evacuation/Gas Backfill System

- Helium Supply Bottles - High purity grade helium was obtained from the helium fill system using standard commercial pressurized cylinders fitted with a regulator capable of supplying 1.7-5.2 KPA (0.25-0.85 psig) to the cask.
- Absolute Pressure Gauge - A Wallace-Tiernan Model 61A absolute pressure gauge (0-31.5 inch Hg range) was used to monitor cask internal pressures.

For air fill test conditions, the helium supply was isolated and disconnected, the vacuum pumps left off and the air bleed valve opened. The bleed valve was left open during all air tests to preclude any pressure change within the cask due to temperature variations.

4.2.2 Electrical Systems

Two separate electrical power supply and control systems were required for the SAHTT. These were for 1) the cask exterior surface heater power supply and control system used to obtain and maintain test boundary condition temperatures, and 2) the electrically heated model fuel assembly power supply and control system.

4.2.2.1 Cask Heater Power Supply and Control System

The three resistance element heaters spirally wound over the outer surface of the cask (see Section 4.2.1.1) were powered by connection to a 220V, 20 Amp circuit. A temperature feedback set-point controller (acting in response to a T/C mounted on the cask inner wall) cycled these "guard" heaters off-on by means of a 110 VAC powered relay. The dead-band of the temperature controller was approximately 3°C (6°F) with a set-point of 178°C (353°F) for all tests where the external heaters were used. Total power draw for the cask exterior heaters was approximately 3 KW.

4.2.2.2 Model Fuel Assembly Power Supply and Control System

The model fuel assembly power was taken from a 440 VAC, 3Ø circuit. A step down transformer was used to reduce to a 208 VAC, 3Ø system. Power was fed through a manually controlled power-stat which allowed the total assembly power to be set to the appropriate level (0.5 or 1.0 KW nominal power).

Indexing holes were drilled in the power-stat face-plate and indicator arm to insure a reliable and repeatable method of setting the required power levels. Due to fluctuations in supply line voltage and the accuracy to which the power-stat control could be set, actual bundle power was typically within $\pm 5\%$ of nominal.

The electrical lead from the power-stat was fed to a bus-bar power distribution box from which feeds to each of the assembly heater rods were routed. To assure a good phase to phase load balance, phase A of the power supply powered heater rods in rows B, C, D, E, and F (see Figure 4-8). Phase B powered rods in rows A, G, H, I, and O. And Phase C powered the rods in rows J, K, L, M, and N. This arrangement permitted each phase to power a total of 70 individual heater rods.

Each row of heater rods in the assembly had their respective electrical leads terminated at a fifteen pin male connector. This connector was then mated to the appropriate female 15 pin unit from the power distribution box. This arrangement permitted for easy connect/disconnect procedures required when the cask was moved between the various test orientations (horizontal, angled, and vertical).

4.2.3 Instrumentation and Data Acquisition System

Instrumentation for the SAHTT included 98 separate assembly mounted thermocouples, a portable surface temperature probe and readout unit, an absolute pressure gauge, one three-phase power transducer, three single-phase power transducers, and two data logger units. The various components are discussed briefly in the sections that follow.

4.2.3.1 Thermocouples

A total of 98 separate thermocouples were mounted on the SAHTT assembly. Post test as-built T/C locations are presented in Figure 4-12 (detailed post-test inspection data is presented in Table C-2, Appendix C). The nominal locations for all assembly T/C's are also shown in the AGNS drawing titled "Assembly and T/C Layout", drawing No. SK-3834200-M15 included in Appendix B.

Examining Figure 4-12, T/C's 1 through 57 were attached to the model fuel assembly at seven different axial data plane levels. Those T/C's mounted by a

FIGURE 4-12. SAHTT Assembly Thermocouple Locations

"clip" (see Table C-2, Appendix C) were held by a stainless steel band directly to the O.D. of the rod identified. For thermocouples identified as being mounted by a "pad", the mounting arrangement is shown in Figure 4-13. The modified weld pad was locked between adjacent heater rods to position the thermocouple within the bundle. The pad-mounted thermocouple locations shown in Figure 4-12 (and Table C-2) are for the left-most rod (as viewed from the bundle flange end of the cask) of the two rods between which the pad was mounted. For example, thermocouple number 14, identified for heater rod D-4, was actually located between rods D-4 and E-4.

Thermocouples 58 through 78 were positioned on the cask inner wall as shown in Figure 4-4. Four thermocouples at each of five separate axial locations monitored the cask wall temperatures. The T/C's were circumferentially spaced from $\phi = 0^\circ$ (Position 'A') to $\phi = 180^\circ$ (Position 'D') at 60° intervals around the cask I.D.

Thermocouples numbered 80 through 100 were positioned along the fuel tube outer wall at axial positions corresponding to the bundle-mounted T/C locations. The thermocouples were of the weld-pad type with the pad welded directly to the fuel tube at the designated axial levels. T/C's 81 through 87 were mounted to the "top" surface of the fuel tube ($\phi = 0^\circ$), 88 through 94 to the "right" face ($\phi = 90^\circ$), 95 through 97 to the "bottom" ($\phi = 180^\circ$) and 98 through 100 to the "left" face ($\phi = 270^\circ$). Each thermocouple was mounted along the axial centerline of the designated face of the fuel tube.

4.2.3.2 Portable Surface Temperature Probe

The temperatures of the uninsulated cask closure lids and cask collars were measured in order to completely characterize the boundary conditions for each of the SAHTT runs. These surface temperature measurements, performed simultaneously with the data collection at final steady state conditions, were accomplished by a means of a calibrated, portable digital thermometer and an exposed junction, spring loaded Type K thermocouple surface temperature probe. Accuracy of the unit was certified to be $\pm 0.25\%$ of reading $+1^\circ\text{C}$.

4.2.3.3 Absolute Pressure Gauge

A calibrated 0-800 mm (0-31.5 inches) Hg absolute pressure gauge was

FIGURE 4-13. Modified Weld Pad for Assembly T/C Mounts

connected to a stand pipe on the bundle mounting flange in order to monitor cask internal pressures for all test conditions. Readings were periodically checked during transition to steady state and manually recorded during final data acquisition.

4.2.3.4 Assembly Power Transducers

Solid state electronic transducers were installed in the power supply circuitry to provide continuous monitoring of the total power being supplied to the electrically heated model fuel assembly. A three-phase power (or "watt") transducer was installed between the power-stat control and the power distribution box. A schematic of the installation is shown on AGNS Drawing SK-3834200-E1, included in Appendix B. Specifications for the transducer include 1500 W full scale input, 0-150 VAC voltage input range, 0-10 Amps current input, and 0-1 mA analog output. With the analog output read across a precision 50 ohm resistor, the resultant 0-50 mV output corresponded to a 0-3000 W power level (3000 W since voltage input was doubled to increase resolution). As shown in the schematic, voltage inputs to the transformer were provided by means of 1:2 step-up transformer units. In place calibration checks of these transformer units revealed the actual step-up ratio to be 1.895 ± 0.004 . As a result, measurements recorded by this transducer were corrected upwards by 5.5% to arrive at a true total power value.

To permit the power supplied to the assembly by each of the three phases to be separately monitored and checked for proper balance (each phase was used to power one-third of the heater rods as discussed in Section 4.2.2.2), three additional calibrated power transducers were installed prior to the start of testing at PNL. Three separate single-phase power transducers were installed in the power distribution box (one per leg of the three-phase supply). Specifications for these power transducers included 0-120 VAC, 0-15 A, 0-1500 W input and 0-50 mV linear output where 50 mV = 1500 watts. Accuracy of the units was certified as $\pm 0.5\%$ of full scale (or ± 7.5 watts). These transducers revealed that $33.3 \pm 1.5\%$ of the total load was being supplied per phase. The total power value (the summation of the individual single phase power readings) was also consistent with that measured by the three-phase transducer to within $\pm 1.5\%$.

Voltage drops between the three-phase power transducer taps and the

individual heater rod power leads were also measured. This was performed as a check on the line losses for the circuit through the power distribution box and the cabling to the individual 15-pin connectors at the heater-rod hook-ups. Voltage drop measurements revealed total line losses to be approximately 4%.

4.2.3.5 Data Loggers

Readings from the 97 cask and bundle mounted thermocouples were recorded by a calibrated data logger unit. The logger is equipped with keyboard programmable auto scan intervals, first and last channels, and analog input ranges (or thermocouple types). The data logger was limited to 50 channels of input, thus complete scans of all the assembly T/C's required a manual repositioning of 50 input channel jumpers between alternate sets of 50 jacks at the 100 position jack panel to which all of the assembly T/C leads were routed. One input set scanned thermocouples 1 through 50, while an alternate set allowed scanning thermocouples 51 through 100.

The data logger was equipped with electronic reference junction circuitry such that all data were recorded directly in temperature units ($^{\circ}\text{F}$ or $^{\circ}\text{C}$). All SAHTT data was recorded on paper tape using the data logger's internal printer. Time and date data were automatically entered on the printout for each data scan.

A second programmable data logger unit was used to collect data from the three single phase power transducers and the single three-phase power transducer (four channels total). Scan intervals were synchronized with those of the thermocouple data logger to provide a complete record of the model fuel assembly power level.

4.3 SAHTT OPERATIONS

This section summarizes the pre- and post-test checks, operational test procedures, the test sequence and final test matrix for the Single Assembly Heat Transfer Tests.

4.3.1 Pre-Test Checks

Prior to the start of testing, each thermocouple was tested for

continuity from the labeled T/C connector at the cask exit, through the lead wire connectors to the 100 position jack panel and through the 50 separate input leads to the data logger. These pre-test checks revealed T/C's numbered 10, 34 and 46 had failed. T/C number 1 was also noted as having a low reading.

The current flow to each individual heater rod was also checked prior to actual testing. By checking the electrical lead of each individual heater with a clamp-on ammeter, each heater unit could be checked for uniformity of power. Heater number N-7 was failed and showed no current draw.

Both single- and three-phase power transducer units were checked for proper operation and connection to the data logger. Readings were checked over the test series power range. Proper operation of the data logger units was also checked and confirmed.

Final data logger channel assignments are shown in Table C-3, Appendix C.

4.3.2 Operational Procedures

Detailed operational procedures were prepared for the SAHTT testing at PNL. The procedures involved establishing 1) the proper cask orientation, 2) the proper cask environment, 3) the desired model fuel assembly power level, and 4) data acquisition. Each of these steps are discussed in the following sections.

4.3.2.1 Cask Orientation

Testing in the horizontal position was accomplished by leaving the test assembly supported by both upper and lower trunnion pairs in the cask support skid framework. Tests in the inclined position were performed by lifting the test assembly upper trunnions using an available overhead bridge crane to a level 211 cm (83 inches) higher than the lower trunnion pair. This procedure allowed positioning the cask centerline to $25^{\circ} \pm 0.2^{\circ}$ from the horizontal. To position the cask in the vertical position, the cask was removed from the skid assembly and suspended by its upper trunnion set by the overhead crane. For stability the cask assembly was then secured against the vertical face of a large concrete block. Bundle heater power leads and backfill control lines

were then reconnected at the lower end of the cask.

4.3.2.2 Cask Environment

The media within the cask inner cavity was controlled by the evacuation and backfill system described in section 4.2.1.5. For vacuum test conditions, the vacuum pumps were run continuously with the air bleed needle valve in the evacuation line used to control cask internal pressure at 78.7 to 88.9 mm (3.1 to 3.5 inches) Hg absolute. Lower absolute pressures were obtainable in the cask cavity with the air bleed valve closed (to approximately 25 mm Hg absolute); however, conduction properties are more stable (i.e., less sensitive to minor pressure variations) for slightly higher absolute pressures. Thus the decision was made to perform vacuum testing at the designated vacuum condition.

During helium backfill testing, the primary concern was to maintain cask internal pressures slightly positive to prevent in-leakage of air and contamination of the pure helium environment. Supply regulators on compressed helium bottles were set to maintain cask internal pressures at 2 - 5 KPA (0.3 - 0.7 psig). Leakage rates from the system were typically very low (<1.5 SCFH). Special cask purge procedures were used during cask backfill changes to prevent gas media contamination.

For air backfill testing, the cask was evacuated and simply vented to the atmosphere using the air bleed valve. The vent valve was left open during testing.

4.3.2.3 Model Fuel Assembly Power Levels

The power-stat manual adjustment wheel was fitted with indexing stops at the positions required for powering the model fuel bundle at either the 0.5 KW or 1.0 KW levels. Settings were confirmed by monitoring both the total power and individual phase power draws with the installed power transducers as read on the data logger. The measured power level exhibited as much as a $\pm 5\%$ drift over the duration of any given test, due to variations in the unregulated supply line voltage.

4.3.2.4 Data Acquisition

Following the set up of all appropriate conditions for a selected test run, data acquisition was initiated. During the transition to final steady state conditions, selected temperature data were recorded as an indicator of when true steady state conditions were reached. Data from the four power transducers and 12 selected thermocouples were recorded at half-hour intervals during the transient period. Cask internal pressures were monitored and recorded manually.

Steady state conditions were assumed when selected bundle centerline thermocouples (T/C's #31, #32, and #33) were cycling within a $\pm 0.6^{\circ}\text{C}$ ($\pm 1^{\circ}\text{F}$) band over the preceding three to six hours. Steady state conditions were usually reached within 24-72 hours of test condition set-up. Final data acquisition was then initiated. Data logger scan intervals were changed to five minutes, and power transducer data was collected for approximately one hour. Temperature data was also collected at 5 minute intervals for one hour (three scans of T/C's 1-50, six scans of T/C's 51-100, and three additional scans of T/C's 1-50 in that order). Run identification and cask internal pressure data were manually recorded on the data record.

4.3.3 Test Matrix

Three separate primary parameters were exercised during the course of the SAHTT: 1) cask orientation (horizontal, vertical, and inclined 25° from horizontal), 2) fuel assembly power (0.5 and 1.0 KW total power levels, the approximate expected decay heat levels of 10 and 5 year old spent fuel, respectively), and 3) backfill media (vacuum, helium, and air cask environments to exercise the primary heat transfer mechanisms of radiation, conduction, and convection, respectively). The resultant test matrix for the SAHTT effort is shown in Table 4-2. Included in the table are several as-measured test parameters (total power, cask internal pressure, ambient temperature, and the test date) for each specific test run. The repeatability of the test data was checked during four separate runs for the 25° orientation, 1.0 KW bundle power, vacuum backfill condition (run numbers 2, 2r1, 2r2, and 2r3).

An additional test, wherein the cask guard heaters were left off during the horizontal orientation, 0.5 KW assembly power, air backfill test condition was designed to allow the contributions of convection and radiation to the

TABLE 4-2

SAHTT Test Matrix

RUN NO.	CASK (1) ORIENTATION	GUARD HEATER CONTROL TEMP (C)	NOMINAL POWER (KW)	ACTUAL POWER (KW)	BACKFILL (2)	PRESSURE (MM HG ABS)	AMBIENT TEMP (C)	TEST DATE
1	Inc	178	1.0	0.951	A	744.0	28	08/09/84
2	Inc	↓	1.0	0.940	Vac	83.3	30	08/10/84
2 repeat #1	Inc		1.0	0.956	Vac	88.9	25	08/24/84
2 repeat #2	Inc		1.0	0.960	Vac	85.3	21	09/14/84
2 repeat #3	Inc		1.0	0.944	Vac	84.1	18	10/19/84
3	Inc		1.0	0.956	He	789.4	27	08/22/84
4	Inc		0.5	0.501	He	789.9	23	08/20/84
5	Inc		0.5	0.484	Vac	82.6	28	08/16/84
6	Inc		0.5	0.477	A	746.8	24	08/15/84
7	H		0.5	0.407	A	749.8	23	09/04/84
8	H		0.5	0.486	Vac	87.6	26	09/05/84
9	H		0.5	0.500	He	795.5	21	09/07/84
10	H		1.0	0.964	He	787.4	23	08/30/84
11	H		1.0	0.949	Vac	87.1	23	08/28/84
12	H		1.0	0.943	A	743.2	27	08/27/84
13	V		1.0	0.994	A	746.3	19	09/21/84
14	V		1.0	0.977	Vac	79.2	17	09/25/84
15	V		1.0	0.995	He	787.4	21	09/28/84
16	V		0.5	0.501	He	785.6	21	10/01/84
17	V		0.5	0.496	Vac	81.3	22	10/03/84
18	V		0.5	0.515	A	749.8	22	10/05/84
19	V	↓	1.0	0.981	Vac	29.2	19	09/26/84
20	H	OFF	0.5	0.497	A	750.3	16	09/12/84
21	V	OFF	0.5	0.515	A	747.3	22	10/09/84
22	H	ON	0.0	0.0	He	787.9	19	10/23/84

(1) V - Vertical, H - Horizontal, Inc - 25° from horizontal

(2) Vac - Vacuum, A - Air, He - Helium

overall heat transport mechanism to be varied for a given bundle power level and cask backfill. The final test added to the matrix (Run Number 22) was designed as a check on the uniformity and accuracy of the assembly thermocouple instrumentation. With an unheated fuel bundle and helium backfill, it was expected that this test should result in a fairly uniform temperature within the cask cavity when the cask guard heaters were powered.

4.3.4 Post Test Checks

Critical dimensions and in particular the actual locations of all test assembly mounted thermocouples were checked during a post test as-building inspection of the SAHTT hardware. The cask assembly was disassembled carefully and the actual positions of all thermocouples were physically verified and documented. Critical dimensions for the TPFT, model fuel assembly, and fuel assembly spacers were also checked and documented.

4.4 SAHTT RESULTS

Tabulated test data and selected axial temperature profile plots for all test runs are included in Appendix D. For purposes of discussion and comparison, selected axial and radial plots for most test runs are included in the following sections.

Each of the backfill media will first be examined separately, comparing first the effects of bundle power level and secondly the effects of cask orientation. Direct comparisons between each of the backfill media will then be presented for each of the three cask orientations and two bundle power levels.

It should be noted that a smooth curve between experimental data points has been included in the profile plots of the experimental data. The continuous curve is for clarity of presentation only and in no way reflects any form of scientific or statistical "fit" to the experimental data.

4.4.1 Vacuum Backfill

The following sections discuss various model fuel assembly power level

and test assembly orientation effects for the cask cavity evacuated to approximately 80 mm (3.15 inches) Hg absolute pressure.

4.4.1.1 0.5 KW vs. 1.0 KW Model Fuel Assembly Power

Selected axial temperature profiles for vacuum condition runs at 0.5 and 1.0 KW fuel assembly power levels are presented in Figure 4-14. Both test runs were for a vertical orientation with an evacuated (81.3 and 79.2 mm (3.20 and 3.12 inches) Hg absolute pressure respectively) cask cavity. The temperature difference between the cask I.D. and the peak temperature center rod nearly doubled (125°C vs. 65°C) when the assembly power was increased from 0.5 KW to 1.0 KW. This is somewhat unexpected because radiant heat transfer is dependent on $(T_{\text{hot}}^4 - T_{\text{cold}}^4)$ not on the simple temperature difference. A detailed rod-to-rod radiation heat transfer analysis of the test assembly will be required to fully understand this result.

Comparative radial temperature profiles for the two power levels are shown in the plots of Figures 4-15. The data in Figure 4-15 at an axial elevation approximately 2.7 m above the cask bottom (data plane number 6), are from (as shown in Figure 4-16):

- 1) Cask I.D. T/C No. 69 at $\phi=0^{\circ}$
- 2) Fuel Tube T/C No. 84 at $\phi=0^{\circ}$
- 3) Fuel Bundle Pin No. A-1, T/C No. 4
- 4) Fuel Bundle Pin No. D-4, T/C No. 14
- 5) Fuel Bundle Pin No. H-9, T/C No. 32
- 6) Fuel Bundle Pin No. L-12, T/C No. 40
- 7) Fuel Bundle Pin No. O-15, T/C No. 54
- 8) Fuel Tube T/C No. 91, at $\phi=90^{\circ}$
- 9) Cask I.D. T/C No. 66, at $\phi=180^{\circ}$

The plot thus represents a diagonal temperature profile across the model assembly from Pin A-1 to Pin O-15, with representative fuel tube and cask I.D. temperatures included. This plot format will be used throughout the remainder of this report for radial temperature profiles at this axial level. The cask wall, fuel tube, and heater rod locations are graphically represented along the x-axis of the plots.

FIGURE 4-14. Axial Temperature Profiles for Vertical, Vacuum, 0.5 and 1.0 KW Conditions.

FIGURE 4-15. Diagonal Temperature Profiles for Vertical, Vacuum, 0.5 and 1.0 KW Conditions.

FIGURE 4.16. T/C Locations for Data Plane No. 6 Plots

FIGURE 4-17. T/C Locations for Data Plane No. 9 Plots

For the profiles of Figure 4-15 at the 4.2 m axial level (data plane number 9) similar data are plotted (although no cask I.D. temperatures are available for this axial level). From left to right, the temperatures plotted are from (as shown in Figure 4-17):

- 1) Fuel Tube T/C No. 87 at $\theta=0^\circ$
- 2) Fuel Bundle Pin No. A-1, T/C No. 7
- 3) Fuel Bundle Pin No. D-4, T/C No. 17
- 4) Fuel Bundle Pin No. H-9, T/C No. 35
- 5) Fuel Bundle Pin No. L-12, T/C No. 43
- 6) Fuel Bundle Pin No. O-15, T/C No. 57
- 7) Fuel Tube T/C No. 97, at $\theta=180^\circ$

This plot format will be used for the remainder of the report.

For the vacuum condition, the radial temperature profiles show expected tendencies; peak temperatures at the assembly centerline with steep temperature gradients to the cask wall. The flatter profiles with lower peak temperatures at the 4.2 m axial level indicate increased radiation to the relatively cold cask closure lid.

Data plots for the vacuum condition, 0.5 and 1.0 KW runs in the inclined (25° from horizontal) and horizontal positions are included in Appendix D. This data indicates trends similar to the vertical orientation runs.

4.4.1.2 Vacuum Backfill - Orientation Effects

Selected axial temperature profiles are shown in Figure 4-18 for the vacuum backfill, 1.0 KW assembly power condition at different cask orientations. As would be expected for the vacuum backfill, where radiation heat transport is dominant, the orientation of the assembly had little effect on the internal temperatures.

FIGURE 4-18. Orientation Effects on Axial Temperature Profiles for Vacuum, 1.0 KW, Vertical, Horizontal, and 25° Conditions.

Most obvious are the effects on the cask internal wall temperatures shown in Figure 4-19. Due to circumferential convection in the air filled annulus between the cask inner and outer walls (see Figure 4-4) when the assembly was in other than the vertical position, warmer temperatures occurred at the $\theta=0^\circ$ radial position (position A) and cooler temperatures at the $\theta=180^\circ$ position (position D). The data in Figure 4-19 clearly shows this effect for the horizontal, 1.0 KW, vacuum test run.

Figure 4-20 shows the assembly radial temperature profiles at the 2.7 m (data plane number 6) and 4.2 m (data plane number 9) axial levels and further confirms the minimal effects of cask orientations on internal temperatures for the vacuum backfill condition.

Axial and radial temperature profiles for a 0.5 KW nominal assembly power level and varying orientations are presented in Appendix D. Although peak temperatures are considerably lower, the orientation effects are again minimal for the vacuum condition.

4.4.2 Air Backfill

The following sections discuss various fuel assembly power level and test assembly orientation effects for the condition of the cask cavity backfilled with air at 1 atmosphere pressure.

4.4.2.1 0.5 KW vs. 1.0 KW Model Fuel Assembly Power

Selected axial temperature profiles for the vertical, air, 0.5 KW and 1.0 KW nominal assembly power levels are compared in Figure 4-21. Other than the obvious decrease in peak temperatures for the lower power level, the most noticeable effect is the less severe axial temperature gradient in the lower half of the assembly at the lower power level. Increased convective airflow at the higher power level accounts for the differences in slope of the axial temperature profiles. Close inspection also reveals that the peak fuel temperature for the 1.0 KW case occurred at a higher elevation in the assembly (3.2 m) than for the 0.5 KW case (2.7 m). Thermally (density) driven axial convection of the hotter air was responsible for the higher elevation peak temperature location.

FIGURE 4-19. Annulus Convection Effects on Cask I.D. Temperatures for Horizontal, Vacuum, 1.0 KW Conditions.

FIGURE 4-20. Orientation Effects on Diagonal Temperature Profiles for Vacuum, 1.0 KW, Vertical, Horizontal, and 25° Conditions.

FIGURE 4-21. Axial Temperature Profiles for Vertical, Air, 0.5 and 1.0 kW Conditions

Radial temperature profiles for the two power levels are compared in Figure 4-22. The profiles are symmetric about the assembly centerline indicating uniform radial heat transport. The temperature differences between the 0.5 and 1.0 KW profiles are consistent from one elevation to the other.

Data plots for air backfills in inclined and horizontal orientations at 0.5 and 1.0 KW assembly power levels are included in Appendix D.

4.4.2.2 Air Backfill - Orientation Effects

Comparisons of the axial temperature profiles for different cask orientations with the cask backfilled with air and 1.0 KW nominal assembly power are presented in Figure 4-23. The effects of increasing axial convection are obvious with cooler temperatures being observed in the lower part of the assembly in vertical and 25° orientations and hotter temperatures present in the upper half of the assembly for these orientations. Note that the magnitudes of the peak clad temperatures are affected very little by orientation.

Circumferential convection within the cask cavity is also evident, especially for the horizontal position. Shown in Figure 4-24 are the cask I.D. axial temperature profiles measured at various circumferential positions for horizontal, air, 1.0 KW conditions. With both the outer annulus and the cask cavity airfilled, the top to bottom temperature variation becomes even more pronounced than when only the annulus was airfilled (compare to Figure 4-19).

Lateral air convection through the model fuel assembly was detectable though not significant. At the 2.7 m axial level, temperatures were within $\pm 5^{\circ}\text{C}$ for all orientations, however a slight skew in the temperature profile toward the "up" side of the horizontal and inclined assemblies was measurable (see Figure 4-25 where in the horizontal orientation rod 1 is adjacent to the "up" side and rod 15 is adjacent to the "down" side of the assembly). As the axial convection effects increase at the 4.2 m level, the lateral temperature profile differences become more pronounced. For the horizontal orientation, overall temperatures are lower, with a definite skew in the profile toward the "up" side of the assembly. For the 25° inclined position, the temperatures increased and lateral convection effects are still evident (i.e., profile

FIGURE 4-22. Diagonal Temperature Profiles for Vertical, Air, 0.5 and 1.0 KW Conditions

FIGURE 4-23. Orientation Effects on Axial Temperature Profiles for Air, 1.0 KW, Vertical, Horizontal, and 25° Conditions.

FIGURE 4-24. Convection Effects on Cask I.D. Temperatures for Horizontal, Air, 1.0 KW Conditions.

FIGURE 4-25. Orientation Effects on Diagonal Temperature Profiles for Air, 1.0 KW, Vertical, Horizontal, and 25° Conditions.

"skew" towards the "up" side of the assembly). When the cask was in the vertical position, axial convection was maximized, and the measured temperatures were highest. With no lateral convection, the temperature profile becomes symmetric about the assembly centerline.

Orientation effects for the air backfill at a 0.5 KW nominal assembly power level are presented in Appendix D. General trends in the profiles are similar to the 1.0 KW case.

4.4.3 Helium Backfill

This section compares assembly power level and cask orientation effects with the cask cavity backfilled with helium.

4.4.3.1 0.5 KW vs. 1.0 KW Model Fuel Assembly Power

Figures 4-26 and 4-27 present axial and radial temperature profile comparisons for vertical 0.5 and 1.0 KW fuel assembly power, helium backfill conditions. With the conduction dominated heat transport for the relatively high thermal conductivity helium backfill, the profiles differ primarily in magnitude and not in shape. Very minimal convection effects are apparent in Figure 4-26.

Data plots for other orientations are available in Appendix D.

4.4.3.2 Helium Backfill - Orientation Effects

Comparisons of selected axial temperature profiles for the different cask orientations with a cask backfill of helium and 1.0 KW nominal fuel assembly power are presented in Figure 4-28. The fuel rod temperature profiles are nearly identical with only a minimum of convective effects apparent in the conduction dominated helium environment. The axial cask I.D. temperature profiles indicate the presence of convection in the air-filled wall annulus as discussed in section 4.4.1.2.

Figure 4-29 shows the radial temperature profiles at the 2.7 m and 4.2 m axial levels. A minor degree of lateral convection can be inferred from the profiles, with the horizontal and inclined orientation profiles skewed toward the "up" side of the assembly.

Orientation effects are quite similar for the 0.5 KW, helium backfill conditions shown in the plots of Appendix D.

4.4.4 Backfill Comparisons

For a given orientation and rod bundle power, comparisons of axial and radial temperature profiles for vacuum, air, and helium are given in the following sections. Axial temperature profiles are shown for the fuel bundle center rod (H-9), fuel bundle corner rod (A-1), and cask I.D. at position 'A', ($\theta=0^\circ$). Radial profiles are again presented for the 2.7 m and 4.2 m axial elevations.

4.4.4.1 Vertical Orientation Comparisons

Results of the vertical, 1.0 KW vacuum, air, and helium runs are presented in Figure 4-30. The specific heat transfer mechanisms at work within the different backfills become obvious in the comparative plot. For the vacuum backfill, the peak temperatures are the highest and temperature gradients the steepest, indicating that radiation is the least effective heat transfer mechanism. With an air backfill, significant axial convection is added to the radiation heat transfer giving decreased peak temperatures (by 25°C) and a significantly skewed axial profile. Convection of the air is sufficient to cause the temperatures at the upper axial levels to be higher than those for the vacuum condition and lower than those for a helium backfill at the lowest axial levels. Upon examining the axial temperature profiles for the helium backfill, the enhanced heat transfer attributable to the higher conductivity is evident; peak temperatures are lowest and the axial profiles flattest for the helium environment.

Comparisons of the radial temperature profiles at the 2.7 m (data plane number 6) and 4.2 m (data plane number 9) axial levels for the three backfill media are shown in Figure 4-31. Convective heat transport in air cools the bundle temperatures considerably below the vacuum condition yet the profile shape at the 2.7 m axial level remains basically unchanged, indicating little change in the degree of radial heat transfer (i.e., still primarily by radiation only since air has relatively poor thermal conductivity and convection is primarily axial). Still lower peak temperatures and a

FIGURE 4-26. Axial Temperature Profiles for Vertical, Helium, 0.5 and 1.0 KW Conditions.

FIGURE 4-27. Diagonal Temperature Profiles for Vertical, Helium, 0.5 and 1.0 KW Conditions.

FIGURE 4-28. Orientation Effects on Axial Temperature Profiles for Helium, 1.0 KW, Vertical, Horizontal, and 25° Conditions.

FIGURE 4-29. Orientation Effects on Diagonal Temperature Profiles for Helium, 1.0 KW, Vertical, Horizontal, and 25° Conditions.

FIGURE 4-30. Backfill Effects on Axial Temperature Profiles for Vertical, 1.0 KW, Vacuum, Air, and Helium Conditions.

FIGURE 4-31. Backfill Effects on Diagonal Temperature Profiles for Vertical, 1.0 KW, Vacuum, Air, and Helium Conditions.

considerably flatter profile again indicate the enhanced radial heat transfer for the conduction dominated helium backfill.

Radial profiles at the 4.2 m axial level show the dramatic shift in model fuel assembly temperatures due to the axial convection of the air backfill. Temperatures in air are as much as 35°C hotter than temperatures in vacuum near the upper end of the heated assembly.

Similar comparisons for a 0.5 KW nominal fuel assembly power level are presented in Appendix D. The profiles show basically the same trends as for the 1.0 KW cases at lower temperatures. Note that in these figures the axial temperature profiles for heater rod A-1 have been deleted for clarity.

4.4.4.2 25° Angled Orientation Comparisons

Figure 4-32 presents axial temperature profiles for vacuum, air, and helium backfills in the 25° from horizontal cask orientation with 1.0 KW nominal model fuel assembly power. Trends are similar to those observed for the vertical orientation, with axial convection of the air backfill being most notable. Likewise, the radial temperature profiles (Figure 4-33) show similar behaviors. Apparent combined lateral and axial convection effects result in maximum temperatures for the 4.2 m axial level occurring for the air backfill case, with the overall profile skewed toward the "up" side of the inclined assembly.

Profiles for the various backfills and the 25° inclined orientation with a 0.5 KW nominal bundle power level are presented in Appendix D. Other than lower peak temperatures, no significant differences (in the data trends and comparisons) are apparent compared to the 1.0 KW power level cases.

4.4.4.3 Horizontal Orientation Comparisons

Helium, air, and vacuum backfills for a 1.0 KW nominal model fuel assembly power and a horizontal orientation are compared in Figure 4-34. The higher conductivity of the helium backfill results in the lowest assembly internal temperatures at all axial levels. For the air backfill, though lacking the more gross effects of axial convection apparent in the vertical orientation, the available lateral convection and conduction heat transport combines to lower temperatures markedly when compared to the evacuated cask

FIGURE 4-32. Backfill Effects on Axial Temperature Profiles for 250, 1.0 KW, Vacuum, Air, and Helium Conditions.

FIGURE 4-33. Backfill Effects on Diagonal Temperature Profiles for 250, 1.0 KW, Vacuum, Air, and Helium Conditions.

FIGURE 4-34. Backfill Effects on Axial Temperature Profiles for Horizontal, 1.0 KW, Vacuum, Air, and Helium Conditions.

cavity condition.

Radial temperature profiles (Figure 4-35) show the temperature differences between vacuum and air backfills to be less dramatic due to lack of dominant axial convection for the horizontal orientation. Lateral air convection through the fuel assembly is most obvious in the plot of data for the 4.2 m (data plane number 9) axial level where temperatures are skewed visibly toward the "up" side of the horizontal assembly.

Similar air, helium and vacuum backfill comparisons for the horizontal orientation at a 0.5 KW nominal power level are included in Appendix D. Here again the overall trends are similar to those for the 1.0 KW cases.

4.4.5 Effects of Imposed Boundary Conditions

To permit the heat transfer mechanisms for dissipating the internally generated model fuel assembly heat to be investigated over a range of controlled boundary temperatures, two test runs were added to the test matrix wherein the vertical and horizontal orientation, air backfill, 0.5 KW conditions were tested without artificially imposed cask I.D. temperatures as a controlling boundary condition. For these tests runs, the cask O.D. (guard) heater units were off and the final steady state temperatures for the assembly were measured. The lower temperature boundary conditions thus varied the relative contributions of radiation, conduction, and convection heat transfer.

4.4.5.1 Horizontal, Air, 0.5 KW w/o Guard Heat

Figure 4-36 presents axial temperature profiles for the horizontal, air, 0.5 KW runs with and without the cask guard heaters on. As discussed in preceding sections (see Section 4.4.4.3) the contributions of air convection heat transport are minimized when the cask is in the horizontal orientation. Heat is transferred primarily by means of radiation between the internal fuel assembly and the cask wall. When the cask guard heaters are off and the temperatures of all internal components decrease, radiation heat transfer decreases for a given temperature difference (recall that radiation heat transfer is proportional to $T_1^4 - T_2^4$ where T_1 is the source absolute temperature and T_2 the sink absolute temperature). Thus the cask wall to fuel

FIGURE 4-35. Backfill Effects on Diagonal Temperature Profiles for Horizontal, 1.0 KW, Vacuum, Air, and Helium Conditions.

FIGURE 4-36. Axial Temperature Profiles for Horizontal, Air, and 0.5 KW Conditions With and Without Cask Guard Heat.

tube and fuel tube to fuel assembly temperature differences must increase to maintain near equal radiation heat transfer rates. As the component temperature differences increase, the relative contributions of convection and conduction heat transfer also increase until a new equilibrium temperature profile is established. That temperature profile is reflected in the data of Figure 4-36.

4.4.5.2 Vertical, Air, 0.5 KW w/o Guard Heat

The factors decreasing the absolute temperature of all assembly components as compared to the case with the guard heaters 'on' can be explained as in the previous section. However for the vertical orientation, as the component temperature differences increase in response to diminished radiant heat transfer, the axial convection contributions begin to increase. The axial temperature profiles shown in Figure 4-37 reflect the large increase in axial convective heat transport (an increase in upper closure lid surface temperatures gives supporting evidence, see Table D-2, Appendix D).

4.4.6 Vacuum Sensitivity Check

The effect of decreasing the absolute pressure for the vacuum testing was checked by repeating the vertical, 1 KW, vacuum test run at a decreased absolute pressure (29 mm Hg vs. 81 mm Hg absolute). The comparison of selected axial temperature profiles is given in Figure 4-38. Radial temperature profiles are given in Figure 4-39. The data are essentially identical within the accuracy with which the cask I.D. temperatures could be controlled. It can be concluded that uncertainties of vacuum pressures used during testing had little effect on measured temperatures.

4.4.7 Isothermal Helium Backfill

The final test run of the test matrix was designed primarily as a check on the uniformity of thermocouple readings within the cask cavity. The cask was oriented horizontally, the model fuel assembly was unheated, the cask backfilled with helium, and the 3 KW guard heaters turned "on". The high thermal conductivity helium backfill resulted in a nearly isothermal "bath" within the cask cavity. Selected axial temperature profiles for this test run are shown in Figure 4-40 and were essentially uniform. The example radial

FIGURE 4-37. Axial Temperature Profiles for Vertical, Air, and 0.5 KW Conditions With and Without Cask Guard Heat.

FIGURE 4-38. Axial Temperature Profiles for Vertical, 0.5 KW Conditions with Different Cask Evacuation Pressures.

Figure 4-39. Diagonal Temperature Profiles for Vertical, 0.5 KW Conditions with Different Cask Evacuation Pressures.

FIGURE 4-40. Axial Temperature Profiles for Horizontal, Helium, and 0.0 KW Conditions (Guard Heat Only).

profile shown in Figure 4-41 for the 2.7 m axial level is typical of the uniformity of T/C readings obtained within the unheated assembly. A slight decrease in temperature is seen to occur from the top side (rod 1) to the bottom side (rod 15) of the horizontal assembly.

4.4.8 Fuel Assembly Peak Temperatures

Table 4-3 presents a summary of the peak rod temperatures for various test conditions grouped by: 1) power level, 2) backfill, and 3) cask orientation. With this format of test conditions, it is readily apparent that peak clad temperature was most sensitive to bundle power level and backfill media and very insensitive ($\pm 5^{\circ}\text{C}$ or less) to cask orientation. Examination of the test data reveals that the measured peak rod temperatures were consistently near the axial center of the model fuel assembly's heated length regardless of backfill or orientation.

4.4.9 Data Repeatability Test Runs

As a periodic check on assembly geometry and instrumentation, the test conditions of the 25° , vacuum, 1.0 KW run were periodically repeated and the data compared to previous test runs at these conditions. Figure 4-42 shows the excellent repeatability of data. Measured peak temperatures varied less than 2.5°C , and all temperatures within the fuel assembly were repeatable within approximately 5°C .

4.5 SAHTT DATA ACCURACIES

The accuracy of the ungrounded Type T thermocouples used to measure SAHTT assembly temperatures is $\pm 2.5^{\circ}\text{C}$ ($\pm 4.5^{\circ}\text{F}$) based on calibration data. Total uncertainty in temperature readings were less than $\pm 3^{\circ}\text{C}$ ($\pm 5.5^{\circ}\text{F}$) when calibrations of the data loggers, with direct readout in units of temperature, are considered. For the hand held direct contact temperature measurement scheme employed (i.e., T/C's or mounting pads in direct contact with the surface to be measured) the total measurement uncertainty is anticipated to be less than $\pm 5^{\circ}\text{C}$ ($\pm 9^{\circ}\text{F}$).

The A.C. watt transducer used to measure electrical power supplied to the

FIGURE 4-41. Diagonal Temperature Profile for Horizontal, Helium, 0.0 KW Conditions (Guard Heat Only).

TABLE 4-3

Power, Backfill, and Orientation Effects on Measured Peak Clad Temperatures

<u>Power (KW)</u>	<u>Backfill</u>	<u>Orientation</u>	<u>Run No.</u>	<u>Measured Peak Fuel Temperature (°C)</u>
1.0	Vacuum	Horizontal	11	294
1.0	Vacuum	25° Angle	2	296
1.0	Vacuum	Vertical	14	298
1.0	Air	Horizontal	12	278
1.0	Air	25° Angle	1	277
1.0	Air	Vertical	13	273
1.0	Helium	Horizontal	10	250
1.0	Helium	25° Angle	3	250
1.0	Helium	Vertical	15	251
0.5	Vacuum	Horizontal	8	242
0.5	Vacuum	25° Angle	5	243
0.5	Vacuum	Vertical	17	239
0.5	Air	Horizontal	7	234
0.5	Air	25° Angle	6	231
0.5	Air	Vertical	18	229
0.5	Helium	Horizontal	9	214
0.5	Helium	25° Angle	4	215
0.5	Helium	Vertical	16	213

FIGURE 4-42. Data Repeatability for 250, Vacuum, 1.0 KW Conditions.

model fuel assembly had an accuracy of $\pm 0.5\%$ per certified calibration records. Additional uncertainty induced by the data logger was less than $\pm 0.05\%$ by separate calibration. The largest uncertainties in assembly power level were induced by supply line voltage fluctuations and resultant variations in the output from the power-stat controller. Although these fluctuations were measurable with the installed instrumentation, no attempt was made to time average the power levels over any specific test period. Thus a $\pm 5\%$ fluctuation in power level was noted while measurement accuracy was better than $\pm 1\%$.

All as-built test assembly dimensions and axial thermocouple locations (as shown in Table C-2, Appendix) are accurate within ± 4 mm (0.125 in).

4.5.1 Quality Assurance

A complete set of quality assurance records for the SAHTT effort were compiled. These records include but are not limited to the project plan, the quality assurance plan document, specific test plans, test procedures, final and as-built design drawings and associated records, raw data records for each test, and instrumentation continuity and calibration records. All quality assurance related records will be maintained for future use in licensing, code qualification, and related areas.

 

5.0 REFERENCES

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3. Schmittroth, F., 1984, ORIGEN 2 Calculations of PWR Spent Fuel Decay Heat Compared with Calorimeter Data, HEDL-TME 83-32, Hanford Engineering Development Laboratory.
4. Davis, R., 1980, Data Report for the Nondestructive Examination of Turkey Point Spent Fuel Assemblies B02, B03, B17, B41, and B43, HEDL-TME 79-68, Hanford Engineering Development Laboratory.
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APPENDICES

APPENDIX A

FTT Thermocouple Locations
and
Experimental Data

TABLE A-1

FUEL TEMPERATURE TEST THERMOCOUPLE LOCATIONS

<u>Data Channel (T/C) No.</u>	<u>Distance Below Top of Canister (In.)</u>	<u>Radius (In.)</u>	<u>Orientation (Degrees)</u>	<u>Location</u>
<u>Data Thermocouples</u>				
301	135.0	0	-	Canister Lid Thermowell No. 1*
302	113.0	0	-	Canister Lid Thermowell No. 1
303	86.8	0	-	Canister Lid Thermowell No. 1
304	73.0	0	-	Canister Lid Thermowell No. 1
305	53.0	0	-	Canister Lid Thermowell No. 1
306	37.0	0	-	Canister Lid Thermowell No. 1
307	25.0	0	-	Canister Lid Thermowell No. 1
308	135.0	3.97	315	Canister Lid Thermowell No. 2
309	113.0	3.97	315	Canister Lid Thermowell No. 2
310	86.8	3.97	315	Canister Lid Thermowell No. 2
311	73.0	3.97	315	Canister Lid Thermowell No. 2
312	53.0	3.97	315	Canister Lid Thermowell No. 2
313	37.0	3.97	315	Canister Lid Thermowell No. 2
314	25.0	3.97	315	Canister Lid Thermowell No. 2
315	135.0	3.03	22	Canister Lid Thermowell No. 3
316	113.0	3.03	22	Canister Lid Thermowell No. 3
317	86.8	3.03	22	Canister Lid Thermowell No. 3
318	73.0	3.03	22	Canister Lid Thermowell No. 3
319	53.0	3.03	22	Canister Lid Thermowell No. 3
320	37.0	3.03	22	Canister Lid Thermowell No. 3
321	25.0	3.03	22	Canister Lid Thermowell No. 3
322	135.0	3.97	45	Canister Lid Thermowell No. 4
323	113.0	3.97	45	Canister Lid Thermowell No. 4
324	86.8	3.97	45	Canister Lid Thermowell No. 4
325	73.0	3.97	45	Canister Lid Thermowell No. 4
326	53.0	3.97	45	Canister Lid Thermowell No. 4
327	37.0	3.97	45	Canister Lid Thermowell No. 4
328†	25.0	3.97	45	Canister Lid Thermowell No. 4
329	135.0	2.38	315	Canister Lid Thermowell No. 5
330	113.0	2.38	315	Canister Lid Thermowell No. 5
331	86.8	2.38	315	Canister Lid Thermowell No. 5
332	73.0	2.38	315	Canister Lid Thermowell No. 5
333**	53.0	2.38	315	Canister Lid Thermowell No. 5
334	37.0	2.38	315	Canister Lid Thermowell No. 5
335	25.0	2.38	315	Canister Lid Thermowell No. 5

*See Figure 2-7 for illustration of thermowell locations

**Connected to heater controller C21

†Electrical check showed low internal resistance - readings may be in error

TABLE A-1 (Cont'd)

Data Channel (T/C) No.	Distance Below Top of Canister (In.)	Radius (In.)	Orientation (Degrees)	Location
336	135.0	2.25	0	Canister Lid Thermowell No. 6
337	113.0	2.25	0	Canister Lid Thermowell No. 6
338	86.8	2.25	0	Canister Lid Thermowell No. 6
339	73.0	2.25	0	Canister Lid Thermowell No. 6
340	53.0	2.25	0	Canister Lid Thermowell No. 6
341	37.0	2.25	0	Canister Lid Thermowell No. 6
342	25.0	2.25	0	Canister Lid Thermowell No. 6
343	135.0	2.38	45	Canister Lid Thermowell No. 7
344	113.0	2.38	45	Canister Lid Thermowell No. 7
345	86.8	2.38	45	Canister Lid Thermowell No. 7
346	73.0	2.38	45	Canister Lid Thermowell No. 7
347	53.0	2.38	45	Canister Lid Thermowell No. 7
348	37.0	2.38	45	Canister Lid Thermowell No. 7
349	25.0	2.38	45	Canister Lid Thermowell No. 7
350	135.0	2.25	270	Canister Lid Thermowell No. 8
351	113.0	2.25	270	Canister Lid Thermowell No. 8
352	86.8	2.25	270	Canister Lid Thermowell No. 8
353	73.0	2.25	270	Canister Lid Thermowell No. 8
354	53.0	2.25	270	Canister Lid Thermowell No. 8
355	37.0	2.25	270	Canister Lid Thermowell No. 8
356	25.0	2.25	270	Canister Lid Thermowell No. 8
357*	135.0	2.25	90	Canister Lid Thermowell No. 9
358	113.0	2.25	90	Canister Lid Thermowell No. 9
359	86.8	2.25	90	Canister Lid Thermowell No. 9
360	73.0	2.25	90	Canister Lid Thermowell No. 9
361	53.0	2.25	90	Canister Lid Thermowell No. 9
362	37.0	2.25	90	Canister Lid Thermowell No. 9
363	25.0	2.25	90	Canister Lid Thermowell No. 9
364	135.0	2.38	225	Canister Lid Thermowell No. 10
365	113.0	2.38	225	Canister Lid Thermowell No. 10
366	86.8	2.38	225	Canister Lid Thermowell No. 10
367	73.0	2.38	225	Canister Lid Thermowell No. 10
368	53.0	2.38	225	Canister Lid Thermowell No. 10
369	37.0	2.38	225	Canister Lid Thermowell No. 10
370	25.0	2.38	225	Canister Lid Thermowell No. 10
371	135.0	2.38	135	Canister Lid Thermowell No. 11
372	113.0	2.38	135	Canister Lid Thermowell No. 11
373	86.8	2.38	135	Canister Lid Thermowell No. 11
374	73.0	2.38	135	Canister Lid Thermowell No. 11
375	53.0	2.38	135	Canister Lid Thermowell No. 11
376	37.0	2.38	135	Canister Lid Thermowell No. 11
377	25.0	2.38	135	Canister Lid Thermowell No. 11

*Electrical check showed low internal resistance - readings may be in error

TABLE A-1 (Cont'd)

Data Channel (T/C) No.	Distance Below Top of Canister (In.)	Radius (In.)	Orientation (Degrees)	Location
378	135.0	2.25	180	Canister Lid Thermowell No. 12
379	113.0	2.25	180	Canister Lid Thermowell No. 12
380	86.8	2.25	180	Canister Lid Thermowell No. 12
381	73.0	2.25	180	Canister Lid Thermowell No. 12
382	53.0	2.25	180	Canister Lid Thermowell No. 12
383*	37.0	2.25	180	Canister Lid Thermowell No. 12
384	25.0	2.25	180	Canister Lid Thermowell No. 12
385	135.0	3.97	225	Canister Lid Thermowell No. 13
386	113.0	3.97	225	Canister Lid Thermowell No. 13
387*	86.8	3.97	225	Canister Lid Thermowell No. 13
388	73.0	3.97	225	Canister Lid Thermowell No. 13
389*	53.0	3.97	225	Canister Lid Thermowell No. 13
390	37.0	3.97	225	Canister Lid Thermowell No. 13
391	25.0	3.97	225	Canister Lid Thermowell No. 13
392	135.0	3.03	202	Canister Lid Thermowell No. 14
393	113.0	3.03	202	Canister Lid Thermowell No. 14
394	86.8	3.03	202	Canister Lid Thermowell No. 14
395	73.0	3.03	202	Canister Lid Thermowell No. 14
396	53.0	3.03	202	Canister Lid Thermowell No. 14
397	37.0	3.03	202	Canister Lid Thermowell No. 14
398	25.0	3.03	202	Canister Lid Thermowell No. 14
399	135.0	3.97	135	Canister Lid Thermowell No. 15
400	113.0	3.97	135	Canister Lid Thermowell No. 15
401	86.8	3.97	135	Canister Lid Thermowell No. 15
402	73.0	3.97	135	Canister Lid Thermowell No. 15
403	53.0	3.97	135	Canister Lid Thermowell No. 15
404	37.0	3.97	135	Canister Lid Thermowell No. 15
405	25.0	3.97	135	Canister Lid Thermowell No. 15
406	0	0.8	180	Canister Lid Top Plate
407	0	5.8	70	Canister Lid Top Plate
408	4.5	0.8	180	Canister Lid Top
409	4.5	5.8	70	Canister Lid Top
415	0.5	9.0	225	Canister Support Ring
416	2.5	8.0	135	Canister Upper Support Pipe
417	16.5	7.0	0	Canister Outside
418	16.5	7.0	180	Canister Outside
419	51.0	7.0	0	Canister Outside (Inside T/C Tube)
420	51.0	7.0	90	Canister Outside (Inside T/C Tube)

*Electrical check showed low internal resistance - readings may be in error

TABLE A-1 (Cont'd)

Data Channel (T/C) No.	Distance Below Top of Canister (In.)	Radius (In.)	Orientation (Degrees)	Location
421	51.0	7.0	180	Canister Outside
422	51.0	7.0	270	Canister Outside
423	85.5	7.0	0	Canister Outside
424	85.5	7.0	45	Canister Outside
425	85.5	7.0	90	Canister Outside
426	85.5	7.0	135	Canister Outside
427	85.5	7.0	180	Canister Outside
428**	85.5	7.0	225	Canister Outside
429	85.5	7.0	270	Canister Outside
430	85.5	7.0	315	Canister Outside
431	120.0	7.0	0	Canister Outside
432	120.0	7.0	90	Canister Outside
433	120.0	7.0	180	Canister Outside (Inside T/C Tube)
434	120.0	7.0	270	Canister Outside (Inside T/C Tube)
435	154.5	7.0	90	Canister Outside
436	154.5	7.0	270	Canister Outside
437	171.6	0.0	-	Canister Bottom
440	1.5	9.0	135	Outside of Liner Pipe
441	6.0	9.0	132	Outside of Liner Pipe
442	12.0	9.0	190	Outside of Liner Pipe
443	18.0	9.0	67	Outside of Liner Pipe
444	24.0	9.0	292	Outside of Liner Pipe
445	30.0	9.0	158	Outside of Liner Pipe
446	36.0	9.0	202	Outside of Liner Pipe
447	42.0	9.0	65	Outside of Liner Pipe
448	48.0	9.0	225	Outside of Liner Pipe
449	54.0	9.0	158	Outside of Liner Pipe
450	60.0	9.0	135	Outside of Liner Pipe
451	66.0	9.0	22	Outside of Liner Pipe
452*	72.0	9.0	245	Outside of Liner Pipe
453	78.0	9.0	68	Outside of Liner Pipe
454**	84.0	9.0	202	Outside of Liner Pipe
455	90.0	9.0	158	Outside of Liner Pipe
456	96.0	9.0	22	Outside of Liner Pipe
457	96.0	9.0	112	Outside of Liner Pipe
458	96.0	9.0	202	Outside of Liner Pipe
459	96.0	9.0	292	Outside of Liner Pipe
460T	102.0	9.0	112	Outside of Liner Pipe

* Connected to heater control C9

** Electrical check showed low internal resistance - readings may be in error

† Connected to heater controller C11

TABLE A-1 (Cont'd)

<u>Data Channel (T/C) No.</u>	<u>Distance Below Top of Canister (In.)</u>	<u>Radius (In.)</u>	<u>Orientation (Degrees)</u>	<u>Location</u>
461	108.0	9.0	135	Outside of Liner Pipe
462	114.0	9.0	22	Outside of Liner Pipe
463	120.0	9.0	248	Outside of Liner Pipe
464	126.0	9.0	68	Outside of Liner Pipe
465	132.0	9.0	202	Outside of Liner Pipe
466	138.0	9.0	158	Outside of Liner Pipe
467	144.0	9.0	292	Outside of Liner Pipe
468	150.0	9.0	112	Outside of Liner Pipe
469	156.0	9.0	135	Outside of Liner Pipe
470	162.0	9.0	22	Outside of Liner Pipe
471	168.0	9.0	248	Outside of Liner Pipe
472	174.0	9.0	68	Outside of Liner Pipe
473	180.0	9.0	202	Outside of Liner Pipe
474	186.0	9.0	158	Outside of Liner Pipe
475	192.0	9.0	292	Outside of Liner Pipe
476	196.2	9.0	90	Outside of Liner Pipe
477	196.2	9.0	180	Outside of Liner Pipe
478	0	10.1	315	On Insulation Sheath
479	65.0	10.1	315	On Insulation Sheath
480	65.0	10.1	135	On Insulation Sheath
481	130.0	10.1	315	On Insulation Sheath
482	130.0	10.1	135	On Insulation Sheath
483	195.0	10.1	315	On Insulation Sheath
484*	0	10.6	315	Outside Flexible Insulation
485	130.0	10.6	315	Outside Flexible Insulation
486	130.0	10.6	135	Outside Flexible Insulation
487	195.0	10.6	315	Outside Flexible Insulation
488	156.0	45.0	65	Ambient Temperature
489	52.0	45.0	65	Ambient Temperature
490	156.0	45.0	245	Ambient Temperature
491	52.0	45.0	245	Ambient Temperature
492	195.5	3.5	330	Top Plate of Insulation Plug

*This thermocouple removed from insulation when insulation was removed

TABLE A-1 (Cont'd)

<u>Data Channel (T/C) No.</u>	<u>Distance Below Top of Canister (In.)</u>	<u>Radius (In.)</u>	<u>Orientation (Degrees)</u>	<u>Location</u>
<u>Heater Controller Thermocouples</u>				
TC-1	0	5.0	295	Canister Lid Cover
TC-2	0	7.7	295	Canister Support Ring
TC-3	6.0	9.0	312	Liner
TC-4	18.0	9.0	247	Liner
TC-5	30.0	9.0	338	Liner
TC-6	42.0	9.0	245	Liner
TC-7	54.0	9.0	338	Liner
TC-8	66.0	9.0	202	Liner
452	72.0	9.0	245	Liner
TC-10	90.0	9.0	338	Liner
460	102.0	9.0	112	Liner
TC-12	114.0	9.0	202	Liner
TC-13	126.0	9.0	248	Liner
TC-14	138.0	9.0	338	Liner
TC-15	150.0	9.0	292	Liner
TC-16	162.0	9.0	202	Liner
TC-17	174.0	9.0	248	Liner
TC-18	186.0	9.0	338	Liner
TC-19	196.2	9.0	292	Liner
TC-20	195.5	4.0	60	Top On Insulation Plug
333	53.0	2.38	315	Canister Lid Thermowell No. 5

TABLE A-2

FUEL TEMPERATURE TEST NO. 7 THERMOCOUPLE DATA

DATE: 12/8/80 TIME: 8:00 a.m.
 TEST CONDITIONS: Drywell Canister Profile With Air

T/C No.	Temp(°F)	T/C No.	Temp(°F)	T/C No.	Temp(°F)
362	459.2	428	324.1	492	96.4
361	460.0	427	328.9	491	80.6
360	465.4	426	325.6	490	78.5
359	459.6	425	320.3	489	80.6
358	450.3	424	316.5	488	78.6
357	418.0	423	316.6	487	77.2
356	400.2	422	318.7	486	109.7
355	462.0	421	319.6	485	110.9
354	469.4	420	303.8	484	95.1
353	474.6	419	304.8	483	78.0
352	477.8	418	285.6	482	149.7
351	467.3	417	278.0	481	150.3
350	425.9	416	218.6	480	146.8
349	415.4	415	212.6	479	131.4
348	459.2	409	233.3	478	142.6
347	459.1	408	240.9	477	84.8
346	464.4	407	197.0	476	85.8
345	462.2	406	198.3	475	87.9
344	453.7	405	386.9	474	99.2
343	421.9	404	423.4	473	109.1
342	420.8	403	428.9	472	134.6
341	464.3	402	432.3	471	173.8
340	460.9	401	430.3	470	220.0
339	465.7	400	421.2	469	227.1
338	464.0	399	393.8	468	221.1
337	456.2	398	404.5	467	216.5
336	425.0	397	445.4	466	218.7
335	420.7	396	450.4	465	225.3
334	464.9	395	457.6	464	228.7
332	470.1	394	461.4	463	237.4
331	470.1	393	452.4	462	246.1
330	459.6	392	405.7	461	263.0
329	425.3	391	391.5	460	184.1
328	383.2	390	432.3	459	269.1
327	423.0	389	436.8	458	272.5
326	421.8	388	444.0	457	274.5
325	429.8	387	448.7	456	267.9
324	426.9	386	438.2	455	267.9
323	420.6	385	393.6	454	250.7
322	395.5	384	415.1	453	224.9
321	403.1	383	457.8	451	228.2
320	444.7	382	465.7	450	239.3
319	440.6	381	471.6	449	239.4
318	448.1	380	473.3	448	232.5
317	446.1	379	463.5	447	232.5
316	439.1	378	421.3	446	230.6
315	410.4	377	410.8	445	228.6
314	394.1	376	455.5	444	223.3
313	428.9	375	462.9	443	219.3
312	429.6	374	466.7	442	215.8
311	434.4	373	463.2	441	209.2
310	433.8	372	455.1	440	210.3
309	425.2	371	420.7	437	191.8
308	397.1	370	417.4	436	260.5
307	435.0	369	459.6	435	263.6
306	478.4	368	469.1	434	310.3
305	487.5	367	474.7	433	311.4
304	491.2	366	476.9	432	312.6
303	489.9	365	465.5	431	313.3
302	478.2	364	424.1	430	317.2
301	442.7	363	413.2	429	321.6

TABLE A-3

FUEL TEMPERATURE TEST NO. 8 THERMOCOUPLE DATA

DATE: 12/10/80

TIME: 8:00 a.m.

TEST CONDITIONS: Drywell Canister Profile With Vacuum

T/C No.	Temp(°F)	T/C No.	Temp(°F)	T/C No.	Temp(°F)
362	435.4	428	315.3	492	95.1
361	473.3	427	321.0	491	80.9
360	488.7	426	323.3	490	78.9
359	491.6	425	320.9	489	80.7
358	488.4	424	318.1	488	78.9
357	468.1	423	317.0	487	77.3
356	344.4	422	301.1	486	107.5
355	435.7	421	302.3	485	108.8
354	475.6	420	295.7	484	96.2
353	483.4	419	294.9	483	78.0
352	491.1	418	236.9	482	144.9
351	487.4	417	240.1	481	145.4
350	486.5	416	190.1	480	142.0
349	361.4	415	185.4	479	127.4
348	437.1	409	195.3	478	134.5
347	475.3	408	195.6	477	84.3
346	490.4	407	173.7	476	85.4
345	492.1	406	173.4	475	87.2
344	489.2	405	338.0	474	97.6
343	469.3	404	401.6	473	106.6
342	365.1	403	438.2	472	129.6
341	441.0	402	451.6	471	163.2
340	476.9	401	455.0	470	202.0
339	490.4	400	451.4	469	209.2
338	491.7	399	434.3	468	206.5
337	488.7	398	351.8	467	207.5
336	471.4	397	419.6	466	214.2
335	362.7	396	455.5	465	224.5
334	440.3	395	468.6	464	229.3
332	489.5	394	471.5	463	235.0
331	490.5	393	469.8	462	236.0
330	486.7	392	448.3	461	239.5
329	469.2	391	340.2	460	152.7
328	341.9	390	405.7	459	241.8
327	409.2	389	439.6	458	244.9
326	441.1	388	453.5	457	246.4
325	457.0	387	457.4	456	242.2
324	460.1	386	453.9	455	249.9
323	455.0	385	432.2	454	237.0
322	437.5	384	358.7	453	215.0
321	353.6	383	431.4	451	220.7
320	425.1	382	472.2	450	228.4
319	459.7	381	485.6	449	227.2
318	474.4	380	487.4	448	218.7
317	477.5	379	484.7	447	222.0
316	473.8	378	465.6	446	214.8
315	455.0	377	351.9	445	213.1
314	341.7	376	429.3	444	205.3
313	406.7	375	472.0	443	204.6
312	440.2	374	486.2	442	195.9
311	453.3	373	487.2	441	190.0
310	456.9	372	485.1	440	187.3
309	453.5	371	467.1	437	194.9
308	437.0	370	360.4	436	260.5
307	372.5	369	433.2	435	263.4
306	451.2	368	474.2	434	311.1
305	496.1	367	487.1	433	312.7
304	510.8	366	488.5	432	315.9
303	510.9	365	484.0	431	316.2
302	506.6	364	467.2	430	315.4
301	489.5	363	355.0	429	313.4

TABLE A-4

FUEL TEMPERATURE TEST NO. 9 THERMOCOUPLE DATA

DATE: 12/14/80

TIME: 4:00 a.m.

TEST CONDITIONS: Drywell Canister Profile With Helium

T/C No.	Temp(°F)	T/C No.	Temp(°F)	T/C No.	Temp(°F)
362	380.3	428	316.2	492	95.2
361	408.3	427	319.2	491	79.1
360	423.7	426	325.7	490	77.4
359	426.0	425	321.1	489	79.1
358	422.9	424	321.8	488	77.3
357	401.0	423	317.0	487	75.9
356	306.3	422	301.3	486	107.0
355	382.8	421	302.7	485	108.5
354	412.1	420	297.4	484	93.4
353	424.5	419	296.4	483	76.6
352	426.5	418	240.9	482	145.8
351	422.3	417	242.5	481	146.4
350	401.5	416	193.2	480	140.9
349	321.4	415	188.8	479	126.9
348	381.2	409	198.9	478	134.3
347	409.4	408	200.2	477	83.5
346	424.1	407	176.4	476	84.6
345	425.6	406	176.3	475	86.6
344	422.4	405	305.5	474	97.8
343	401.0	404	356.5	473	107.6
342	325.7	403	383.8	472	132.6
341	385.8	402	395.5	471	170.6
340	411.3	401	398.7	470	213.7
339	424.8	400	395.0	469	217.4
338	426.0	399	375.7	468	209.4
337	423.2	398	320.0	467	208.6
336	403.2	397	374.4	466	214.8
335	323.7	396	399.7	465	223.2
334	385.4	395	411.7	464	226.8
332	424.3	394	413.8	463	232.9
331	424.9	393	410.4	462	235.7
330	421.0	392	388.3	461	239.9
329	401.2	391	308.9	460	153.4
328	307.6	390	364.2	459	243.7
327	361.3	389	387.4	458	246.5
326	383.8	388	400.5	457	248.6
325	399.3	387	403.1	456	244.4
324	402.3	386	398.7	455	252.2
323	397.5	385	375.1	454	238.7
322	378.5	384	322.6	453	215.7
321	317.9	383	379.9	451	221.7
320	374.5	382	409.8	450	229.8
319	399.3	381	422.4	449	228.3
318	414.4	380	423.6	448	219.8
317	416.6	379	420.1	447	223.9
316	413.0	378	399.3	446	216.5
315	392.1	377	314.8	445	215.2
314	309.0	376	376.0	444	209.5
313	361.3	375	408.1	443	209.7
312	385.5	374	421.1	442	200.2
311	397.8	373	422.3	441	192.8
310	400.7	372	419.6	440	190.4
309	397.9	371	399.9	437	196.4
308	378.7	370	322.7	436	262.3
307	329.0	369	381.2	435	265.2
306	391.1	368	410.6	434	309.9
305	425.0	367	422.9	433	311.2
304	439.0	366	424.2	432	315.3
303	439.0	365	419.2	431	315.7
302	434.8	364	399.9	430	318.0
301	415.9	363	316.9	429	317.0

A. Vacuum Backfill (Reference: Table A-3)

B. Helium Backfill (Reference: Table A-4)

C. Air Backfill (Reference: Table A-2)

FIGURE A-1. Thermowell and Canister Temperature (°F)
Maps (86.8 inches below top of canister)

APPENDIX B

AGNS SAHTT Design Drawings

FUEL GRID LOCATION ①

1/2 ELEMENT	1/2 ELEMENT
1, A	15, H
2, B	16, I
3, C	17, J
4, D	18, K
5, E	19, L
6, F	20, M
7, G	21, N
8, H	22, O
9, I	23, P
10, J	24, Q

GRID LOCATION ②

1/2 ELEMENT	1/2 ELEMENT
2, B	1, A
3, C	2, B
4, D	3, C
5, E	4, D
6, F	5, E
7, G	6, F
8, H	7, G
9, I	8, H
10, J	9, I
11, K	10, J
12, L	11, K
13, M	12, L
14, N	13, M
15, O	14, N
16, P	15, O

GRID LOCATION ③

1/2 ELEMENT	1/2 ELEMENT
3, C	1, A
4, D	2, B
5, E	3, C
6, F	4, D
7, G	5, E
8, H	6, F
9, I	7, G
10, J	8, H
11, K	9, I
12, L	10, J
13, M	11, K
14, N	12, L
15, O	13, M
16, P	14, N

GRID LOCATION ④

1/2 ELEMENT	1/2 ELEMENT
4, D	1, A
5, E	2, B
6, F	3, C
7, G	4, D
8, H	5, E
9, I	6, F
10, J	7, G
11, K	8, H
12, L	9, I
13, M	10, J
14, N	11, K
15, O	12, L
16, P	13, M

GRID LOCATION ⑤

1/2 ELEMENT	1/2 ELEMENT
5, E	1, A
6, F	2, B
7, G	3, C
8, H	4, D
9, I	5, E
10, J	6, F
11, K	7, G
12, L	8, H
13, M	9, I
14, N	10, J
15, O	11, K
16, P	12, L

GRID LOCATION ⑥

1/2 ELEMENT	1/2 ELEMENT
6, F	1, A
7, G	2, B
8, H	3, C
9, I	4, D
10, J	5, E
11, K	6, F
12, L	7, G
13, M	8, H
14, N	9, I
15, O	10, J
16, P	11, K

GRID LOCATION ⑦

1/2 ELEMENT	1/2 ELEMENT
7, G	1, A
8, H	2, B
9, I	3, C
10, J	4, D
11, K	5, E
12, L	6, F
13, M	7, G
14, N	8, H
15, O	9, I
16, P	10, J

FUEL & TUBE 1/2 LOCATIONS

SECTION A-A

BOARD NO.	1/2 LOC
1	58, 59, 60, 61
2	62, 63, 64, 65
3	66, 67, 68, 69
4	70, 71, 72, 73
5	74, 75, 76, 77

VERIFIED DISTANCE FROM FLANGE "A" TO 1/2 DIMENSION IN INCHES ± 1/2"
 1/2 NOT ATTACHED TO ROD, LOOSE IN BUNDLE

NOTE
 ALL HEATING RODS VERIFIED TO BE .820" DIA.
 10 BLENDS .500" DIA.

ALL 38142-15880
 RAN 1/1/21

DATE	10/1/21	ISSUE FOR CONSTRUCTION	YES
BY	10/1/21	DESIGN	10/1/21
REFERENCE	10/1/21	10/1/21	10/1/21
ALLIED GENERAL NUCLEAR SERVICES			
BARNWELL NUCLEAR FUEL PLANT			
BARNWELL, SOUTH CAROLINA			
AGNS DESIGN ENGINEERING DEPARTMENT			
BARNWELL, S. C. 29036			
SINGLE ASSEMBLY			
HEAT TRANSFER TEST			
ASSEMBLY & T/C LAYOUT			
PROJECT	10/1/21	10/1/21	10/1/21
10/1/21	10/1/21	10/1/21	10/1/21

APPENDIX C

SAHTT Model Fuel Rod Resistance Measurements

SAHTT Assembly Thermocouple Locations

SAHTT Data Logger Channel Assignments

TABLE C-1. Heater Resistance Measurements
(at room temperature)

Heater Row & Number	Resistance- Ω	
	Test 1	Test 2
A	1	160
	2	160
	3	161
	4	159
	5	160
	6	159
	7	160
	8	157
	9	159
	10	159
	11	161
	12	161
	13	160
	14	163
	15	159
B	1	161
	2	159
	3	157
	4	159
	5	160
	6	160
	7	161
	8	159
	9	158
	10	160
	11	161
	12	157
	13	158
	14	166
	15	161
C	1	160
	2	160
	3	---
	4	159
	5	159
	6	158
	7	162
	8	160
	9	158
	10	160
	11	159

Heater Row and Number	Resistance- Ω	
	Test 1	Test 2
C	12	158
	13	---
	14	161
	15	161
	16	160
D	1	160
	2	161
	3	158
	4	159
	5	160
	6	159
	7	161
	8	162
	9	160
	10	159
	11	160
	12	164
	13	163
	14	158
	15	163
E	1	161
	2	159
	3	160
	4	159
	5	---
	6	158
	7	159
	8	160
	9	159
	10	161
	11	---
	12	160
	13	161
	14	160
	15	161
F	1	159
	2	157
	3	158
	4	159
	5	162
	6	155
	7	159

Heater Row and Number	Resistance- Ω	
	Test 1	Test 2
F	8	159
	9	159
	10	161
	11	158
	12	160
	13	161
	14	163
	15	166
G	1	159
	2	159
	3	161
	4	159
	5	158
	6	157
	7	160
	8	157
	9	159
	10	160
	11	163
	12	159
	13	160
	14	161
	15	160
H	1	158
	2	160
	3	159
	4	161
	5	159
	6	158
	7	156
	8	neutral
	9	160
	10	159
	11	156
	12	161
	13	160
	14	161
	15	162
I	1	160
	2	158
	3	160

TABLE C-1. (Continued)

Heater Row and Number	Resistance- Ω	
	Test 1	Test 2
I	4	159
	5	161
	6	161
	7	159
	8	160
	9	156
	10	159
	11	158
	12	162
	13	158
	14	159
	15	161
	1	159
	2	158
	3	159
J	4	160
	5	163
	6	159
	7	159
	8	161
	9	159
	10	162
	11	161
	12	160
	13	163
	14	161
	15	160
	1	159
	2	151
	3	160
K	4	162
	5	---
	6	162
	7	158
	8	160
	9	162
	10	161
	11	---
	12	160
	13	160
	14	157

Heater Row and Number	Resistance- Ω	
	Test 1	Test 2
K	15	162
	1	160
	2	157
	3	164
	4	159
	5	162
	6	160
	7	160
	8	159
	9	158
	10	160
	11	161
	12	161
	13	162
	14	161
L	15	163
	1	161
	2	161
	3	---
	4	159
	5	158
	6	160
	7	163
	8	162
	9	160
	10	163
	11	160
	12	162
	13	---
	14	161
M	15	160
	1	158
	2	159
	3	162
	4	161
	5	160
	6	163
	7	162
	8	162
	9	160
	10	163
	11	160
	12	162
	13	---
	14	161
N	15	160
	1	158
	2	159
	3	159
	4	158
	5	156
	6	159
	7*	163
	8	161
	9	162
	10	162

Heater Row and Number	Resistance- Ω	
	Test 1	Test 2
N	11	159
	12	160
	13	159
	14	160
	15	159
	1	159
	2	160
	3	160
	4	160
	5	---
	6	160
	7	160
	8	162
	9	157
	10	160
O	11	---
	12	160
	13	162
	14	161
	15	161

* - Heater showed open circuit during testing.

TABLE C-2. SAHTT Assembly T/C Locations

<u>T/C No.</u>	<u>Nominal Location</u>	<u>Mount¹</u>	<u>Axial Level²</u>	<u>Data Plane No.³</u>
1 ^F	Rod A-1	Clip	101.6	1
2	Rod A-1	Clip	164.8	3
3	Rod A-1	Clip	229.6	5
4	Rod A-1	Clip	270.8	6
5	Rod A-1	Clip	316.5	7
6	Rod A-1	Clip	363.9	8
7	Rod A-1	Clip	424.5	9
8	Rod H-1	Clip	110.8	1
9	Rod H-1	Clip	165.4	3
10 ^F	Rod H-1	Clip	229.6	5
11	Rod H-1	Clip	270.8	6
12	Rod H-1	Clip	362.9	8
13	Rod D-4	Pad	225.1	5
14	Rod D-4	Pad	269.6	6
15	Rod D-4	Pad	316.5	7
16	Rod D-4	Clip	362.9	8
17	Rod D-4	Pad	422.0	9
18	Rod L-4	Pad	222.6	5
19	Rod L-4	Pad	319.1	7
20	Rod L-4	Pad	423.2	9

1 - Clip - Clipped to given rod, Pad-Weld pad mount (see figure 4-13),
Band-cask I.D. band mount

2 - Distance from cask lower end in cm, post-test as-built dimension

3 - * cask I.D. data plane
otherwise assembly/fuel tube data plane

4 - Replaced with T/C to measure ambient temp.

F - failed T/C or failed mount

J - type J T/C (all others type T)

TABLE C-2 (Continued)

<u>T/C No.</u>	<u>Nominal Location</u>	<u>Mount¹</u>	<u>Axial Level²</u>	<u>Data Plane No.³</u>
21	Rod 8-E	Clip	115.9	1
22	Rod 8-E	Clip ^F	231.5	5
23	Rod J-8	Clip ^F	107.6	1
24	Rod J-8	Clip ^F	230.8	5
25	Rod O-8	Clip	119.7	1
26	Rod O-8	Clip	164.8	3
27	Rod O-8	Clip	223.2	5
28	Rod O-8	Clip	317.8	7
29	Rod O-8	Clip	423.9	9
30	Rod H-9	Clip ^F	101.9	1
31	Rod H-9	Clip ^F	230.2	5
32	Rod H-9	Pad	273.4	6
33	Rod H-9	Pad	318.5	7
34 ^{F,4}	Rod H-9	Clip	-	8
35	Rod H-9	Pad	423.2	9
36	Rod D-12	Pad	226.7	5
37	Rod D-12	Pad	319.7	7
38	Rod D-12	Pad	420.7	9
39	Rod L-12	Pad	224.5	5
40	Rod L-12	Pad	272.1	6
41	Rod L-12	Pad	321.3	7
42	Rod L-12	Clip ^F	356.9	8
43	Rod L-12	Pad	422.6	9
44	Rod H-15	Clip	121.6	1
45	Rod H-15	Clip	164.8	3
46 ^F	-	-	-	5
47	Rod H-15	Clip	274.0	6
48	Rod H-15	Clip	315.9	7
49	Rod H-15	Clip	361.6	8
50	Rod H-15	Clip	424.5	9
51	Rod O-15	Clip	119.4	1
52	Rod O-15	Clip	163.8	3
53	Rod O-15	Clip	221.0	5
54	Rod O-15	Clip	272.7	6
55	Rod O-15	Clip	316.5	7
56	Rod O-15	Clip ^F	363.5	8
57	Rod O-15	Clip	421.3	9
58	Cask wall, Pos. D	Band	34.6	1*
59	Cask Wall, Pos. C	Band	34.6	1*

TABLE C-2 (Continued)

<u>T/C No.</u>	<u>Nominal Location</u>	<u>Mount¹</u>	<u>Axial Level²</u>	<u>Data Plane No.³</u>
60	Cask Wall, Pos. B	Band	34.6	1*
61	Cask Wall, Pos. A	Band	35.1	1*
62	Cask Wall, Pos. D	Band	148.9	2*
63	Cask Wall, Pos. C	Band	148.6	2*
64	Cask Wall, Pos. B	Band	148.3	2*
65	Cask Wall, Pos. A	Band	148.0	2*
66	Cask Wall, Pos. D	Band	263.2	3*
67	Cask Wall, Pos. C	Band	263.8	3*
68	Cask Wall, Pos. B	Band	263.5	3*
69	Cask Wall, Pos. A	Band	261.6	3*
70	Cask Wall, Pos. D	Band	376.2	4*
71	Cask Wall, Pos. C	Band	375.6	4*
72	Cask Wall, Pos. B	Band	375.3	4*
73	Cask Wall, Pos. A	Band	375.3	4*
74	Cask Wall, Pos. D	Band	489.4	5*
75	Cask Wall, Pos. C	Band	489.3	5*
76	Cask Wall, Pos. B	Band	489.0	5*
77	Cask Wall, Pos. A	Band	489.0	5*
78 ^J	Cask Wall, Pos. C	Band	263.8	3*
79	None	-	-	
80	None	-	-	

TABLE C-2 (Continued)

<u>T/C No.</u>	<u>Nominal Location</u>	<u>Mount</u>	<u>Axial Level</u>	<u>Data Plane No.</u>
81	Fuel Tube O.D., 0°	Weld Pad	121.3	1
82	Fuel Tube O.D., 0°	Weld Pad	166.4	3
83	Fuel Tube O.D., 0°	Weld Pad	223.8	5
84	Fuel Tube O.D., 0°	Weld Pad	270.8	6
85	Fuel Tube O.D., 0°	Weld Pad	319.1	7
86	Fuel Tube O.D., 0°	Weld Pad	362.6	8
87	Fuel Tube O.D., 0°	Weld Pad	421.3	9
88	Fuel Tube O.D., 90°	Weld Pad	121.0	1
89	Fuel Tube O.D., 90°	Weld Pad	166.4	3
90	Fuel Tube O.D., 90°	Weld Pad	223.8	5
91	Fuel Tube O.D., 90°	Weld Pad	270.8	6
92	Fuel Tube O.D., 90°	Weld Pad	318.8	7
93	Fuel Tube O.D., 90°	Weld Pad	364.5	8
94	Fuel Tube O.D., 90°	Weld Pad	421.0	9
95	Fuel Tube O.D., 180°	Weld Pad	121.0	1
96	Fuel Tube O.D., 180°	Weld Pad	224.2	5
97	Fuel Tube O.D., 180°	Weld Pad	422.0	9
98	Fuel Tube O.D., 270°	Weld Pad	121.0	1
99	Fuel Tube O.D., 270°	Weld Pad	224.2	5
100	Fuel Tube O.D., 270°	Weld Pad	422.0	9

TABLE C-3. Data Logger Channel Assignments

DATA LOGGER NO. 1.

(FOR SCANS OF THERMOCOUPLE NOS. 1-50:)

Channel No.	T/C No.	Channel No.	T/C No.
0	1	25	26
1	2	26	27
2	3	27	28
3	4	28	29
4	5	29	30
5	6	30	31
6	7	31	32
7	8	32	33
8	9	33 ^A	Ambient Temp.
9	10 ^F	34	35
10	11	35	36
11	12	36	37
12	13	37	38
13	14	38	39
14	15	39	40
15	16	40	41
16	17	41	42
17	18	42	43
18	19	43	44
19	20	44	45
20	21	45	48
21	22	46	47
22	23	47 ^D	46 ^F
23	24	48	49
24	25	49	50

F - Failed T/C

A - T/C No. 34 Failed - Channel No. 33 connected to T/C monitoring ambient temperature

D - Inoperative logger channel No. 47 connected to failed T/C No. 46. (T/C No. 48 moved to channel No. 45).

TABLE C-3 (Continued)

DATA LOGGER NO. 1

(FOR SCANS OF THERMOCOUPLE NOS. 51-100)

Channel No.	T/C No.	Channel No.	T/C No.
0	51	25	76
1	52	26	71
2	53	27	None
3	54	28	None
4	55	29	None
5	56	30	81
6	57	31	82
7	58	32	83
8	59	33	84
9	60	34	85
10	61	35	86
11	62	36	87
12	63	37	88
13	64	38	89
14	65	39	90
15	66	40	91
16	67	41	92
17	68	42	93
18	69	43	94
19	70	44	95
20	71	45	96
21	72	46	97
22	73	47*	98
23	74	48	99
24	75	49	100

*Inoperative data logger channel - data from T/C No. 98 not recorded.

TABLE C-3 (Continued)

DATA LOGGER NO. 2

(POWER TRANSDUCER READINGS)

Channel No.	Signal	Source
20	0-50 mV	3 ϕ Power Transducer
21	0-50 mV	A Power Transducer
22	0-50 mV	B Power Transducer
23	0-50 mV	C Power Transducer

APPENDIX D
SAHTT Data and Selected Data Plots

TABLE D-1

SAHTT Thermocouple Data

RUN NO.1 7/0's 1-50

49	4200	Y	49	4201	Y	49	4202	Y	49	4204	Y	49	4203	Y	49	4203	Y
48	5057	Y	48	5057	Y	48	5058	Y	48	5059	Y	48	5056	Y	48	5058	Y
47	***5*	Y	47	***5*	Y	47	***5*	Y	47	***5*	Y	47	***5*	Y	47	***5*	Y
46	4852	Y	46	4852	Y	46	4853	Y	46	4854	Y	46	4854	Y	46	4853	Y
45	4812	Y	45	4813	Y	45	4814	Y	45	4815	Y	45	4815	Y	45	4814	Y
44	4172	Y	44	4174	Y	44	4175	Y	44	4176	Y	44	4177	Y	44	4176	Y
43	3632	Y	43	3633	Y	43	3634	Y	43	3635	Y	43	3635	Y	43	3634	Y
42	4368	Y	42	4368	Y	42	4369	Y	42	4370	Y	42	4371	Y	42	4371	Y
41	5209	Y	41	5209	Y	41	5210	Y	41	5211	Y	41	5210	Y	41	5210	Y
40	5023	Y	40	5023	Y	40	5024	Y	40	5025	Y	40	5025	Y	40	5025	Y
39	4935	Y	39	4935	Y	39	4936	Y	39	4937	Y	39	4937	Y	39	4937	Y
38	4729	Y	38	4729	Y	38	4730	Y	38	4731	Y	38	4732	Y	38	4732	Y
37	4527	Y	37	4526	Y	37	4527	Y	37	4530	Y	37	4530	Y	37	4531	Y
36	5066	Y	36	5066	Y	36	5067	Y	36	5070	Y	36	5070	Y	36	5070	Y
35	4768	Y	35	4768	Y	35	4769	Y	35	4772	Y	35	4772	Y	35	4772	Y
34	4784	Y	34	4784	Y	34	4784	Y	34	4793	Y	34	4793	Y	34	4793	Y
33	817	Y	33	816	Y	33	820	Y	33	828	Y	33	831	Y	33	830	Y
32	5311	Y	32	5311	Y	32	5311	Y	32	5311	Y	32	5311	Y	32	5311	Y
31	5277	Y	31	5277	Y	31	5277	Y	31	5276	Y	31	5276	Y	31	5276	Y
30	5039	Y	30	5038	Y	30	5038	Y	30	5037	Y	30	5037	Y	30	5037	Y
29	3751	Y	29	3751	Y	29	3751	Y	29	3750	Y	29	3749	Y	29	3749	Y
28	4384	Y	28	4384	Y	28	4384	Y	28	4386	Y	28	4385	Y	28	4385	Y
27	4929	Y	27	4929	Y	27	4930	Y	27	4931	Y	27	4930	Y	27	4929	Y
26	4620	Y	26	4621	Y	26	4621	Y	26	4622	Y	26	4621	Y	26	4621	Y
25	4283	Y	25	4284	Y	25	4284	Y	25	4286	Y	25	4285	Y	25	4284	Y
24	3836	Y	24	3857	Y	24	3857	Y	24	3858	Y	24	3858	Y	24	3857	Y
23	5006	Y	23	5006	Y	23	5006	Y	23	5006	Y	23	5005	Y	23	5005	Y
22	3878	Y	22	3878	Y	22	3877	Y	22	3876	Y	22	3876	Y	22	3876	Y
21	4619	Y	21	4620	Y	21	4621	Y	21	4624	Y	21	4624	Y	21	4624	Y
20	3987	Y	20	3988	Y	20	3987	Y	20	3988	Y	20	3987	Y	20	3987	Y
19	4726	Y	19	4726	Y	19	4725	Y	19	4727	Y	19	4726	Y	19	4727	Y
18	5120	Y	18	5120	Y	18	5120	Y	18	5122	Y	18	5121	Y	18	5121	Y
17	4792	Y	17	4792	Y	17	4793	Y	17	4794	Y	17	4794	Y	17	4794	Y
16	4862	Y	16	4862	Y	16	4861	Y	16	4863	Y	16	4863	Y	16	4864	Y
15	4977	Y	15	4977	Y	15	4977	Y	15	4976	Y	15	4976	Y	15	4976	Y
14	5161	Y	14	5161	Y	14	5161	Y	14	5164	Y	14	5163	Y	14	5164	Y
13	5061	Y	13	5062	Y	13	5061	Y	13	5064	Y	13	5063	Y	13	5064	Y
12	4832	Y	12	4833	Y	12	4833	Y	12	4835	Y	12	4835	Y	12	4836	Y
11	5234	Y	11	5234	Y	11	5234	Y	11	5234	Y	11	5233	Y	11	5234	Y
10	4948	Y	10	4949	Y	10	4949	Y	10	4950	Y	10	4949	Y	10	4949	Y
9	4661	Y	9	4661	Y	9	4662	Y	9	4662	Y	9	4662	Y	9	4661	Y
8	4431	Y	8	4432	Y	8	4432	Y	8	4433	Y	8	4433	Y	8	4432	Y
7	3728	Y	7	3729	Y	7	3730	Y	7	3731	Y	7	3730	Y	7	3730	Y
6	4433	Y	6	4433	Y	6	4434	Y	6	4434	Y	6	4434	Y	6	4434	Y
5	4790	Y	5	4791	Y	5	4792	Y	5	4802	Y	5	4803	Y	5	4803	Y
4	4749	Y	4	4750	Y	4	4750	Y	4	4759	Y	4	4759	Y	4	4759	Y
3	4594	Y	3	4595	Y	3	4595	Y	3	4606	Y	3	4607	Y	3	4607	Y
2	4364	Y	2	4365	Y	2	4366	Y	2	4376	Y	2	4376	Y	2	4376	Y
1	4165	Y	1	4166	Y	1	4167	Y	1	4176	Y	1	4178	Y	1	4178	Y
0	3205	Y	0	3206	Y	0	3206	Y	0	3214	Y	0	3214	Y	0	3214	Y

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RUN NO. 1 T/c's 51-100

49	3875	Y	49	3874	Y	49	3873	Y	49	3872	Y	49	3869	Y	49	3867	Y
48	3935	Y	48	3934	Y	48	3933	Y	48	3931	Y	48	3930	Y	48	3946	Y
47	***3*	Y	47	***3*	Y	47	***3*	Y	47	***3*	Y	47	***3*	Y	47	***3*	Y
46	3786	Y	46	3785	Y	46	3785	Y	46	3783	Y	46	3781	Y	46	3780	Y
45	3966	Y	45	3966	Y	45	3965	Y	45	3964	Y	45	3961	Y	45	3960	Y
44	3271	Y	44	3270	Y	44	3270	Y	44	3268	Y	44	3267	Y	44	3265	Y
43	3081	Y	43	3080	Y	43	3088	Y	43	3086	Y	43	3085	Y	43	3082	Y
42	4122	Y	42	4119	Y	42	4119	Y	42	4117	Y	42	4116	Y	42	4112	Y
41	4186	Y	41	4186	Y	41	4185	Y	41	4184	Y	41	4183	Y	41	4181	Y
40	4033	Y	40	4032	Y	40	4032	Y	40	4030	Y	40	4049	Y	40	4035	Y
39	3969	Y	39	3968	Y	39	3967	Y	39	3965	Y	39	3962	Y	39	3960	Y
38	3733	Y	38	3733	Y	38	3732	Y	38	3730	Y	38	3727	Y	38	3726	Y
37	3362	Y	37	3361	Y	37	3360	Y	37	3359	Y	37	3356	Y	37	3355	Y
36	4011	Y	36	4010	Y	36	1116	Y	36	4009	Y	36	4006	Y	36	4005	Y
35	4173	Y	35	111	Y	35	4171	Y	35	4170	Y	35	4168	Y	35	4166	Y
34	4202	Y	34	4200	Y	34	4189	Y	34	4189	Y	34	4187	Y	34	4187	Y
33	4083	Y	33	4083	Y	33	4081	Y	33	4081	Y	33	4078	Y	33	4077	Y
32	3989	Y	32	3980	Y	32	3988	Y	32	3987	Y	32	3985	Y	32	3983	Y
31	3771	Y	31	3770	Y	31	3770	Y	31	3769	Y	31	3764	Y	31	3764	Y
30	3461	Y	30	3461	Y	30	3459	Y	30	3458	Y	30	3455	Y	30	3453	Y
29	***3*	Y	29	***3*	Y	29	***3*	Y	29	***3*	Y	29	***3*	Y	29	***3*	Y
28	***3*	Y	28	***3*	Y	28	***3*	Y	28	***3*	Y	28	***3*	Y	28	***3*	Y
27	***3*	Y	27	***3*	Y	27	***3*	Y	27	***3*	Y	27	***3*	Y	27	***3*	Y
26	2772	Y	26	2770	Y	26	2768	Y	26	2766	Y	26	2764	Y	26	2760	Y
25	2783	Y	25	2779	Y	25	2778	Y	25	2774	Y	25	2772	Y	25	2768	Y
24	2682	Y	24	2680	Y	24	2677	Y	24	2673	Y	24	2670	Y	24	2667	Y
23	2599	Y	23	2596	Y	23	2593	Y	23	2591	Y	23	2589	Y	23	2584	Y
22	3668	Y	22	3663	Y	22	3658	Y	22	3651	Y	22	3645	Y	22	3638	Y
21	3624	Y	21	3618	Y	21	3613	Y	21	3607	Y	21	3601	Y	21	3594	Y
20	3580	Y	20	3575	Y	20	3569	Y	20	3563	Y	20	3559	Y	20	3551	Y
19	3461	Y	19	3457	Y	19	3451	Y	19	3445	Y	19	3438	Y	19	3431	Y
18	3616	Y	18	3610	Y	18	3605	Y	18	3599	Y	18	3592	Y	18	3586	Y
17	3566	Y	17	3562	Y	17	3557	Y	17	3551	Y	17	3545	Y	17	3537	Y
16	3559	Y	16	3555	Y	16	3550	Y	16	3545	Y	16	3540	Y	16	3533	Y
15	3482	Y	15	3476	Y	15	3471	Y	15	3464	Y	15	3457	Y	15	3449	Y
14	3381	Y	14	3376	Y	14	3371	Y	14	3363	Y	14	3357	Y	14	3349	Y
13	3345	Y	13	3340	Y	13	3335	Y	13	3327	Y	13	3320	Y	13	3312	Y
12	3214	Y	12	3208	Y	12	3200	Y	12	3193	Y	12	3185	Y	12	3177	Y
11	3082	Y	11	3076	Y	11	3069	Y	11	3061	Y	11	3053	Y	11	3045	Y
10	2379	Y	10	2376	Y	10	2373	Y	10	2369	Y	10	2365	Y	10	2361	Y
9	2185	Y	9	2183	Y	9	2180	Y	9	2177	Y	9	2173	Y	9	2170	Y
8	1830	Y	8	1829	Y	8	1828	Y	8	1826	Y	8	1824	Y	8	1822	Y
7	1649	Y	7	1649	Y	7	1648	Y	7	1647	Y	7	1647	Y	7	1646	Y
6	4096	Y	6	4097	Y	6	4097	Y	6	4097	Y	6	4097	Y	6	4096	Y
5	4570	Y	5	4571	Y	5	4570	Y	5	4570	Y	5	4569	Y	5	4559	Y
4	4564	Y	4	4564	Y	4	4565	Y	4	4564	Y	4	4564	Y	4	4564	Y
3	4501	Y	3	4502	Y	3	4502	Y	3	4502	Y	3	4501	Y	3	4501	Y
2	4324	Y	2	4325	Y	2	4325	Y	2	4325	Y	2	4324	Y	2	4324	Y
1	4057	Y	1	4058	Y	1	4057	Y	1	4057	Y	1	4058	Y	1	4057	Y
0	3531	Y	0	3532	Y	0	3532	Y	0	3531	Y	0	3531	Y	0	3531	Y

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RUN NO.2- T/C's 1-50

49	4233	Y	49	4233	Y	49	4233	Y	49	4233	Y	49	4233	Y
48	5437	Y	48	5437	Y	48	5437	Y	48	5437	Y	48	5437	Y
47	***5*	Y	47	***5*	Y	47	***5*	Y	47	***5*	Y	47	***5*	Y
46	5377	Y	46	5377	Y	46	5377	Y	46	5377	Y	46	5377	Y
45	5203	Y	45	5203	Y	45	5203	Y	45	5203	Y	45	5203	Y
44	4701	Y	44	4701	Y	44	4701	Y	44	4701	Y	44	4701	Y
43	4195	Y	43	4195	Y	43	4195	Y	43	4195	Y	43	4195	Y
42	4322	Y	42	4322	Y	42	4322	Y	42	4322	Y	42	4322	Y
41	5422	Y	41	5422	Y	41	5422	Y	41	5422	Y	41	5422	Y
40	5368	Y	40	5368	Y	40	5368	Y	40	5368	Y	40	5368	Y
39	5310	Y	39	5310	Y	39	5310	Y	39	5310	Y	39	5310	Y
38	5157	Y	38	5157	Y	38	5157	Y	38	5157	Y	38	5157	Y
37	4482	Y	37	4482	Y	37	4482	Y	37	4482	Y	37	4482	Y
36	5415	Y	36	5415	Y	36	5415	Y	36	5415	Y	36	5415	Y
35	5217	Y	35	5217	Y	35	5217	Y	35	5217	Y	35	5217	Y
34	4582	Y	34	4582	Y	34	4582	Y	34	4582	Y	34	4582	Y
33	862	Y	33	862	Y	33	862	Y	33	862	Y	33	862	Y
32	5643	Y	32	5643	Y	32	5643	Y	32	5643	Y	32	5643	Y
31	5639	Y	31	5639	Y	31	5639	Y	31	5639	Y	31	5639	Y
30	5443	Y	30	5443	Y	30	5443	Y	30	5443	Y	30	5443	Y
29	4412	Y	29	4412	Y	29	4412	Y	29	4412	Y	29	4412	Y
28	4243	Y	28	4243	Y	28	4243	Y	28	4243	Y	28	4243	Y
27	5235	Y	27	5235	Y	27	5235	Y	27	5235	Y	27	5235	Y
26	5062	Y	26	5062	Y	26	5062	Y	26	5062	Y	26	5062	Y
25	4743	Y	25	4743	Y	25	4743	Y	25	4743	Y	25	4743	Y
24	4311	Y	24	4311	Y	24	4311	Y	24	4311	Y	24	4311	Y
23	5405	Y	23	5405	Y	23	5405	Y	23	5405	Y	23	5405	Y
22	4475	Y	22	4475	Y	22	4475	Y	22	4475	Y	22	4475	Y
21	5122	Y	21	5122	Y	21	5122	Y	21	5122	Y	21	5122	Y
20	4549	Y	20	4549	Y	20	4549	Y	20	4549	Y	20	4549	Y
19	4402	Y	19	4402	Y	19	4402	Y	19	4402	Y	19	4402	Y
18	5425	Y	18	5425	Y	18	5425	Y	18	5425	Y	18	5425	Y
17	5180	Y	17	5180	Y	17	5180	Y	17	5180	Y	17	5180	Y
16	4533	Y	16	4533	Y	16	4533	Y	16	4533	Y	16	4533	Y
15	5431	Y	15	5431	Y	15	5431	Y	15	5431	Y	15	5431	Y
14	5480	Y	14	5480	Y	14	5480	Y	14	5480	Y	14	5480	Y
13	5432	Y	13	5432	Y	13	5432	Y	13	5432	Y	13	5432	Y
12	5241	Y	12	5241	Y	12	5241	Y	12	5241	Y	12	5241	Y
11	5531	Y	11	5531	Y	11	5531	Y	11	5531	Y	11	5531	Y
10	5436	Y	10	5436	Y	10	5436	Y	10	5436	Y	10	5436	Y
9	5232	Y	9	5232	Y	9	5232	Y	9	5232	Y	9	5232	Y
8	4837	Y	8	4837	Y	8	4837	Y	8	4837	Y	8	4837	Y
7	4205	Y	7	4205	Y	7	4205	Y	7	4205	Y	7	4205	Y
6	4150	Y	6	4150	Y	6	4150	Y	6	4150	Y	6	4150	Y
5	5050	Y	5	5050	Y	5	5050	Y	5	5050	Y	5	5050	Y
4	5090	Y	4	5090	Y	4	5090	Y	4	5090	Y	4	5090	Y
3	4986	Y	3	4986	Y	3	4986	Y	3	4986	Y	3	4986	Y
2	4795	Y	2	4795	Y	2	4795	Y	2	4795	Y	2	4795	Y
1	4538	Y	1	4538	Y	1	4538	Y	1	4538	Y	1	4538	Y
0	3508	Y	0	3508	Y	0	3508	Y	0	3508	Y	0	3508	Y

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RUN NO.2 T/C's 61-100

49	3778	Y	49	3781	Y	49	3782	Y	49	3784	Y	49	3785	Y	49	3786	Y
48	4266	Y	48	4269	Y	48	4271	Y	48	4272	Y	48	4273	Y	48	4274	Y
47	***5*	Y	47	***5*	Y	47	***5*	Y	47	***5*	Y	47	***5*	Y	47	***5*	Y
46	3774	Y	46	3776	Y	46	3777	Y	46	3778	Y	46	3780	Y	46	3780	Y
45	4295	Y	45	4297	Y	45	4299	Y	45	4300	Y	45	4301	Y	45	4302	Y
44	3611	Y	44	3614	Y	44	3615	Y	44	3617	Y	44	3619	Y	44	3619	Y
43	3786	Y	43	3789	Y	43	3790	Y	43	3792	Y	43	3793	Y	43	3794	Y
42	4222	Y	42	4225	Y	42	4226	Y	42	4228	Y	42	4229	Y	42	4230	Y
41	4406	Y	41	4409	Y	41	4411	Y	41	4412	Y	41	4414	Y	41	4414	Y
40	4321	Y	40	4324	Y	40	4325	Y	40	4326	Y	40	4327	Y	40	4327	Y
39	4263	Y	39	4265	Y	39	4267	Y	39	4269	Y	39	4270	Y	39	4270	Y
38	4006	Y	38	4008	Y	38	4010	Y	38	4012	Y	38	4013	Y	38	4013	Y
37	3649	Y	37	3651	Y	37	3654	Y	37	3656	Y	37	3657	Y	37	3657	Y
36	3890	Y	36	3892	Y	36	3894	Y	36	3896	Y	36	3897	Y	36	3898	Y
35	4310	Y	35	4311	Y	35	4314	Y	35	4315	Y	35	4315	Y	35	4316	Y
34	4447	Y	34	4448	Y	34	4450	Y	34	4451	Y	34	4453	Y	34	4453	Y
33	4369	Y	33	4371	Y	33	4374	Y	33	4375	Y	33	4375	Y	33	4376	Y
32	4298	Y	32	4300	Y	32	4303	Y	32	4305	Y	32	4306	Y	32	4306	Y
31	4037	Y	31	4038	Y	31	4040	Y	31	4042	Y	31	4043	Y	31	4043	Y
30	3711	Y	30	3713	Y	30	3715	Y	30	3717	Y	30	3718	Y	30	3718	Y
29	***5*	Y	29	***5*	Y	29	***5*	Y	29	***5*	Y	29	***5*	Y	29	***5*	Y
28	***5*	Y	28	***5*	Y	28	***5*	Y	28	***5*	Y	28	***5*	Y	28	***5*	Y
27	***5*	Y	27	***5*	Y	27	***5*	Y	27	***5*	Y	27	***5*	Y	27	***5*	Y
26	801	Y	26	2406	Y	26	2408	Y	26	2410	Y	26	2409	Y	26	2409	Y
25	2440	Y	25	2442	Y	25	2445	Y	25	2445	Y	25	2443	Y	25	2444	Y
24	2393	Y	24	2394	Y	24	2397	Y	24	2397	Y	24	2396	Y	24	2397	Y
23	2369	Y	23	2371	Y	23	2372	Y	23	2373	Y	23	2372	Y	23	2371	Y
22	3589	Y	22	3593	Y	22	3595	Y	22	3595	Y	22	3593	Y	22	3591	Y
21	3533	Y	21	3536	Y	21	3539	Y	21	3540	Y	21	3539	Y	21	3538	Y
20	3489	Y	20	3493	Y	20	3497	Y	20	3499	Y	20	3499	Y	20	3497	Y
19	3420	Y	19	3425	Y	19	3426	Y	19	3427	Y	19	3427	Y	19	3424	Y
18	3621	Y	18	3625	Y	18	3629	Y	18	3627	Y	18	3629	Y	18	3627	Y
17	3547	Y	17	3552	Y	17	3557	Y	17	3559	Y	17	3558	Y	17	3556	Y
16	3571	Y	16	3577	Y	16	3580	Y	16	3583	Y	16	3584	Y	16	3581	Y
15	3515	Y	15	3519	Y	15	3521	Y	15	3521	Y	15	3520	Y	15	3516	Y
14	3344	Y	14	3349	Y	14	3352	Y	14	3353	Y	14	3353	Y	14	3350	Y
13	3295	Y	13	3300	Y	13	3302	Y	13	3303	Y	13	3302	Y	13	3299	Y
12	3181	Y	12	3185	Y	12	3187	Y	12	3187	Y	12	3185	Y	12	3182	Y
11	3090	Y	11	3093	Y	11	3095	Y	11	3094	Y	11	3093	Y	11	3089	Y
10	2203	Y	10	2206	Y	10	2208	Y	10	2209	Y	10	2209	Y	10	2209	Y
9	2087	Y	9	2091	Y	9	2093	Y	9	2094	Y	9	2095	Y	9	2094	Y
8	1884	Y	8	1887	Y	8	1889	Y	8	1890	Y	8	1891	Y	8	1891	Y
7	1729	Y	7	1732	Y	7	1734	Y	7	1735	Y	7	1737	Y	7	1738	Y
6	4097	Y	6	4098	Y	6	4098	Y	6	4099	Y	6	4100	Y	6	4100	Y
5	4931	Y	5	4932	Y	5	4932	Y	5	4933	Y	5	4933	Y	5	4934	Y
4	4900	Y	4	4901	Y	4	4901	Y	4	4902	Y	4	4904	Y	4	4905	Y
3	4905	Y	3	4906	Y	3	4906	Y	3	4906	Y	3	4907	Y	3	4907	Y
2	4747	Y	2	4749	Y	2	4749	Y	2	4750	Y	2	4751	Y	2	4752	Y
1	4500	Y	1	4501	Y	1	4502	Y	1	4502	Y	1	4503	Y	1	4504	Y
0	4100	Y	0	4100	Y	0	4101	Y	0	4102	Y	0	4103	Y	0	4103	Y

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ROOM NO 281 T/105 1-50

49	4180	Y	49	4189	Y	49	4189	Y	49	4183	Y	49	4183	Y
48	4670	Y	48	4674	Y	48	4674	Y	48	4670	Y	48	4669	Y
47	***5	Y	47	***5	Y	47	***5	Y	47	***5	Y	47	***5	Y
46	5328	Y	46	5327	Y	46	5326	Y	46	5158	Y	46	5158	Y
45	5145	Y	45	5144	Y	45	5143	Y	45	5323	Y	45	5323	Y
44	5343	Y	44	5342	Y	44	5342	Y	44	776	Y	44	776	Y
43	4160	Y	43	4165	Y	43	4165	Y	43	4160	Y	43	4160	Y
42	4262	Y	42	4262	Y	42	4262	Y	42	4260	Y	42	4260	Y
41	5321	Y	41	5321	Y	41	5321	Y	41	5369	Y	41	5369	Y
40	5328	Y	40	5326	Y	40	5326	Y	40	5325	Y	40	5325	Y
39	5267	Y	39	5268	Y	39	5267	Y	39	5266	Y	39	5266	Y
38	5131	Y	38	5132	Y	38	5132	Y	38	5130	Y	38	5129	Y
37	4443	Y	37	4443	Y	37	4442	Y	37	4440	Y	37	4440	Y
36	5329	Y	36	5329	Y	36	5328	Y	36	5327	Y	36	5326	Y
35	5193	Y	35	5194	Y	35	5193	Y	35	5192	Y	35	5191	Y
34	4539	Y	34	4540	Y	34	4539	Y	34	4536	Y	34	4536	Y
33	767	Y	33	770	Y	33	769	Y	33	776	Y	33	776	Y
32	5603	Y	32	5604	Y	32	5603	Y	32	5603	Y	32	5602	Y
31	5642	Y	31	5643	Y	31	5642	Y	31	5642	Y	31	5641	Y
30	5418	Y	30	5418	Y	30	5418	Y	30	5418	Y	30	5418	Y
29	4409	Y	29	4409	Y	29	4409	Y	29	4406	Y	29	4406	Y
28	4201	Y	28	4201	Y	28	4200	Y	28	4196	Y	28	4195	Y
27	5207	Y	27	5207	Y	27	5207	Y	27	5203	Y	27	5201	Y
26	5032	Y	26	5032	Y	26	5031	Y	26	5026	Y	26	5025	Y
25	4715	Y	25	4715	Y	25	4714	Y	25	4711	Y	25	4710	Y
24	4295	Y	24	4295	Y	24	4294	Y	24	4291	Y	24	4290	Y
23	5329	Y	23	5329	Y	23	5329	Y	23	5328	Y	23	5328	Y
22	4469	Y	22	4469	Y	22	4469	Y	22	4468	Y	22	4468	Y
21	5081	Y	21	5081	Y	21	5080	Y	21	5078	Y	21	5077	Y
20	4545	Y	20	4545	Y	20	4545	Y	20	4545	Y	20	4544	Y
19	4362	Y	19	4362	Y	19	4361	Y	19	4360	Y	19	4359	Y
18	5334	Y	18	5334	Y	18	5334	Y	18	5332	Y	18	5331	Y
17	5132	Y	17	5132	Y	17	5132	Y	17	5131	Y	17	5130	Y
16	4431	Y	16	4431	Y	16	4431	Y	16	4439	Y	16	4438	Y
15	5360	Y	15	5360	Y	15	5360	Y	15	5368	Y	15	5367	Y
14	5436	Y	14	5436	Y	14	5436	Y	14	5434	Y	14	5434	Y
13	5386	Y	13	5386	Y	13	5386	Y	13	5386	Y	13	5386	Y
12	5214	Y	12	5214	Y	12	5214	Y	12	5212	Y	12	5212	Y
11	5465	Y	11	5465	Y	11	5467	Y	11	5466	Y	11	5465	Y
10	5395	Y	10	5395	Y	10	5395	Y	10	5393	Y	10	5393	Y
9	5177	Y	9	5177	Y	9	5177	Y	9	5176	Y	9	5176	Y
8	4811	Y	8	4811	Y	8	4811	Y	8	4801	Y	8	4807	Y
7	4190	Y	7	4194	Y	7	4193	Y	7	4190	Y	7	4179	Y
6	4190	Y	6	4190	Y	6	4190	Y	6	4193	Y	6	4191	Y
5	4933	Y	5	4933	Y	5	4933	Y	5	4927	Y	5	4926	Y
4	5041	Y	4	5041	Y	4	5040	Y	4	5045	Y	4	5044	Y
3	4944	Y	3	4943	Y	3	4943	Y	3	4938	Y	3	4937	Y
2	4755	Y	2	4755	Y	2	4754	Y	2	4755	Y	2	4747	Y
1	4525	Y	1	4525	Y	1	4525	Y	1	4520	Y	1	4519	Y
0	3435	Y	0	3435	Y	0	3435	Y	0	3432	Y	0	3430	Y

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RUN NO. 2RI T/C'S 51-100

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49	3732	Y	49	3730	Y	49	3748	Y	49	3746	Y	49	3745	Y
48	4271	Y	48	4270	Y	48	4266	Y	48	4267	Y	48	4266	Y
47	***5*	Y	47	***5*	Y	47	***5*	Y	47	***5*	Y	47	***5*	Y
46	3748	Y	46	3746	Y	46	3744	Y	46	3743	Y	46	3742	Y
45	4297	Y	45	4295	Y	45	4293	Y	45	4292	Y	45	4291	Y
44	3613	Y	44	3612	Y	44	3610	Y	44	3608	Y	44	3608	Y
43	3767	Y	43	3765	Y	43	3762	Y	43	3760	Y	43	3759	Y
42	4212	Y	42	4213	Y	42	4211	Y	42	4209	Y	42	4207	Y
41	4400	Y	41	4405	Y	41	4402	Y	41	4400	Y	41	4396	Y
40	4331	Y	40	4320	Y	40	4324	Y	40	4321	Y	40	4320	Y
39	4272	Y	39	4268	Y	39	4266	Y	39	4263	Y	39	4261	Y
38	4011	Y	38	4009	Y	38	4008	Y	38	4006	Y	38	4005	Y
37	3645	Y	37	3641	Y	37	3645	Y	37	3643	Y	37	3642	Y
36	3871	Y	36	3869	Y	36	3868	Y	36	3867	Y	36	3865	Y
35	4235	Y	35	4293	Y	35	4284	Y	35	4283	Y	35	4282	Y
34	4442	Y	34	4440	Y	34	4440	Y	34	4438	Y	34	4436	Y
33	4366	Y	33	4367	Y	33	4366	Y	33	4364	Y	33	4365	Y
32	4295	Y	32	4294	Y	32	4293	Y	32	4290	Y	32	4291	Y
31	4037	Y	31	4035	Y	31	4036	Y	31	4033	Y	31	4031	Y
30	1258	Y	30	3705	Y	30	3704	Y	30	3702	Y	30	3701	Y
29	***5*	Y	29	***5*	Y	29	***5*	Y	29	***5*	Y	29	***5*	Y
28	***5*	Y	28	***5*	Y	28	***5*	Y	28	***5*	Y	28	***5*	Y
27	***5*	Y	27	***5*	Y	27	***5*	Y	27	***5*	Y	27	***5*	Y
26	711	Y	26	2329	Y	26	2036	Y	26	2330	Y	26	2329	Y
25	2346	Y	25	2348	Y	25	2349	Y	25	2351	Y	25	2348	Y
24	2300	Y	24	2300	Y	24	2302	Y	24	2303	Y	24	2301	Y
23	2276	Y	23	2274	Y	23	2273	Y	23	2274	Y	23	2275	Y
22	3511	Y	22	3508	Y	22	3506	Y	22	3506	Y	22	3511	Y
21	3457	Y	21	3455	Y	21	3455	Y	21	3455	Y	21	3456	Y
20	3412	Y	20	3406	Y	20	3406	Y	20	3405	Y	20	3405	Y
19	3333	Y	19	3329	Y	19	3324	Y	19	3324	Y	19	3328	Y
18	3540	Y	18	3544	Y	18	3546	Y	18	3541	Y	18	3542	Y
17	3440	Y	17	3476	Y	17	3472	Y	17	3471	Y	17	3473	Y
16	3507	Y	16	3500	Y	16	3494	Y	16	3492	Y	16	3493	Y
15	3421	Y	15	3416	Y	15	3416	Y	15	3416	Y	15	3420	Y
14	3261	Y	14	3257	Y	14	3254	Y	14	3253	Y	14	3256	Y
13	3211	Y	13	3208	Y	13	3205	Y	13	3204	Y	13	3206	Y
12	3041	Y	12	3041	Y	12	3079	Y	12	3060	Y	12	3063	Y
11	2931	Y	11	2988	Y	11	2988	Y	11	2989	Y	11	2992	Y
10	2117	Y	10	2115	Y	10	2113	Y	10	2113	Y	10	2114	Y
9	2001	Y	9	1998	Y	9	1996	Y	9	1997	Y	9	1997	Y
8	1791	Y	8	1795	Y	8	1794	Y	8	1794	Y	8	1793	Y
7	1636	Y	7	1634	Y	7	1632	Y	7	1632	Y	7	1632	Y
6	4053	Y	6	4052	Y	6	4050	Y	6	4050	Y	6	4047	Y
5	4840	Y	5	4855	Y	5	4854	Y	5	4854	Y	5	4852	Y
4	4865	Y	4	4864	Y	4	4862	Y	4	4862	Y	4	4860	Y
3	4857	Y	3	4856	Y	3	4857	Y	3	4856	Y	3	4858	Y
2	4726	Y	2	4725	Y	2	4723	Y	2	4723	Y	2	4721	Y
1	4442	Y	1	4441	Y	1	4440	Y	1	4440	Y	1	4439	Y
0	4041	Y	0	4081	Y	0	4079	Y	0	4079	Y	0	4078	Y

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RUN NO. 2R2 T/C'S 1-50

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49	4123	1	49	4123	1	49	4123	1	49	4126	1	49	4126	1
48	5326	1	48	5326	1	48	5327	1	48	5327	1	48	5327	1
47	5325	1	47	5325	1	47	5325	1	47	5325	1	47	5325	1
46	5324	1	46	5324	1	46	5324	1	46	5325	1	46	5325	1
45	5139	1	45	5139	1	45	5139	1	45	5142	1	45	5142	1
44	4660	1	44	4660	1	44	4663	1	44	4663	1	44	4663	1
43	4150	1	43	4150	1	43	4153	1	43	4153	1	43	4153	1
42	4269	1	42	4269	1	42	4269	1	42	4269	1	42	4269	1
41	5366	1	41	5366	1	41	5366	1	41	5366	1	41	5366	1
40	5324	1	40	5325	1	40	5325	1	40	5325	1	40	5325	1
39	5267	1	39	5267	1	39	5267	1	39	5267	1	39	5267	1
38	5131	1	38	5131	1	38	5131	1	38	5131	1	38	5131	1
37	4422	1	37	4422	1	37	4421	1	37	4421	1	37	4422	1
36	5369	1	36	5369	1	36	5369	1	36	5369	1	36	5369	1
35	5183	1	35	5183	1	35	5183	1	35	5183	1	35	5183	1
34	4524	1	34	4524	1	34	4524	1	34	4524	1	34	4524	1
33	687	1	33	687	1	33	687	1	33	687	1	33	687	1
32	5600	1	32	5600	1	32	5600	1	32	5600	1	32	5600	1
31	5538	1	31	5538	1	31	5538	1	31	5538	1	31	5538	1
30	5413	1	30	5413	1	30	5413	1	30	5413	1	30	5413	1
29	4385	1	29	4385	1	29	4385	1	29	4385	1	29	4385	1
28	4186	1	28	4186	1	28	4186	1	28	4187	1	28	4187	1
27	5206	1	27	5206	1	27	5206	1	27	5208	1	27	5208	1
26	5030	1	26	5030	1	26	5032	1	26	5033	1	26	5033	1
25	4707	1	25	4707	1	25	4709	1	25	4709	1	25	4710	1
24	4278	1	24	4278	1	24	4278	1	24	4278	1	24	4278	1
23	5329	1	23	5329	1	23	5329	1	23	5329	1	23	5329	1
22	4449	1	22	4449	1	22	4449	1	22	4449	1	22	4449	1
21	5074	1	21	5074	1	21	5074	1	21	5075	1	21	5076	1
20	4520	1	20	4520	1	20	4520	1	20	4520	1	20	4520	1
19	4346	1	19	4346	1	19	4346	1	19	4346	1	19	4346	1
18	5382	1	18	5382	1	18	5382	1	18	5382	1	18	5382	1
17	5150	1	17	5150	1	17	5150	1	17	5150	1	17	5150	1
16	4473	1	16	4473	1	16	4473	1	16	4473	1	16	4473	1
15	5383	1	15	5383	1	15	5383	1	15	5383	1	15	5383	1
14	5428	1	14	5428	1	14	5428	1	14	5428	1	14	5428	1
13	5382	1	13	5382	1	13	5382	1	13	5382	1	13	5382	1
12	5205	1	12	5205	1	12	5205	1	12	5205	1	12	5205	1
11	5459	1	11	5459	1	11	5459	1	11	5459	1	11	5459	1
10	5381	1	10	5381	1	10	5381	1	10	5381	1	10	5381	1
9	5140	1	9	5140	1	9	5140	1	9	5142	1	9	5142	1
8	4800	1	8	4800	1	8	4800	1	8	4801	1	8	4801	1
7	4143	1	7	4143	1	7	4143	1	7	4143	1	7	4143	1
6	4085	1	6	4085	1	6	4085	1	6	4085	1	6	4085	1
5	4957	1	5	4957	1	5	4957	1	5	4957	1	5	4957	1
4	5036	1	4	5036	1	4	5036	1	4	5041	1	4	5042	1
3	4928	1	3	4928	1	3	4928	1	3	4932	1	3	4933	1
2	4734	1	2	4734	1	2	4734	1	2	4734	1	2	4734	1
1	4506	1	1	4506	1	1	4506	1	1	4506	1	1	4506	1
0	3475	1	0	3475	1	0	3475	1	0	3475	1	0	3475	1

RUN NO. 2R2 T/C'S 51-100

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43	3733	7	49	3736	7	49	3739	7	49	3741	7	49	3743	7	49	3745	7
48	4264	7	48	4267	7	48	4269	7	48	4271	7	48	4273	7	48	4275	7
47	***5	7	47	***5	7	47	***5	7	47	***5	7	47	***5	7	47	***5	7
46	3730	7	46	3733	7	46	3734	7	46	3736	7	46	3738	7	46	3741	7
45	4289	7	45	4291	7	45	4293	7	45	4295	7	45	4297	7	45	4299	7
44	3597	7	44	3600	7	44	3602	7	44	3604	7	44	3606	7	44	3608	7
43	3749	7	43	3752	7	43	3754	7	43	3757	7	43	3758	7	43	3761	7
42	4202	7	42	4205	7	42	4208	7	42	4210	7	42	4212	7	42	4214	7
41	4347	7	41	4400	7	41	4402	7	41	4405	7	41	4407	7	41	4409	7
40	4316	7	40	4317	7	40	4322	7	40	4327	7	40	4331	7	40	4334	7
39	4262	7	39	4264	7	39	4268	7	39	4271	7	39	4274	7	39	4277	7
38	4002	7	38	4004	7	38	4006	7	38	4009	7	38	4011	7	38	4013	7
37	3635	7	37	3637	7	37	3639	7	37	3642	7	37	3644	7	37	3647	7
36	3834	7	36	3836	7	36	3838	7	36	3841	7	36	3843	7	36	3845	7
35	4246	7	35	4248	7	35	4251	7	35	4253	7	35	4257	7	35	4259	7
34	4435	7	34	4436	7	34	4440	7	34	4442	7	34	4445	7	34	4448	7
33	4361	7	33	4364	7	33	4365	7	33	4367	7	33	4369	7	33	4370	7
32	4291	7	32	4292	7	32	4293	7	32	4296	7	32	4298	7	32	4301	7
31	4030	7	31	4030	7	31	4034	7	31	4036	7	31	4038	7	31	4041	7
30	3634	7	30	3636	7	30	3638	7	30	3701	7	30	3703	7	30	3705	7
29	***5	7	29	***5	7	29	***5	7	29	***5	7	29	***5	7	29	***5	7
28	***5	7	28	***5	7	28	***5	7	28	***5	7	28	***5	7	28	***5	7
27	***5	7	27	***5	7	27	***5	7	27	***5	7	27	***5	7	27	***5	7
26	2238	7	26	2239	7	26	647	7	26	692	7	26	2306	7	26	2308	7
25	2338	7	25	2345	7	25	2349	7	25	2353	7	25	2355	7	25	2357	7
24	2234	7	24	2239	7	24	2243	7	24	2287	7	24	2297	7	24	2297	7
23	2234	7	23	2237	7	23	2261	7	23	2263	7	23	2264	7	23	2267	7
22	3544	7	22	3532	7	22	3539	7	22	3564	7	22	3568	7	22	3570	7
21	3447	7	21	3435	7	21	3503	7	21	3509	7	21	3513	7	21	3514	7
20	3435	7	20	3442	7	20	3449	7	20	3456	7	20	3460	7	20	3463	7
19	3357	7	19	3364	7	19	3371	7	19	3376	7	19	3383	7	19	3386	7
18	3543	7	18	3531	7	18	3539	7	18	3603	7	18	3609	7	18	3612	7
17	3510	7	17	3518	7	17	3526	7	17	3534	7	17	3539	7	17	3541	7
16	3528	7	16	3537	7	16	3542	7	16	3548	7	16	3555	7	16	3560	7
15	3466	7	15	3474	7	15	3481	7	15	3487	7	15	3493	7	15	3495	7
14	3231	7	14	3239	7	14	3307	7	14	3312	7	14	3320	7	14	3323	7
13	3240	7	13	3248	7	13	3256	7	13	3262	7	13	3268	7	13	3271	7
12	3126	7	12	3135	7	12	3143	7	12	3150	7	12	3155	7	12	3156	7
11	3036	7	11	3044	7	11	3052	7	11	3059	7	11	3064	7	11	3065	7
10	2111	7	10	2115	7	10	2120	7	10	2124	7	10	2127	7	10	2129	7
9	1990	7	9	1994	7	9	1999	7	9	2002	7	9	2005	7	9	2006	7
8	1750	7	8	1742	7	8	1745	7	8	1748	7	8	1750	7	8	1752	7
7	***5	7	7	***5	7	7	***5	7	7	***5	7	7	***5	7	7	***5	7
6	4030	7	6	4029	7	6	4031	7	6	4031	7	6	4031	7	6	4032	7
5	4637	7	5	4647	7	5	4648	7	5	4649	7	5	4649	7	5	4649	7
4	4636	7	4	4636	7	4	4637	7	4	4638	7	4	4639	7	4	4639	7
3	4849	7	3	4842	7	3	4839	7	3	4830	7	3	4837	7	3	4837	7
2	4717	7	2	4716	7	2	4717	7	2	4718	7	2	4716	7	2	4719	7
1	4466	7	1	4466	7	1	4466	7	1	4466	7	1	4467	7	1	4467	7
0	4063	7	0	4062	7	0	4063	7	0	4063	7	0	4063	7	0	4063	7

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RUN NO. 2R3 T/C's 1-50

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49	4160	Y	49	4159	Y	49	4159	Y	49	4154	Y	49	4153	Y	49	4153	Y
48	5375	Y	48	5375	Y	48	5375	Y	48	5374	Y	48	5374	Y	48	5374	Y
47	***5*	Y	47	***5*	Y	47	***5*	Y	47	***5*	Y	47	621	Y	47	622	Y
46	5346	Y	46	5348	Y	46	5349	Y	46	5347	Y	46	5346	Y	46	5346	Y
45	5172	Y	45	5171	Y	45	5172	Y	45	5169	Y	45	5168	Y	45	5168	Y
44	4672	Y	44	4671	Y	44	4672	Y	44	4669	Y	44	4669	Y	44	4668	Y
43	4151	Y	43	4150	Y	43	4150	Y	43	4148	Y	43	4148	Y	43	4147	Y
42	4249	Y	42	4249	Y	42	4250	Y	42	4247	Y	42	4246	Y	42	4245	Y
41	5362	Y	41	5361	Y	41	5362	Y	41	5361	Y	41	5360	Y	41	5360	Y
40	5326	Y	40	5326	Y	40	5326	Y	40	5326	Y	40	5325	Y	40	5324	Y
39	5284	Y	39	5284	Y	39	5284	Y	39	5283	Y	39	5283	Y	39	5282	Y
38	5133	Y	38	5133	Y	38	5132	Y	38	5131	Y	38	5131	Y	38	5130	Y
37	4403	Y	37	4403	Y	37	4403	Y	37	4402	Y	37	4402	Y	37	4401	Y
36	5374	Y	36	5374	Y	36	5374	Y	36	5374	Y	36	5374	Y	36	5374	Y
35	5190	Y	35	5191	Y	35	5191	Y	35	5191	Y	35	5191	Y	35	5190	Y
34	4438	Y	34	4438	Y	34	4438	Y	34	4437	Y	34	4437	Y	34	4436	Y
33	640	Y	33	640	Y	33	640	Y	33	642	Y	33	644	Y	33	621	Y
32	5598	Y	32	5599	Y	32	5599	Y	32	5599	Y	32	5599	Y	32	5599	Y
31	5605	Y	31	5606	Y	31	5606	Y	31	5606	Y	31	5607	Y	31	5606	Y
30	5415	Y	30	5415	Y	30	5416	Y	30	5416	Y	30	5416	Y	30	5415	Y
29	4358	Y	29	4359	Y	29	4359	Y	29	4359	Y	29	4360	Y	29	4360	Y
28	4172	Y	28	4172	Y	28	4172	Y	28	4167	Y	28	4168	Y	28	4167	Y
27	5202	Y	27	5202	Y	27	5202	Y	27	5199	Y	27	5200	Y	27	5200	Y
26	5044	Y	26	5044	Y	26	5043	Y	26	5041	Y	26	5042	Y	26	5041	Y
25	4714	Y	25	4714	Y	25	4714	Y	25	4710	Y	25	4711	Y	25	4711	Y
24	4266	Y	24	4266	Y	24	4266	Y	24	4263	Y	24	4263	Y	24	4263	Y
23	5374	Y	23	5375	Y	23	5375	Y	23	5375	Y	23	5375	Y	23	5375	Y
22	4424	Y	22	4425	Y	22	4425	Y	22	4425	Y	22	4426	Y	22	4425	Y
21	5117	Y	21	5117	Y	21	5117	Y	21	5115	Y	21	5116	Y	21	5115	Y
20	4506	Y	20	4507	Y	20	4507	Y	20	4507	Y	20	4508	Y	20	4508	Y
19	4324	Y	19	4324	Y	19	4324	Y	19	4322	Y	19	4322	Y	19	4322	Y
18	5371	Y	18	5371	Y	18	5371	Y	18	5370	Y	18	5371	Y	18	5371	Y
17	5144	Y	17	5144	Y	17	5144	Y	17	5143	Y	17	5144	Y	17	5144	Y
16	4456	Y	16	4456	Y	16	4456	Y	16	4455	Y	16	4455	Y	16	4455	Y
15	5396	Y	15	5396	Y	15	5396	Y	15	5396	Y	15	5396	Y	15	5396	Y
14	5433	Y	14	5434	Y	14	5434	Y	14	5433	Y	14	5434	Y	14	5434	Y
13	5399	Y	13	5399	Y	13	5399	Y	13	5399	Y	13	5400	Y	13	5400	Y
12	5215	Y	12	5215	Y	12	5215	Y	12	5215	Y	12	5215	Y	12	5215	Y
11	5466	Y	11	5466	Y	11	5466	Y	11	5466	Y	11	5466	Y	11	5466	Y
10	5401	Y	10	5401	Y	10	5401	Y	10	5400	Y	10	5400	Y	10	5401	Y
9	5206	Y	9	5205	Y	9	5204	Y	9	5203	Y	9	5203	Y	9	5202	Y
8	4806	Y	8	4806	Y	8	4805	Y	8	4805	Y	8	4804	Y	8	4804	Y
7	4129	Y	7	4129	Y	7	4129	Y	7	4127	Y	7	4127	Y	7	4127	Y
6	4077	Y	6	4075	Y	6	4075	Y	6	4070	Y	6	4069	Y	6	4066	Y
5	4965	Y	5	4960	Y	5	4987	Y	5	4984	Y	5	4983	Y	5	4983	Y
4	5047	Y	4	5046	Y	4	5045	Y	4	5042	Y	4	5042	Y	4	5041	Y
3	4956	Y	3	4955	Y	3	4955	Y	3	4950	Y	3	4950	Y	3	4949	Y
2	4754	Y	2	4753	Y	2	4753	Y	2	4749	Y	2	4748	Y	2	4748	Y
1	4507	Y	1	4506	Y	1	4506	Y	1	4503	Y	1	4502	Y	1	4501	Y
0	3468	Y	0	3467	Y	0	3467	Y	0	2521	Y	0	2530	Y	0	3463	Y

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49	3686	Y	49	3686	Y	49	3685	Y	49	3685	Y	49	3685	Y
48	4219	Y	48	4218	Y	48	4217	Y	48	4217	Y	48	4217	Y
47	***	Y	47	***	Y	47	***	Y	47	***	Y	47	***	Y
46	3680	Y	46	3678	Y	46	3677	Y	46	3676	Y	46	3676	Y
45	4248	Y	45	4247	Y	45	4246	Y	45	4246	Y	45	4246	Y
44	3544	Y	44	3543	Y	44	3542	Y	44	3542	Y	44	3543	Y
43	3700	Y	43	3696	Y	43	3697	Y	43	3696	Y	43	3697	Y
42	4143	Y	42	4142	Y	42	4141	Y	42	4140	Y	42	4141	Y
41	4352	Y	41	4350	Y	41	4350	Y	41	4350	Y	41	4351	Y
40	4269	Y	40	4267	Y	40	4267	Y	40	4267	Y	40	4267	Y
39	4227	Y	39	4226	Y	39	4225	Y	39	4224	Y	39	4226	Y
38	3958	Y	38	3957	Y	38	3957	Y	38	3956	Y	38	3958	Y
37	3589	Y	37	3587	Y	37	3587	Y	37	3586	Y	37	3587	Y
36	511	Y	36	3811	Y	36	3810	Y	36	3809	Y	36	556	Y
35	4232	Y	35	4231	Y	35	4231	Y	35	4231	Y	35	4231	Y
34	4391	Y	34	4389	Y	34	4390	Y	34	4389	Y	34	4391	Y
33	4306	Y	33	4307	Y	33	4306	Y	33	4305	Y	33	4306	Y
32	4252	Y	32	4249	Y	32	4250	Y	32	4249	Y	32	4249	Y
31	3961	Y	31	3962	Y	31	3962	Y	31	3961	Y	31	3963	Y
30	3646	Y	30	3647	Y	30	3647	Y	30	3646	Y	30	3648	Y
29	***	Y	29	***	Y	29	***	Y	29	***	Y	29	***	Y
28	***	Y	28	***	Y	28	***	Y	28	***	Y	28	***	Y
27	***	Y	27	***	Y	27	***	Y	27	***	Y	27	***	Y
26	2252	Y	26	2222	Y	26	2223	Y	26	2224	Y	26	2228	Y
25	2247	Y	25	2244	Y	25	2245	Y	25	2248	Y	25	2253	Y
24	2185	Y	24	2193	Y	24	2196	Y	24	2197	Y	24	2204	Y
23	2166	Y	23	2165	Y	23	2167	Y	23	2169	Y	23	2174	Y
22	3472	Y	22	3471	Y	22	3472	Y	22	3476	Y	22	3484	Y
21	3408	Y	21	3406	Y	21	3408	Y	21	3411	Y	21	3420	Y
20	3354	Y	20	3354	Y	20	3356	Y	20	3358	Y	20	3366	Y
19	3271	Y	19	3273	Y	19	3273	Y	19	3275	Y	19	3285	Y
18	3515	Y	18	3512	Y	18	3512	Y	18	3517	Y	18	3525	Y
17	3430	Y	17	3430	Y	17	3431	Y	17	3434	Y	17	3444	Y
16	3450	Y	16	3449	Y	16	3451	Y	16	3453	Y	16	3462	Y
15	3376	Y	15	3378	Y	15	3381	Y	15	3384	Y	15	3394	Y
14	3212	Y	14	3211	Y	14	3213	Y	14	3216	Y	14	3226	Y
13	3159	Y	13	3159	Y	13	3160	Y	13	3164	Y	13	3173	Y
12	3036	Y	12	3037	Y	12	3039	Y	12	3044	Y	12	3056	Y
11	2947	Y	11	2948	Y	11	2951	Y	11	2956	Y	11	2968	Y
10	2035	Y	10	2034	Y	10	2034	Y	10	2035	Y	10	2040	Y
9	1911	Y	9	1909	Y	9	1910	Y	9	1911	Y	9	1914	Y
8	1708	Y	8	1707	Y	8	1707	Y	8	1707	Y	8	1709	Y
7	1555	Y	7	1553	Y	7	1553	Y	7	1552	Y	7	1553	Y
6	4021	Y	6	4019	Y	6	4019	Y	6	4018	Y	6	4016	Y
5	4848	Y	5	4847	Y	5	4846	Y	5	4845	Y	5	4844	Y
4	4860	Y	4	4865	Y	4	4864	Y	4	4863	Y	4	4862	Y
3	4847	Y	3	4848	Y	3	4850	Y	3	4850	Y	3	4851	Y
2	4726	Y	2	4725	Y	2	4724	Y	2	4723	Y	2	4722	Y
1	4466	Y	1	4464	Y	1	4464	Y	1	4463	Y	1	4462	Y
0	4057	Y	0	4056	Y	0	4055	Y	0	4054	Y	0	4053	Y

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RUN NO.3 T/c's 1-50

D-11

49	3710	Y
48	4059	Y
47	4538	Y
46	4538	Y
45	4376	Y
44	4536	Y
43	3640	Y
42	3801	Y
41	4612	Y
40	4523	Y
39	4581	Y
38	4462	Y
37	3929	Y
36	4555	Y
35	4497	Y
34	4026	Y
33	803	Y
32	4733	Y
31	4816	Y
30	4666	Y
29	3757	Y
28	3785	Y
27	4465	Y
26	4399	Y
25	4125	Y
24	3764	Y
23	4640	Y
22	3822	Y
21	4432	Y
20	3884	Y
19	3952	Y
18	4606	Y
17	4481	Y
16	4030	Y
15	4631	Y
14	4634	Y
13	4693	Y
12	4527	Y
11	4730	Y
10	4640	Y
9	4479	Y
8	4198	Y
7	3690	Y
6	3800	Y
5	4353	Y
4	4348	Y
3	4345	Y
2	4195	Y
1	3999	Y
0	3179	Y

49	3710	Y
48	4059	Y
47	4538	Y
46	4538	Y
45	4376	Y
44	4536	Y
43	3640	Y
42	3801	Y
41	4612	Y
40	4523	Y
39	4581	Y
38	4462	Y
37	3929	Y
36	4555	Y
35	4497	Y
34	4026	Y
33	803	Y
32	4733	Y
31	4816	Y
30	4666	Y
29	3757	Y
28	3784	Y
27	4465	Y
26	4399	Y
25	4124	Y
24	3764	Y
23	4640	Y
22	3822	Y
21	4432	Y
20	3884	Y
19	3952	Y
18	4606	Y
17	4481	Y
16	4050	Y
15	4631	Y
14	4634	Y
13	4693	Y
12	4526	Y
11	4730	Y
10	4641	Y
9	4479	Y
8	4198	Y
7	3689	Y
6	3795	Y
5	4352	Y
4	4347	Y
3	4345	Y
2	4194	Y
1	3985	Y
0	3179	Y

49	3700	Y
48	4059	Y
47	4538	Y
46	4538	Y
45	4376	Y
44	4536	Y
43	3633	Y
42	3801	Y
41	4612	Y
40	4522	Y
39	4580	Y
38	4461	Y
37	3926	Y
36	4553	Y
35	4497	Y
34	4026	Y
33	805	Y
32	4733	Y
31	4816	Y
30	4666	Y
29	3757	Y
28	3783	Y
27	4464	Y
26	4397	Y
25	4123	Y
24	3763	Y
23	4640	Y
22	3822	Y
21	4431	Y
20	3883	Y
19	3951	Y
18	4606	Y
17	4481	Y
16	4049	Y
15	4631	Y
14	4633	Y
13	4692	Y
12	4526	Y
11	4729	Y
10	4639	Y
9	4479	Y
8	4198	Y
7	3689	Y
6	3795	Y
5	4352	Y
4	4347	Y
3	4345	Y
2	4195	Y
1	3999	Y
0	3179	Y

49	3711	Y
48	4060	Y
47	4538	Y
46	4377	Y
45	4536	Y
44	805	Y
43	3641	Y
42	3799	Y
41	4611	Y
40	4522	Y
39	4579	Y
38	4460	Y
37	3926	Y
36	4553	Y
35	4495	Y
34	4024	Y
33	809	Y
32	4731	Y
31	4815	Y
30	4666	Y
29	3756	Y
28	3786	Y
27	4466	Y
26	4399	Y
25	4124	Y
24	3763	Y
23	4639	Y
22	3821	Y
21	4431	Y
20	3882	Y
19	3949	Y
18	4604	Y
17	4480	Y
16	4046	Y
15	4629	Y
14	4632	Y
13	4691	Y
12	4525	Y
11	4728	Y
10	4639	Y
9	4479	Y
8	4198	Y
7	3690	Y
6	3804	Y
5	4353	Y
4	4349	Y
3	4347	Y
2	4195	Y
1	3999	Y
0	3179	Y

49	3712	Y
48	4060	Y
47	4538	Y
46	4378	Y
45	4537	Y
44	805	Y
43	3641	Y
42	3800	Y
41	4611	Y
40	4522	Y
39	4580	Y
38	4460	Y
37	3927	Y
36	4553	Y
35	4495	Y
34	4024	Y
33	810	Y
32	4731	Y
31	4815	Y
30	4666	Y
29	3756	Y
28	3786	Y
27	4467	Y
26	4399	Y
25	4125	Y
24	3764	Y
23	4639	Y
22	3821	Y
21	4432	Y
20	3882	Y
19	3950	Y
18	4605	Y
17	4480	Y
16	4046	Y
15	4630	Y
14	4632	Y
13	4692	Y
12	4525	Y
11	4729	Y
10	4640	Y
9	4479	Y
8	4198	Y
7	3690	Y
6	3804	Y
5	4353	Y
4	4350	Y
3	4348	Y
2	4199	Y
1	3999	Y
0	3179	Y

49	3713	Y
48	4061	Y
47	4538	Y
46	4379	Y
45	4537	Y
44	805	Y
43	3642	Y
42	3800	Y
41	4611	Y
40	4522	Y
39	4580	Y
38	4461	Y
37	3927	Y
36	4553	Y
35	4495	Y
34	4024	Y
33	812	Y
32	4731	Y
31	4815	Y
30	4666	Y
29	3756	Y
28	3787	Y
27	4467	Y
26	4400	Y
25	4127	Y
24	3765	Y
23	4639	Y
22	3821	Y
21	4433	Y
20	3883	Y
19	3950	Y
18	4604	Y
17	4480	Y
16	4046	Y
15	4630	Y
14	4632	Y
13	4691	Y
12	4524	Y
11	4728	Y
10	4640	Y
9	4460	Y
8	4199	Y
7	3691	Y
6	3806	Y
5	4355	Y
4	4352	Y
3	4349	Y
2	4201	Y
1	4001	Y
0	3181	Y

RUN NO. 3 T/C's 51-100

0-12

49	3538	Y	49	3540	Y	49	3542	Y	49	3544	Y	49	3547	Y	49	3549	Y
48	3539	Y	48	3540	Y	48	3542	Y	48	3543	Y	48	3546	Y	48	3548	Y
47	3539	Y	47	3540	Y	47	3542	Y	47	3543	Y	47	3546	Y	47	3548	Y
46	3468	Y	46	3469	Y	46	3420	Y	46	3422	Y	46	3424	Y	46	3426	Y
45	3957	Y	45	3958	Y	45	3960	Y	45	3962	Y	45	3964	Y	45	3966	Y
44	3284	Y	44	3285	Y	44	3287	Y	44	3289	Y	44	3291	Y	44	3293	Y
43	3539	Y	43	3540	Y	43	3542	Y	43	3543	Y	43	3546	Y	43	3548	Y
42	3850	Y	42	3851	Y	42	3853	Y	42	3855	Y	42	3858	Y	42	3860	Y
41	4014	Y	41	4015	Y	41	4019	Y	41	4019	Y	41	4021	Y	41	4023	Y
40	3985	Y	40	3986	Y	40	3987	Y	40	3990	Y	40	3992	Y	40	3995	Y
39	3954	Y	39	3955	Y	39	3957	Y	39	3959	Y	39	3961	Y	39	3964	Y
38	3730	Y	38	3731	Y	38	3733	Y	38	3735	Y	38	3738	Y	38	3740	Y
37	3385	Y	37	3386	Y	37	3388	Y	37	3390	Y	37	3392	Y	37	3395	Y
36	3756	Y	36	3757	Y	36	3758	Y	36	3759	Y	36	3761	Y	36	3763	Y
35	4030	Y	35	4032	Y	35	4034	Y	35	4037	Y	35	4038	Y	35	4040	Y
34	4039	Y	34	4101	Y	34	4104	Y	34	4107	Y	34	4108	Y	34	4112	Y
33	4030	Y	33	4032	Y	33	4036	Y	33	4039	Y	33	4039	Y	33	4041	Y
32	4005	Y	32	4006	Y	32	4007	Y	32	4009	Y	32	4013	Y	32	4019	Y
31	3788	Y	31	3789	Y	31	3801	Y	31	3803	Y	31	3805	Y	31	3807	Y
30	3513	Y	30	3514	Y	30	3516	Y	30	3518	Y	30	3520	Y	30	3522	Y
29	3513	Y	29	3514	Y	29	3516	Y	29	3518	Y	29	3520	Y	29	3522	Y
28	3513	Y	28	3514	Y	28	3516	Y	28	3518	Y	28	3520	Y	28	3522	Y
27	3513	Y	27	3514	Y	27	3516	Y	27	3518	Y	27	3520	Y	27	3522	Y
26	745	Y	26	745	Y	26	2580	Y	26	2582	Y	26	2586	Y	26	2588	Y
25	2576	Y	25	2577	Y	25	2579	Y	25	2581	Y	25	2586	Y	25	2589	Y
24	2505	Y	24	2506	Y	24	2508	Y	24	2511	Y	24	2516	Y	24	2519	Y
23	2426	Y	23	2427	Y	23	2428	Y	23	2429	Y	23	2433	Y	23	2435	Y
22	3538	Y	22	3539	Y	22	3542	Y	22	3547	Y	22	3549	Y	22	3551	Y
21	3525	Y	21	3528	Y	21	3532	Y	21	3537	Y	21	3544	Y	21	3551	Y
20	3397	Y	20	3401	Y	20	3406	Y	20	3411	Y	20	3418	Y	20	3424	Y
19	3231	Y	19	3238	Y	19	3254	Y	19	3259	Y	19	3261	Y	19	3266	Y
18	3584	Y	18	3600	Y	18	3605	Y	18	3611	Y	18	3616	Y	18	3622	Y
17	3577	Y	17	3580	Y	17	3583	Y	17	3586	Y	17	3587	Y	17	3605	Y
16	3515	Y	16	3520	Y	16	3525	Y	16	3530	Y	16	3537	Y	16	3545	Y
15	3432	Y	15	3437	Y	15	3443	Y	15	3449	Y	15	3456	Y	15	3461	Y
14	3405	Y	14	3410	Y	14	3415	Y	14	3420	Y	14	3426	Y	14	3431	Y
13	3350	Y	13	3356	Y	13	3361	Y	13	3367	Y	13	3372	Y	13	3376	Y
12	3220	Y	12	3226	Y	12	3232	Y	12	3238	Y	12	3244	Y	12	3251	Y
11	3063	Y	11	3069	Y	11	3084	Y	11	3100	Y	11	3107	Y	11	3113	Y
10	2373	Y	10	2376	Y	10	2380	Y	10	2383	Y	10	2387	Y	10	2391	Y
9	2201	Y	9	2204	Y	9	2207	Y	9	2210	Y	9	2213	Y	9	2217	Y
8	1850	Y	8	1852	Y	8	1854	Y	8	1856	Y	8	1859	Y	8	1861	Y
7	760	Y	7	347	Y	7	1646	Y	7	1648	Y	7	1650	Y	7	1652	Y
6	3536	Y	6	3536	Y	6	3536	Y	6	3537	Y	6	3538	Y	6	3539	Y
5	4201	Y	5	4201	Y	5	4202	Y	5	4203	Y	5	4203	Y	5	4205	Y
4	4169	Y	4	4169	Y	4	4170	Y	4	4172	Y	4	4172	Y	4	4174	Y
3	4247	Y	3	4247	Y	3	4248	Y	3	4249	Y	3	4249	Y	3	4250	Y
2	4147	Y	2	4147	Y	2	4148	Y	2	4149	Y	2	4150	Y	2	4151	Y
1	3938	Y	1	3938	Y	1	3939	Y	1	3940	Y	1	3940	Y	1	3941	Y
0	3536	Y	0	3538	Y	0	3538	Y	0	3539	Y	0	3540	Y	0	3541	Y

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RUN NO 4 T/C's 1-50

D-13

49	3403	Y	49	3402	Y	49	3401	Y	49	3396	Y	49	3395	Y	49	3394	Y
48	3671	Y	48	3670	Y	48	3669	Y	48	3664	Y	48	3664	Y	48	3663	Y
47	***5*	Y	47	***5*	Y	47	***5*	Y	47	***5*	Y	47	***5*	Y	47	***5*	Y
46	3957	Y	46	3957	Y	46	3956	Y	46	3954	Y	46	3954	Y	46	3953	Y
45	3917	Y	45	3916	Y	45	3915	Y	45	3911	Y	45	3910	Y	45	3910	Y
44	4036	Y	44	4036	Y	44	4035	Y	44	4032	Y	44	4032	Y	44	4031	Y
43	3295	Y	43	3294	Y	43	3293	Y	43	3289	Y	43	3289	Y	43	3288	Y
42	3456	Y	42	3455	Y	42	3454	Y	42	3450	Y	42	3450	Y	42	3449	Y
41	4012	Y	41	4012	Y	41	4011	Y	41	4009	Y	41	4009	Y	41	4008	Y
40	4002	Y	40	4002	Y	40	4002	Y	40	3997	Y	40	3998	Y	40	3996	Y
39	4056	Y	39	4055	Y	39	4055	Y	39	4052	Y	39	4051	Y	39	4051	Y
38	3982	Y	38	3982	Y	38	3982	Y	38	3979	Y	38	3978	Y	38	3978	Y
37	3539	Y	37	3539	Y	37	3538	Y	37	3535	Y	37	3534	Y	37	3533	Y
36	4020	Y	36	4019	Y	36	4019	Y	36	4016	Y	36	4016	Y	36	4015	Y
35	4002	Y	35	4002	Y	35	4002	Y	35	4000	Y	35	3999	Y	35	3998	Y
34	3589	Y	34	3589	Y	34	3589	Y	34	3588	Y	34	3588	Y	34	3587	Y
33	732	Y	33	734	Y	33	736	Y	33	743	Y	33	741	Y	33	746	Y
32	4123	Y	32	4123	Y	32	4123	Y	32	4123	Y	32	4123	Y	32	4122	Y
31	4140	Y	31	4149	Y	31	4180	Y	31	4180	Y	31	4180	Y	31	4180	Y
30	4088	Y	30	4088	Y	30	4088	Y	30	4089	Y	30	4089	Y	30	4089	Y
29	3304	Y	29	3305	Y	29	3305	Y	29	3305	Y	29	3305	Y	29	3305	Y
28	3466	Y	28	3466	Y	28	3465	Y	28	3459	Y	28	3459	Y	28	3459	Y
27	3980	Y	27	3980	Y	27	3979	Y	27	3975	Y	27	3974	Y	27	3974	Y
26	3949	Y	26	3948	Y	26	3948	Y	26	3944	Y	26	3944	Y	26	3943	Y
25	3721	Y	25	3720	Y	25	3719	Y	25	3715	Y	25	3715	Y	25	3714	Y
24	3397	Y	24	3397	Y	24	3397	Y	24	3392	Y	24	3391	Y	24	3391	Y
23	4076	Y	23	4076	Y	23	4076	Y	23	4077	Y	23	4076	Y	23	4076	Y
22	3368	Y	22	3369	Y	22	3369	Y	22	3369	Y	22	3369	Y	22	3369	Y
21	3961	Y	21	3960	Y	21	3961	Y	21	3957	Y	21	3956	Y	21	3956	Y
20	3432	Y	20	3433	Y	20	3433	Y	20	3433	Y	20	3433	Y	20	3433	Y
19	3576	Y	19	3576	Y	19	3576	Y	19	3571	Y	19	3571	Y	19	3570	Y
18	4064	Y	18	4064	Y	18	4064	Y	18	4061	Y	18	4061	Y	18	4060	Y
17	3986	Y	17	3985	Y	17	3986	Y	17	3983	Y	17	3982	Y	17	3982	Y
16	3635	Y	16	3635	Y	16	3636	Y	16	3632	Y	16	3632	Y	16	3631	Y
15	4074	Y	15	4075	Y	15	4075	Y	15	4073	Y	15	4073	Y	15	4073	Y
14	4061	Y	14	4061	Y	14	4062	Y	14	4059	Y	14	4059	Y	14	4058	Y
13	4128	Y	13	4128	Y	13	4128	Y	13	4127	Y	13	4126	Y	13	4126	Y
12	4021	Y	12	4022	Y	12	4022	Y	12	4020	Y	12	4019	Y	12	4019	Y
11	4090	Y	11	4090	Y	11	4090	Y	11	4088	Y	11	4088	Y	11	4088	Y
10	4097	Y	10	4097	Y	10	4097	Y	10	4094	Y	10	4093	Y	10	4093	Y
9	3767	Y	9	3987	Y	9	3956	Y	9	3982	Y	9	3982	Y	9	3982	Y
8	3767	Y	8	3766	Y	8	3766	Y	8	3762	Y	8	3763	Y	8	3762	Y
7	3340	Y	7	3340	Y	7	3339	Y	7	3334	Y	7	3334	Y	7	3334	Y
6	3512	Y	6	3511	Y	6	3509	Y	6	3502	Y	6	3502	Y	6	3502	Y
5	3882	Y	5	3881	Y	5	3880	Y	5	3873	Y	5	3873	Y	5	3873	Y
4	3926	Y	4	3925	Y	4	3924	Y	4	3917	Y	4	3916	Y	4	3917	Y
3	3946	Y	3	3936	Y	3	3936	Y	3	3930	Y	3	3930	Y	3	3929	Y
2	3637	Y	2	3635	Y	2	3634	Y	2	3626	Y	2	3627	Y	2	3626	Y
1	3641	Y	1	3639	Y	1	3636	Y	1	3631	Y	1	3631	Y	1	3631	Y
0	2962	Y	0	2961	Y	0	2960	Y	0	2954	Y	0	2955	Y	0	2403	Y

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Run NO. 4 T/c's 51-100

D-14

49	3360	Y
48	3709	Y
47	----	Y
46	3229	Y
45	3636	Y
44	3086	Y
43	3348	Y
42	3593	Y
41	3730	Y
40	3733	Y
39	3706	Y
38	3510	Y
37	3202	Y
36	760	Y
35	3730	Y
34	3803	Y
33	3729	Y
32	3739	Y
31	3561	Y
30	939	Y
29	----	Y
28	----	Y
27	----	Y
26	2509	Y
25	2553	Y
24	2472	Y
23	2386	Y
22	3517	Y
21	3462	Y
20	3352	Y
19	3209	Y
18	3521	Y
17	3511	Y
16	3475	Y
15	3397	Y
14	3351	Y
13	3315	Y
12	3200	Y
11	3066	Y
10	2363	Y
9	2189	Y
8	1837	Y
7	1622	Y
6	3342	Y
5	3720	Y
4	3801	Y
3	3864	Y
2	3804	Y
1	3606	Y
0	3251	Y

49	3359	Y
48	3708	Y
47	----	Y
46	3228	Y
45	3635	Y
44	3085	Y
43	3347	Y
42	3591	Y
41	3729	Y
40	3732	Y
39	3707	Y
38	3509	Y
37	3200	Y
36	3513	Y
35	3729	Y
34	3801	Y
33	3727	Y
32	3737	Y
31	3560	Y
30	3311	Y
29	----	Y
28	----	Y
27	----	Y
26	2509	Y
25	2554	Y
24	2472	Y
23	2386	Y
22	3517	Y
21	3461	Y
20	3351	Y
19	3206	Y
18	3521	Y
17	3511	Y
16	3474	Y
15	3396	Y
14	3350	Y
13	3314	Y
12	3200	Y
11	3067	Y
10	2362	Y
9	2189	Y
8	1837	Y
7	839	Y
6	3341	Y
5	3749	Y
4	3800	Y
3	3863	Y
2	3804	Y
1	3606	Y
0	3251	Y

49	3338	Y
48	3706	Y
47	----	Y
46	3227	Y
45	3633	Y
44	3084	Y
43	3345	Y
42	3589	Y
41	3727	Y
40	3730	Y
39	3706	Y
38	3508	Y
37	3200	Y
36	3513	Y
35	3728	Y
34	3801	Y
33	3727	Y
32	3737	Y
31	3560	Y
30	3311	Y
29	----	Y
28	----	Y
27	----	Y
26	687	Y
25	2556	Y
24	2473	Y
23	2386	Y
22	3518	Y
21	3462	Y
20	3351	Y
19	3207	Y
18	3521	Y
17	3510	Y
16	3473	Y
15	3397	Y
14	3351	Y
13	3314	Y
12	3200	Y
11	3067	Y
10	2362	Y
9	2189	Y
8	1837	Y
7	1621	Y
6	3340	Y
5	3768	Y
4	3739	Y
3	3862	Y
2	3802	Y
1	3604	Y
0	3250	Y

49	3357	Y
48	3706	Y
47	----	Y
46	3226	Y
45	3633	Y
44	3083	Y
43	3345	Y
42	3589	Y
41	3727	Y
40	3730	Y
39	3706	Y
38	3508	Y
37	3199	Y
36	3512	Y
35	3727	Y
34	3800	Y
33	3726	Y
32	3736	Y
31	3559	Y
30	3310	Y
29	----	Y
28	----	Y
27	----	Y
26	682	Y
25	2556	Y
24	2473	Y
23	2386	Y
22	3519	Y
21	3462	Y
20	3351	Y
19	3209	Y
18	3522	Y
17	3510	Y
16	3475	Y
15	3399	Y
14	3352	Y
13	3315	Y
12	3203	Y
11	3070	Y
10	2362	Y
9	2189	Y
8	1836	Y
7	1620	Y
6	3339	Y
5	3767	Y
4	3738	Y
3	3860	Y
2	3801	Y
1	3607	Y
0	3249	Y

49	3357	Y
48	3706	Y
47	----	Y
46	3226	Y
45	3633	Y
44	3083	Y
43	3345	Y
42	3588	Y
41	3726	Y
40	3729	Y
39	3705	Y
38	3506	Y
37	3198	Y
36	3510	Y
35	3726	Y
34	3729	Y
33	3725	Y
32	3735	Y
31	3558	Y
30	3309	Y
29	----	Y
28	----	Y
27	----	Y
26	2502	Y
25	2558	Y
24	2475	Y
23	2386	Y
22	3521	Y
21	3464	Y
20	3353	Y
19	3211	Y
18	3524	Y
17	3511	Y
16	3476	Y
15	3400	Y
14	3354	Y
13	3318	Y
12	3204	Y
11	3072	Y
10	2363	Y
9	2189	Y
8	1837	Y
7	1620	Y
6	3339	Y
5	3766	Y
4	3737	Y
3	3859	Y
2	3800	Y
1	3602	Y
0	3248	Y

49	3357	Y
48	3706	Y
47	----	Y
46	3226	Y
45	3633	Y
44	3083	Y
43	3345	Y
42	3588	Y
41	3727	Y
40	3730	Y
39	3706	Y
38	3508	Y
37	3199	Y
36	3511	Y
35	3726	Y
34	3800	Y
33	3726	Y
32	3735	Y
31	3558	Y
30	3309	Y
29	----	Y
28	----	Y
27	----	Y
26	2512	Y
25	2559	Y
24	2476	Y
23	2389	Y
22	3523	Y
21	3466	Y
20	3355	Y
19	3213	Y
18	3526	Y
17	3513	Y
16	3478	Y
15	3403	Y
14	3356	Y
13	3320	Y
12	3207	Y
11	3074	Y
10	2364	Y
9	2190	Y
8	1837	Y
7	1620	Y
6	3337	Y
5	3766	Y
4	3726	Y
3	3859	Y
2	3800	Y
1	3602	Y
0	3247	Y

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RUN NO.5 T/C'S 1-50

D-15

49	4514	Y	49	4513	Y	49	4514	Y	49	4513	Y	49	4514	Y
48	4015	Y	48	4015	Y	48	4015	Y	48	4015	Y	48	4015	Y
47	4414	Y	47	4414	Y	47	4414	Y	47	4414	Y	47	4414	Y
46	4528	Y	46	4528	Y	46	4528	Y	46	4528	Y	46	4528	Y
45	810	Y	45	809	Y	45	811	Y	45	812	Y	45	813	Y
44	3583	Y	44	3582	Y	44	3582	Y	44	3583	Y	44	3583	Y
43	3764	Y	43	3764	Y	43	3763	Y	43	3761	Y	43	3760	Y
42	4515	Y	42	4515	Y	42	4515	Y	42	4515	Y	42	4513	Y
41	4520	Y	41	4520	Y	41	4520	Y	41	4518	Y	41	4518	Y
40	4492	Y	40	4492	Y	40	4492	Y	40	4491	Y	40	4491	Y
39	4384	Y	39	4384	Y	39	4384	Y	39	4382	Y	39	4382	Y
38	3864	Y	38	3863	Y	38	3863	Y	38	3860	Y	38	3860	Y
37	4548	Y	37	4547	Y	37	4547	Y	37	4546	Y	37	4545	Y
36	4415	Y	36	4415	Y	36	4416	Y	36	4414	Y	36	4414	Y
35	3912	Y	35	3912	Y	35	3912	Y	35	3910	Y	35	3909	Y
34	818	Y	34	818	Y	34	819	Y	34	825	Y	34	824	Y
33	4688	Y	33	4688	Y	33	4689	Y	33	4688	Y	33	4687	Y
32	4695	Y	32	4695	Y	32	4696	Y	32	4695	Y	32	4695	Y
31	4547	Y	31	4546	Y	31	4546	Y	31	4547	Y	31	4546	Y
30	3646	Y	30	3646	Y	30	3646	Y	30	3647	Y	30	3647	Y
29	3722	Y	29	3721	Y	29	3720	Y	29	3718	Y	29	3718	Y
28	4453	Y	28	4452	Y	28	4452	Y	28	4451	Y	28	4452	Y
27	4325	Y	27	4324	Y	27	4324	Y	27	4324	Y	27	4324	Y
26	4049	Y	26	4049	Y	26	4049	Y	26	4049	Y	26	4049	Y
25	3679	Y	25	3678	Y	25	3678	Y	25	3677	Y	25	3678	Y
24	4530	Y	24	4529	Y	24	4529	Y	24	4529	Y	24	4530	Y
23	3716	Y	23	3715	Y	23	3715	Y	23	3716	Y	23	3716	Y
22	4349	Y	22	4348	Y	22	4348	Y	22	4347	Y	22	4347	Y
21	3788	Y	21	3787	Y	21	3788	Y	21	3788	Y	21	3788	Y
20	3823	Y	20	3822	Y	20	3821	Y	20	3818	Y	20	3818	Y
19	4562	Y	19	4561	Y	19	4561	Y	19	4559	Y	19	4559	Y
18	4398	Y	18	4398	Y	18	4398	Y	18	4397	Y	18	4397	Y
17	3902	Y	17	3901	Y	17	3901	Y	17	3899	Y	17	3899	Y
16	4545	Y	16	4545	Y	16	4545	Y	16	4544	Y	16	4544	Y
15	4596	Y	15	4596	Y	15	4595	Y	15	4593	Y	15	4594	Y
14	4565	Y	14	4565	Y	14	4564	Y	14	4563	Y	14	4563	Y
13	4432	Y	13	4432	Y	13	4431	Y	13	4430	Y	13	4431	Y
12	4575	Y	12	4575	Y	12	4574	Y	12	4573	Y	12	4573	Y
11	4567	Y	11	4567	Y	11	4566	Y	11	4566	Y	11	4566	Y
10	4428	Y	10	4428	Y	10	4429	Y	10	4428	Y	10	4428	Y
9	4104	Y	9	4104	Y	9	4104	Y	9	4103	Y	9	4103	Y
8	3575	Y	8	3575	Y	8	3575	Y	8	3575	Y	8	3575	Y
7	3681	Y	7	3680	Y	7	3680	Y	7	3679	Y	7	3679	Y
6	4291	Y	6	4290	Y	6	4290	Y	6	4289	Y	6	4289	Y
5	4363	Y	5	4363	Y	5	4362	Y	5	4362	Y	5	4362	Y
4	4303	Y	4	4302	Y	4	4302	Y	4	4302	Y	4	4302	Y
3	4158	Y	3	4158	Y	3	4158	Y	3	4158	Y	3	4158	Y
2	3936	Y	2	3936	Y	2	3936	Y	2	3936	Y	2	3936	Y
1	3106	Y	1	3106	Y	1	3106	Y	1	3106	Y	1	3106	Y
0			0			0			0			0		

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Run NO.5 T/c's 51-100

D-16

49	3465	Y	49	3486	Y	49	3487	Y	49	3486	Y	49	3490	Y	49	3491	Y
48	3363	Y	48	3369	Y	48	3370	Y	48	3371	Y	48	3372	Y	48	3374	Y
47	***	Y	47	***	Y	47	***	Y	47	***	Y	47	***	Y	47	***	Y
46	3457	Y	46	3458	Y	46	3459	Y	46	3460	Y	46	3461	Y	46	3462	Y
45	3381	Y	45	3382	Y	45	3383	Y	45	3384	Y	45	3385	Y	45	3386	Y
44	3275	Y	44	3276	Y	44	3277	Y	44	3279	Y	44	3280	Y	44	3280	Y
43	3484	Y	43	3485	Y	43	3485	Y	43	3487	Y	43	3488	Y	43	3489	Y
42	3123	Y	42	3124	Y	42	3125	Y	42	3126	Y	42	3127	Y	42	3128	Y
41	3968	Y	41	3969	Y	41	3970	Y	41	3971	Y	41	3972	Y	41	3973	Y
40	3924	Y	40	3925	Y	40	3925	Y	40	3927	Y	40	3928	Y	40	3929	Y
39	3668	Y	39	3669	Y	39	3670	Y	39	3672	Y	39	3672	Y	39	3674	Y
38	3662	Y	38	3663	Y	38	3664	Y	38	3666	Y	38	3666	Y	38	3668	Y
37	3319	Y	37	3320	Y	37	3321	Y	37	3323	Y	37	3323	Y	37	3325	Y
36	3563	Y	36	3564	Y	36	3565	Y	36	3566	Y	36	3567	Y	36	3560	Y
35	3867	Y	35	3868	Y	35	3868	Y	35	3869	Y	35	3869	Y	35	3863	Y
34	3995	Y	34	3996	Y	34	3997	Y	34	3999	Y	34	3999	Y	34	4001	Y
33	3955	Y	33	3956	Y	33	3957	Y	33	3959	Y	33	3959	Y	33	3961	Y
32	3892	Y	32	3893	Y	32	3894	Y	32	3895	Y	32	3896	Y	32	3898	Y
31	3666	Y	31	3667	Y	31	3668	Y	31	3670	Y	31	3671	Y	31	3673	Y
30	2245	Y	30	2245	Y	30	2245	Y	30	2246	Y	30	2247	Y	30	2249	Y
29	***	Y	29	***	Y	29	***	Y	29	***	Y	29	***	Y	29	***	Y
28	***	Y	28	***	Y	28	***	Y	28	***	Y	28	***	Y	28	***	Y
27	***	Y	27	***	Y	27	***	Y	27	***	Y	27	***	Y	27	***	Y
26	752	Y	26	830	Y	26	2387	Y	26	2390	Y	26	2393	Y	26	2396	Y
25	2437	Y	25	2440	Y	25	2444	Y	25	2446	Y	25	2449	Y	25	2451	Y
24	2381	Y	24	2384	Y	24	2387	Y	24	2390	Y	24	2392	Y	24	2394	Y
23	2355	Y	23	2357	Y	23	2359	Y	23	2362	Y	23	2365	Y	23	2367	Y
22	3491	Y	22	3495	Y	22	3499	Y	22	3503	Y	22	3507	Y	22	3511	Y
21	3456	Y	21	3460	Y	21	3464	Y	21	3469	Y	21	3473	Y	21	3477	Y
20	3413	Y	20	3416	Y	20	3420	Y	20	3425	Y	20	3429	Y	20	3433	Y
19	3348	Y	19	3351	Y	19	3355	Y	19	3359	Y	19	3363	Y	19	3368	Y
18	3534	Y	18	3538	Y	18	3540	Y	18	3545	Y	18	3549	Y	18	3554	Y
17	3487	Y	17	3493	Y	17	3497	Y	17	3502	Y	17	3506	Y	17	3510	Y
16	3492	Y	16	3496	Y	16	3500	Y	16	3505	Y	16	3509	Y	16	3514	Y
15	3456	Y	15	3461	Y	15	3465	Y	15	3469	Y	15	3474	Y	15	3480	Y
14	3293	Y	14	3297	Y	14	3301	Y	14	3307	Y	14	3311	Y	14	3316	Y
13	3258	Y	13	3263	Y	13	3266	Y	13	3271	Y	13	3276	Y	13	3281	Y
12	3167	Y	12	3172	Y	12	3177	Y	12	3182	Y	12	3187	Y	12	3193	Y
11	3071	Y	11	3076	Y	11	3080	Y	11	3086	Y	11	3091	Y	11	3097	Y
10	2200	Y	10	2203	Y	10	2205	Y	10	2209	Y	10	2212	Y	10	2215	Y
9	2088	Y	9	2090	Y	9	2093	Y	9	2096	Y	9	2099	Y	9	2102	Y
8	1878	Y	8	1880	Y	8	1882	Y	8	1885	Y	8	1887	Y	8	1889	Y
7	1731	Y	7	1721	Y	7	1723	Y	7	1725	Y	7	1727	Y	7	1729	Y
6	3637	Y	6	3636	Y	6	3637	Y	6	3637	Y	6	3637	Y	6	3637	Y
5	4220	Y	5	4220	Y	5	4220	Y	5	4220	Y	5	4220	Y	5	4221	Y
4	4240	Y	4	4240	Y	4	4240	Y	4	4240	Y	4	4241	Y	4	4241	Y
3	4253	Y	3	4253	Y	3	4253	Y	3	4253	Y	3	4253	Y	3	4253	Y
2	4135	Y	2	4135	Y	2	4136	Y	2	4136	Y	2	4137	Y	2	4137	Y
1	2672	Y	1	3906	Y	1	3906	Y	1	3906	Y	1	3907	Y	1	3907	Y
0	3549	Y	0	3549	Y	0	3549	Y	0	3549	Y	0	3549	Y	0	3549	Y

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RUN NO.6 T/c's 1-50

D-17

49 4274 Y
48 762 Y
47 ***5* Y
46 4147 Y
45 4167 Y
44 3727 Y
43 3282 Y
42 3724 Y
41 4362 Y
40 4243 Y
39 4232 Y
38 4106 Y
37 3883 Y
36 4337 Y
35 4154 Y
34 4028 Y
33 753 Y
32 4470 Y
31 4456 Y
30 4295 Y
29 3286 Y
28 3799 Y
27 4233 Y
26 4042 Y
25 3789 Y
24 3425 Y
23 4266 Y
22 3377 Y
21 4055 Y
20 3495 Y
19 3993 Y
18 4351 Y
17 4142 Y
16 4097 Y
15 4265 Y
14 4402 Y
13 4343 Y
12 4191 Y
11 4408 Y
10 4252 Y
9 4065 Y
8 3881 Y
7 3333 Y
6 3857 Y
5 4159 Y
4 4159 Y
3 4064 Y
2 3910 Y
1 3747 Y
0 2977 Y

49 4274 Y
48 762 Y
47 ***5* Y
46 4147 Y
45 4167 Y
44 3726 Y
43 3282 Y
42 3794 Y
41 4362 Y
40 4283 Y
39 4232 Y
38 4106 Y
37 3883 Y
36 4337 Y
35 4154 Y
34 4028 Y
33 753 Y
32 4470 Y
31 4456 Y
30 4295 Y
29 3287 Y
28 3799 Y
27 4233 Y
26 4041 Y
25 3789 Y
24 3425 Y
23 4266 Y
22 3377 Y
21 4055 Y
20 3495 Y
19 3993 Y
18 4351 Y
17 4142 Y
16 4097 Y
15 4265 Y
14 4402 Y
13 4343 Y
12 4191 Y
11 4408 Y
10 4252 Y
9 4065 Y
8 3881 Y
7 3333 Y
6 3857 Y
5 4159 Y
4 4159 Y
3 4064 Y
2 3910 Y
1 3746 Y
0 2977 Y

49 4274 Y
48 763 Y
47 ***5* Y
46 4187 Y
45 4167 Y
44 3727 Y
43 3252 Y
42 3793 Y
41 4362 Y
40 4262 Y
39 4231 Y
38 4106 Y
37 3882 Y
36 4336 Y
35 4154 Y
34 4028 Y
33 756 Y
32 4470 Y
31 4456 Y
30 4295 Y
29 3287 Y
28 3798 Y
27 4232 Y
26 4041 Y
25 3789 Y
24 3425 Y
23 4266 Y
22 3377 Y
21 4055 Y
20 3495 Y
19 3993 Y
18 4351 Y
17 4142 Y
16 4097 Y
15 4265 Y
14 4401 Y
13 4343 Y
12 4191 Y
11 4408 Y
10 4252 Y
9 4065 Y
8 3880 Y
7 3333 Y
6 3856 Y
5 4158 Y
4 4159 Y
3 4064 Y
2 3910 Y
1 3746 Y
0 2977 Y

49 3691 Y
48 3725 Y
47 ***5* Y
46 4186 Y
45 4169 Y
44 771 Y
43 3283 Y
42 3793 Y
41 4360 Y
40 4281 Y
39 4229 Y
38 4103 Y
37 3876 Y
36 4334 Y
35 4151 Y
34 4025 Y
33 767 Y
32 4466 Y
31 4454 Y
30 4293 Y
29 3286 Y
28 3799 Y
27 4233 Y
26 4041 Y
25 3790 Y
24 3425 Y
23 4265 Y
22 3375 Y
21 4055 Y
20 3494 Y
19 3991 Y
18 4349 Y
17 4140 Y
16 4094 Y
15 4263 Y
14 4400 Y
13 4341 Y
12 4189 Y
11 4407 Y
10 4252 Y
9 4065 Y
8 3880 Y
7 3334 Y
6 3856 Y
5 4159 Y
4 4160 Y
3 4065 Y
2 3912 Y
1 3747 Y
0 2977 Y

49 3691 Y
48 3725 Y
47 ***5* Y
46 4188 Y
45 4189 Y
44 771 Y
43 3282 Y
42 3792 Y
41 4359 Y
40 4280 Y
39 4229 Y
38 4103 Y
37 3878 Y
36 4334 Y
35 4151 Y
34 4026 Y
33 766 Y
32 4466 Y
31 4454 Y
30 4293 Y
29 3285 Y
28 3600 Y
27 4233 Y
26 4042 Y
25 3790 Y
24 3425 Y
23 4264 Y
22 3375 Y
21 4055 Y
20 3493 Y
19 3990 Y
18 4349 Y
17 4140 Y
16 4094 Y
15 4263 Y
14 4399 Y
13 4340 Y
12 4189 Y
11 4407 Y
10 4252 Y
9 4066 Y
8 3880 Y
7 3334 Y
6 3857 Y
5 4160 Y
4 4160 Y
3 4066 Y
2 3912 Y
1 3746 Y
0 2976 Y

49 3692 Y
48 3730 Y
47 ***5* Y
46 4166 Y
45 4188 Y
44 773 Y
43 3283 Y
42 3792 Y
41 4359 Y
40 4281 Y
39 4229 Y
38 4103 Y
37 3878 Y
36 4334 Y
35 4151 Y
34 4026 Y
33 767 Y
32 4468 Y
31 4454 Y
30 4284 Y
29 3285 Y
28 3799 Y
27 4233 Y
26 4042 Y
25 3790 Y
24 3425 Y
23 4264 Y
22 3375 Y
21 4055 Y
20 3493 Y
19 3990 Y
18 4349 Y
17 4139 Y
16 4093 Y
15 4263 Y
14 4399 Y
13 4340 Y
12 4188 Y
11 4407 Y
10 4252 Y
9 4066 Y
8 3880 Y
7 3335 Y
6 3857 Y
5 4160 Y
4 4161 Y
3 4066 Y
2 3912 Y
1 3746 Y
0 2978 Y

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49	3573	Y	49	3574	Y	49	3575	Y	49	3577	Y	49	3578	Y	49	3579	Y
48	367E	Y	48	3680	Y	48	3681	Y	48	3683	Y	48	3684	Y	48	3685	Y
47	----	Y	47	----	Y	47	----	Y	47	----	Y	47	----	Y	47	----	Y
46	3476	Y	46	3477	Y	46	3477	Y	46	3479	Y	46	3480	Y	46	3481	Y
45	3681	Y	45	3682	Y	45	3683	Y	45	3685	Y	45	3686	Y	45	3687	Y
44	3100	Y	44	3101	Y	44	3102	Y	44	3103	Y	44	3105	Y	44	3105	Y
43	3570	Y	43	3572	Y	43	3573	Y	43	3574	Y	43	3576	Y	43	3577	Y
42	3760	Y	42	3761	Y	42	3764	Y	42	3765	Y	42	3767	Y	42	3768	Y
41	3817	Y	41	3818	Y	41	3819	Y	41	3821	Y	41	3822	Y	41	3823	Y
40	3737	Y	40	3739	Y	40	3740	Y	40	3742	Y	40	3744	Y	40	3745	Y
39	3684	Y	39	3684	Y	39	3685	Y	39	3688	Y	39	3689	Y	39	3690	Y
38	3495	Y	38	3496	Y	38	3497	Y	38	3499	Y	38	3499	Y	38	3502	Y
37	3185	Y	37	3186	Y	37	3186	Y	37	3190	Y	37	3190	Y	37	3193	Y
36	3658	Y	36	3659	Y	36	3661	Y	36	3662	Y	36	3663	Y	36	3665	Y
35	3812	Y	35	3813	Y	35	3815	Y	35	3816	Y	35	3816	Y	35	3818	Y
34	3833	Y	34	3834	Y	34	3836	Y	34	3837	Y	34	3837	Y	34	3839	Y
33	3764	Y	33	3765	Y	33	3766	Y	33	3768	Y	33	3768	Y	33	3771	Y
32	3692	Y	32	3694	Y	32	3696	Y	32	3697	Y	32	3697	Y	32	3700	Y
31	3522	Y	31	3523	Y	31	3525	Y	31	3527	Y	31	3526	Y	31	3529	Y
30	961	Y	30	3276	Y	30	3277	Y	30	3279	Y	30	3280	Y	30	3282	Y
29	----	Y	29	----	Y	29	----	Y	29	----	Y	29	----	Y	29	----	Y
28	----	Y	28	----	Y	28	----	Y	28	----	Y	28	----	Y	28	----	Y
27	----	Y	27	----	Y	27	----	Y	27	----	Y	27	----	Y	27	----	Y
26	----	Y	26	----	Y	26	----	Y	26	----	Y	26	----	Y	26	----	Y
25	2718	Y	25	2718	Y	25	2721	Y	25	2722	Y	25	2725	Y	25	2728	Y
24	2624	Y	24	2626	Y	24	2628	Y	24	2629	Y	24	2631	Y	24	2633	Y
23	2546	Y	23	2549	Y	23	254	Y	23	2552	Y	23	2553	Y	23	2554	Y
22	3565	Y	22	3568	Y	22	3571	Y	22	3574	Y	22	3578	Y	22	3580	Y
21	3532	Y	21	3535	Y	21	3538	Y	21	3542	Y	21	3545	Y	21	3548	Y
20	3485	Y	20	3487	Y	20	3491	Y	20	3494	Y	20	3497	Y	20	3499	Y
19	3361	Y	19	3382	Y	19	3386	Y	19	3389	Y	19	3392	Y	19	3394	Y
18	3534	Y	18	3536	Y	18	3541	Y	18	3545	Y	18	3547	Y	18	3550	Y
17	3506	Y	17	3510	Y	17	3513	Y	17	3517	Y	17	3520	Y	17	3524	Y
16	3492	Y	16	3495	Y	16	3498	Y	16	3501	Y	16	3505	Y	16	3508	Y
15	3436	Y	15	3441	Y	15	3443	Y	15	3447	Y	15	3450	Y	15	3452	Y
14	3351	Y	14	3356	Y	14	3359	Y	14	3363	Y	14	3365	Y	14	3369	Y
13	3326	Y	13	3331	Y	13	3335	Y	13	3338	Y	13	3341	Y	13	3344	Y
12	3229	Y	12	3233	Y	12	3236	Y	12	3240	Y	12	3243	Y	12	3246	Y
11	3101	Y	11	3111	Y	11	3114	Y	11	3116	Y	11	3121	Y	11	3124	Y
10	2377	Y	10	2379	Y	10	2380	Y	10	2383	Y	10	2384	Y	10	2386	Y
9	2186	Y	9	2189	Y	9	2191	Y	9	2193	Y	9	2194	Y	9	2196	Y
8	1829	Y	8	1829	Y	8	1831	Y	8	1831	Y	8	1832	Y	8	1833	Y
7	1640	Y	7	1644	Y	7	1647	Y	7	1642	Y	7	1642	Y	7	1643	Y
6	3641	Y	6	3641	Y	6	3641	Y	6	3641	Y	6	3641	Y	6	3642	Y
5	3985	Y	5	3985	Y	5	3985	Y	5	3985	Y	5	3986	Y	5	3986	Y
4	4010	Y	4	4010	Y	4	4010	Y	4	4010	Y	4	4011	Y	4	4011	Y
3	3971	Y	3	3971	Y	3	3971	Y	3	3972	Y	3	3972	Y	3	3972	Y
2	3871	Y	2	3870	Y	2	3871	Y	2	3871	Y	2	3871	Y	2	3872	Y
1	3655	Y	1	3654	Y	1	3655	Y	1	3655	Y	1	3655	Y	1	3655	Y
0	1492	Y	0	3232	Y	0	3233	Y	0	2902	Y	0	3232	Y	0	3233	Y

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RUN NO. 8 T/C's 1-50

D-21

49	3647	Y	49	3647	Y	49	3647	Y	49	3647	Y	49	3647	Y
48	4455	Y	48	4455	Y	48	4455	Y	48	4455	Y	48	4455	Y
47	4455	Y	47	4455	Y	47	4455	Y	47	4455	Y	47	4455	Y
46	4506	Y	46	4506	Y	46	4506	Y	46	4506	Y	46	4506	Y
45	4381	Y	45	4381	Y	45	4381	Y	45	4381	Y	45	4381	Y
44	4121	Y	44	4121	Y	44	4121	Y	44	4121	Y	44	4121	Y
43	3792	Y	43	3792	Y	43	3792	Y	43	3792	Y	43	3792	Y
42	3707	Y	42	3707	Y	42	3707	Y	42	3707	Y	42	3707	Y
41	4456	Y	41	4456	Y	41	4456	Y	41	4456	Y	41	4456	Y
40	4455	Y	40	4455	Y	40	4455	Y	40	4455	Y	40	4455	Y
39	4479	Y	39	4479	Y	39	4479	Y	39	4479	Y	39	4479	Y
38	4414	Y	38	4414	Y	38	4414	Y	38	4414	Y	38	4414	Y
37	3800	Y	37	3800	Y	37	3800	Y	37	3800	Y	37	3800	Y
36	4506	Y	36	4506	Y	36	4506	Y	36	4506	Y	36	4506	Y
35	4439	Y	35	4439	Y	35	4439	Y	35	4439	Y	35	4439	Y
34	3858	Y	34	3858	Y	34	3858	Y	34	3858	Y	34	3858	Y
33	781	Y	33	781	Y	33	781	Y	33	781	Y	33	781	Y
32	4654	Y	32	4654	Y	32	4654	Y	32	4654	Y	32	4654	Y
31	4684	Y	31	4684	Y	31	4684	Y	31	4684	Y	31	4684	Y
30	4576	Y	30	4576	Y	30	4576	Y	30	4576	Y	30	4576	Y
29	3898	Y	29	3898	Y	29	3898	Y	29	3898	Y	29	3898	Y
28	3654	Y	28	3654	Y	28	3654	Y	28	3654	Y	28	3654	Y
27	4416	Y	27	4416	Y	27	4416	Y	27	4416	Y	27	4416	Y
26	4351	Y	26	4351	Y	26	4351	Y	26	4351	Y	26	4351	Y
25	4165	Y	25	4165	Y	25	4165	Y	25	4165	Y	25	4165	Y
24	3892	Y	24	3892	Y	24	3892	Y	24	3892	Y	24	3892	Y
23	4557	Y	23	4557	Y	23	4557	Y	23	4557	Y	23	4557	Y
22	356	Y	22	356	Y	22	356	Y	22	356	Y	22	356	Y
21	4359	Y	21	4359	Y	21	4359	Y	21	4359	Y	21	4359	Y
20	4067	Y	20	4067	Y	20	4067	Y	20	4067	Y	20	4067	Y
19	3764	Y	19	3764	Y	19	3764	Y	19	3764	Y	19	3764	Y
18	4526	Y	18	4526	Y	18	4526	Y	18	4526	Y	18	4526	Y
17	4434	Y	17	4434	Y	17	4434	Y	17	4434	Y	17	4434	Y
16	3837	Y	16	3837	Y	16	3837	Y	16	3837	Y	16	3837	Y
15	4547	Y	15	4547	Y	15	4547	Y	15	4547	Y	15	4547	Y
14	4555	Y	14	4555	Y	14	4555	Y	14	4555	Y	14	4555	Y
13	4550	Y	13	4550	Y	13	4550	Y	13	4550	Y	13	4550	Y
12	4461	Y	12	4461	Y	12	4461	Y	12	4461	Y	12	4461	Y
11	4508	Y	11	4508	Y	11	4508	Y	11	4508	Y	11	4508	Y
10	4549	Y	10	4549	Y	10	4549	Y	10	4549	Y	10	4549	Y
9	4426	Y	9	4426	Y	9	4426	Y	9	4426	Y	9	4426	Y
8	4226	Y	8	4226	Y	8	4226	Y	8	4226	Y	8	4226	Y
7	3802	Y	7	3802	Y	7	3802	Y	7	3802	Y	7	3802	Y
6	3616	Y	6	3616	Y	6	3616	Y	6	3616	Y	6	3616	Y
5	4222	Y	5	4222	Y	5	4222	Y	5	4222	Y	5	4222	Y
4	4329	Y	4	4329	Y	4	4329	Y	4	4329	Y	4	4329	Y
3	4232	Y	3	4232	Y	3	4232	Y	3	4232	Y	3	4232	Y
2	4185	Y	2	4185	Y	2	4185	Y	2	4185	Y	2	4185	Y
1	4064	Y	1	4064	Y	1	4064	Y	1	4064	Y	1	4064	Y
0	3317	Y	0	3317	Y	0	3317	Y	0	3317	Y	0	3317	Y

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RUN NO. 8 T/C's 51-100

D-22

49	3486	Y	49	3447	Y	49	3444	Y	49	3450	Y	49	3441	Y	49	3438	Y
48	3533	Y	48	3946	Y	48	3941	Y	48	3942	Y	48	3943	Y	48	3944	Y
47	3485	Y	47	3935	Y	47	3936	Y	47	3937	Y	47	3938	Y	47	3939	Y
46	3484	Y	46	3436	Y	46	3437	Y	46	3438	Y	46	3439	Y	46	3440	Y
45	3480	Y	45	3517	Y	45	3518	Y	45	3519	Y	45	3520	Y	45	3521	Y
44	3486	Y	44	3456	Y	44	3457	Y	44	3458	Y	44	3459	Y	44	3460	Y
43	3457	Y	43	3820	Y	43	3821	Y	43	3822	Y	43	3823	Y	43	3824	Y
42	3458	Y	42	3925	Y	42	3926	Y	42	3927	Y	42	3928	Y	42	3929	Y
41	3927	Y	41	3940	Y	41	3941	Y	41	3942	Y	41	3943	Y	41	3944	Y
40	3935	Y	40	3934	Y	40	3935	Y	40	3936	Y	40	3937	Y	40	3938	Y
39	3933	Y	39	3934	Y	39	3935	Y	39	3936	Y	39	3937	Y	39	3938	Y
38	3569	Y	38	3570	Y	38	3571	Y	38	3572	Y	38	3573	Y	38	3574	Y
37	3567	Y	37	3568	Y	37	3569	Y	37	3570	Y	37	3571	Y	37	3572	Y
36	3567	Y	36	3860	Y	36	3861	Y	36	3862	Y	36	3863	Y	36	3864	Y
35	3864	Y	35	4012	Y	35	4013	Y	35	4014	Y	35	4015	Y	35	4016	Y
34	4011	Y	34	4011	Y	34	4012	Y	34	4013	Y	34	4014	Y	34	4015	Y
33	4000	Y	33	3925	Y	33	3926	Y	33	3927	Y	33	3928	Y	33	3929	Y
32	3924	Y	32	3833	Y	32	3834	Y	32	3835	Y	32	3836	Y	32	3837	Y
31	3832	Y	31	3833	Y	31	3834	Y	31	3835	Y	31	3836	Y	31	3837	Y
30	3835	Y	30	3836	Y	30	3837	Y	30	3838	Y	30	3839	Y	30	3840	Y
29	3835	Y	29	3836	Y	29	3837	Y	29	3838	Y	29	3839	Y	29	3840	Y
28	3835	Y	28	3836	Y	28	3837	Y	28	3838	Y	28	3839	Y	28	3840	Y
27	3835	Y	27	3836	Y	27	3837	Y	27	3838	Y	27	3839	Y	27	3840	Y
26	726	Y	26	2336	Y	26	2337	Y	26	2338	Y	26	2339	Y	26	2340	Y
25	2335	Y	25	2336	Y	25	2337	Y	25	2338	Y	25	2339	Y	25	2340	Y
24	2335	Y	24	2336	Y	24	2337	Y	24	2338	Y	24	2339	Y	24	2340	Y
23	2240	Y	23	2241	Y	23	2242	Y	23	2243	Y	23	2244	Y	23	2245	Y
22	3515	Y	22	3516	Y	22	3517	Y	22	3518	Y	22	3519	Y	22	3520	Y
21	3450	Y	21	3451	Y	21	3452	Y	21	3453	Y	21	3454	Y	21	3455	Y
20	3379	Y	20	3380	Y	20	3381	Y	20	3382	Y	20	3383	Y	20	3384	Y
19	3304	Y	19	3305	Y	19	3306	Y	19	3307	Y	19	3308	Y	19	3309	Y
18	3634	Y	18	3635	Y	18	3636	Y	18	3637	Y	18	3638	Y	18	3639	Y
17	3540	Y	17	3541	Y	17	3542	Y	17	3543	Y	17	3544	Y	17	3545	Y
16	3437	Y	16	3503	Y	16	3504	Y	16	3505	Y	16	3506	Y	16	3507	Y
15	3460	Y	15	3451	Y	15	3452	Y	15	3453	Y	15	3454	Y	15	3455	Y
14	3532	Y	14	3533	Y	14	3534	Y	14	3535	Y	14	3536	Y	14	3537	Y
13	3421	Y	13	3422	Y	13	3423	Y	13	3424	Y	13	3425	Y	13	3426	Y
12	3325	Y	12	3326	Y	12	3327	Y	12	3328	Y	12	3329	Y	12	3330	Y
11	3269	Y	11	3270	Y	11	3271	Y	11	3272	Y	11	3273	Y	11	3274	Y
10	2586	Y	10	2587	Y	10	2588	Y	10	2589	Y	10	2590	Y	10	2591	Y
9	2504	Y	9	2505	Y	9	2506	Y	9	2507	Y	9	2508	Y	9	2509	Y
8	2407	Y	8	2408	Y	8	2409	Y	8	2410	Y	8	2411	Y	8	2412	Y
7	2245	Y	7	2246	Y	7	2247	Y	7	2248	Y	7	2249	Y	7	2250	Y
6	1560	Y	6	1561	Y	6	1562	Y	6	1563	Y	6	1564	Y	6	1565	Y
5	4155	Y	5	4156	Y	5	4157	Y	5	4158	Y	5	4159	Y	5	4160	Y
4	4217	Y	4	4218	Y	4	4219	Y	4	4220	Y	4	4221	Y	4	4222	Y
3	4235	Y	3	4236	Y	3	4237	Y	3	4238	Y	3	4239	Y	3	4240	Y
2	4121	Y	2	4122	Y	2	4123	Y	2	4124	Y	2	4125	Y	2	4126	Y
1	4025	Y	1	4026	Y	1	4027	Y	1	4028	Y	1	4029	Y	1	4030	Y
0	3730	Y	0	3731	Y	0	3732	Y	0	3733	Y	0	3734	Y	0	3735	Y

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RUN NO.9 T/C's 1-50

D-23

49	3297	Y	49	3296	Y	49	3295	Y	49	3295	Y	49	3295	Y
48	4094	Y	48	3893	Y	48	3892	Y	48	3892	Y	48	3892	Y
47	4093	Y	47	4092	Y	47	4091	Y	47	4090	Y	47	4089	Y
46	4091	Y	46	4090	Y	46	4089	Y	46	4088	Y	46	4087	Y
45	3898	Y	45	3897	Y	45	3896	Y	45	3895	Y	45	3894	Y
44	3697	Y	44	3696	Y	44	3695	Y	44	3694	Y	44	3693	Y
43	3491	Y	43	3490	Y	43	3489	Y	43	3488	Y	43	3487	Y
42	3395	Y	42	3394	Y	42	3393	Y	42	3392	Y	42	3391	Y
41	3964	Y	41	3963	Y	41	3962	Y	41	3961	Y	41	3960	Y
40	3964	Y	40	3963	Y	40	3962	Y	40	3961	Y	40	3960	Y
39	4066	Y	39	4065	Y	39	4064	Y	39	4063	Y	39	4062	Y
38	3963	Y	38	3962	Y	38	3961	Y	38	3960	Y	38	3959	Y
37	3434	Y	37	3433	Y	37	3432	Y	37	3431	Y	37	3430	Y
36	3965	Y	36	3964	Y	36	3963	Y	36	3962	Y	36	3961	Y
35	3972	Y	35	3971	Y	35	3970	Y	35	3969	Y	35	3968	Y
34	3517	Y	34	3516	Y	34	3515	Y	34	3514	Y	34	3513	Y
33	685	Y	33	684	Y	33	683	Y	33	682	Y	33	681	Y
32	4106	Y	32	4105	Y	32	4104	Y	32	4103	Y	32	4102	Y
31	4179	Y	31	4178	Y	31	4177	Y	31	4176	Y	31	4175	Y
30	4083	Y	30	4082	Y	30	4081	Y	30	4080	Y	30	4079	Y
29	3596	Y	29	3595	Y	29	3594	Y	29	3593	Y	29	3592	Y
28	3392	Y	28	3391	Y	28	3390	Y	28	3389	Y	28	3388	Y
27	3961	Y	27	3960	Y	27	3959	Y	27	3958	Y	27	3957	Y
26	3937	Y	26	3936	Y	26	3935	Y	26	3934	Y	26	3933	Y
25	3723	Y	25	3722	Y	25	3721	Y	25	3720	Y	25	3719	Y
24	3606	Y	24	3605	Y	24	3604	Y	24	3603	Y	24	3602	Y
23	4072	Y	23	4071	Y	23	4070	Y	23	4069	Y	23	4068	Y
22	3640	Y	22	3639	Y	22	3638	Y	22	3637	Y	22	3636	Y
21	3938	Y	21	3937	Y	21	3936	Y	21	3935	Y	21	3934	Y
20	3637	Y	20	3636	Y	20	3635	Y	20	3634	Y	20	3633	Y
19	3509	Y	19	3508	Y	19	3507	Y	19	3506	Y	19	3505	Y
18	4052	Y	18	4051	Y	18	4050	Y	18	4049	Y	18	4048	Y
17	4004	Y	17	4003	Y	17	4002	Y	17	4001	Y	17	4000	Y
16	3554	Y	16	3553	Y	16	3552	Y	16	3551	Y	16	3550	Y
15	4051	Y	15	4050	Y	15	4049	Y	15	4048	Y	15	4047	Y
14	4061	Y	14	4060	Y	14	4059	Y	14	4058	Y	14	4057	Y
13	4113	Y	13	4112	Y	13	4111	Y	13	4110	Y	13	4109	Y
12	4001	Y	12	4000	Y	12	3999	Y	12	3998	Y	12	3997	Y
11	4026	Y	11	4025	Y	11	4024	Y	11	4023	Y	11	4022	Y
10	4029	Y	10	4028	Y	10	4027	Y	10	4026	Y	10	4025	Y
9	3961	Y	9	3960	Y	9	3959	Y	9	3958	Y	9	3957	Y
8	3545	Y	8	3544	Y	8	3543	Y	8	3542	Y	8	3541	Y
7	3597	Y	7	3596	Y	7	3595	Y	7	3594	Y	7	3593	Y
6	3425	Y	6	3424	Y	6	3423	Y	6	3422	Y	6	3421	Y
5	3631	Y	5	3630	Y	5	3629	Y	5	3628	Y	5	3627	Y
4	3910	Y	4	3909	Y	4	3908	Y	4	3907	Y	4	3906	Y
3	4056	Y	3	4055	Y	3	4054	Y	3	4053	Y	3	4052	Y
2	3637	Y	2	3636	Y	2	3635	Y	2	3634	Y	2	3633	Y
1	3727	Y	1	3726	Y	1	3725	Y	1	3724	Y	1	3723	Y
0	3211	Y	0	3210	Y	0	3209	Y	0	3208	Y	0	3207	Y

RUN NO. 9 T/c's 51-100

D-24

49	3274	Y	49	3274	Y	49	3275	Y	49	3275	Y	49	3276	Y
48	3717	Y	48	3717	Y	48	3717	Y	48	3717	Y	48	3717	Y
47	3126	Y	47	3126	Y	47	3127	Y	47	3127	Y	47	3127	Y
46	3640	Y	46	3640	Y	46	3641	Y	46	3641	Y	46	3641	Y
45	3278	Y	45	3278	Y	45	3279	Y	45	3279	Y	45	3279	Y
44	3284	Y	44	3285	Y	44	3285	Y	44	3285	Y	44	3286	Y
43	3544	Y	43	3545	Y	43	3545	Y	43	3545	Y	43	3546	Y
42	3740	Y	42	3740	Y	42	3741	Y	42	3741	Y	42	3742	Y
41	3745	Y	41	3746	Y	41	3746	Y	41	3747	Y	41	3747	Y
40	3721	Y	40	3721	Y	40	3722	Y	40	3722	Y	40	3723	Y
39	3560	Y	39	3560	Y	39	3561	Y	39	3562	Y	39	3562	Y
38	3425	Y	38	3426	Y	38	3426	Y	38	3427	Y	38	3428	Y
37	3439	Y	37	3439	Y	37	3439	Y	37	3440	Y	37	3440	Y
36	3706	Y	36	3706	Y	36	3707	Y	36	3707	Y	36	3708	Y
35	3817	Y	35	3817	Y	35	3817	Y	35	3817	Y	35	3818	Y
34	3813	Y	34	3813	Y	34	3813	Y	34	3814	Y	34	3814	Y
33	3730	Y	33	3730	Y	33	3731	Y	33	3732	Y	33	3732	Y
32	3660	Y	32	3660	Y	32	3660	Y	32	3661	Y	32	3661	Y
31	3555	Y	31	3555	Y	31	3555	Y	31	3556	Y	31	3556	Y
30	2533	Y	30	2533	Y	30	2534	Y	30	2535	Y	30	2536	Y
29	2537	Y	29	2537	Y	29	2538	Y	29	2539	Y	29	2540	Y
28	2405	Y	28	2405	Y	28	2406	Y	28	2407	Y	28	2408	Y
27	2193	Y	27	2193	Y	27	2194	Y	27	2194	Y	27	2195	Y
26	3521	Y	26	3521	Y	26	3522	Y	26	3523	Y	26	3524	Y
25	3467	Y	25	3467	Y	25	3468	Y	25	3469	Y	25	3470	Y
24	3314	Y	24	3314	Y	24	3315	Y	24	3316	Y	24	3317	Y
23	3123	Y	23	3123	Y	23	3124	Y	23	3125	Y	23	3126	Y
22	3646	Y	22	3646	Y	22	3647	Y	22	3648	Y	22	3649	Y
21	3557	Y	21	3557	Y	21	3558	Y	21	3559	Y	21	3560	Y
20	3469	Y	20	3469	Y	20	3470	Y	20	3471	Y	20	3472	Y
19	3420	Y	19	3420	Y	19	3421	Y	19	3422	Y	19	3423	Y
18	3594	Y	18	3594	Y	18	3595	Y	18	3596	Y	18	3597	Y
17	3510	Y	17	3510	Y	17	3511	Y	17	3512	Y	17	3513	Y
16	3347	Y	16	3347	Y	16	3348	Y	16	3349	Y	16	3350	Y
15	3116	Y	15	3116	Y	15	3117	Y	15	3118	Y	15	3119	Y
14	2917	Y	14	2917	Y	14	2918	Y	14	2919	Y	14	2920	Y
13	2764	Y	13	2764	Y	13	2765	Y	13	2766	Y	13	2767	Y
12	2547	Y	12	2547	Y	12	2548	Y	12	2549	Y	12	2550	Y
11	2121	Y	11	2121	Y	11	2122	Y	11	2123	Y	11	2124	Y
10	3248	Y	10	3248	Y	10	3249	Y	10	3250	Y	10	3251	Y
9	3701	Y	9	3701	Y	9	3702	Y	9	3703	Y	9	3704	Y
8	3700	Y	8	3700	Y	8	3701	Y	8	3702	Y	8	3703	Y
7	3655	Y	7	3655	Y	7	3656	Y	7	3657	Y	7	3658	Y
6	3724	Y	6	3724	Y	6	3725	Y	6	3726	Y	6	3727	Y
5	3628	Y	5	3628	Y	5	3629	Y	5	3630	Y	5	3631	Y
4	3445	Y	4	3445	Y	4	3446	Y	4	3447	Y	4	3448	Y

001354
007:03:10:10

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007:03:10:10

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007:03:10:10

RUN NO. 10 T/C's 1-50

D-25

49	3603	Y
48	4495	Y
47	4544	Y
46	4382	Y
44	4058	Y
43	3836	Y
42	3714	Y
41	4589	Y
40	4530	Y
39	4588	Y
38	4454	Y
37	3833	Y
36	4556	Y
35	4481	Y
34	3949	Y
33	727	Y
32	4742	Y
31	4826	Y
30	4679	Y
29	4080	Y
28	3707	Y
27	4421	Y
26	4400	Y
25	4191	Y
24	3939	Y
23	4654	Y
22	4124	Y
21	4452	Y
20	4136	Y
19	3855	Y
18	4624	Y
17	4505	Y
16	3974	Y
15	4633	Y
14	4644	Y
13	4704	Y
12	4545	Y
11	4703	Y
10	4627	Y
9	4456	Y
8	4294	Y
7	3956	Y
6	3727	Y
5	4328	Y
4	4350	Y
3	4360	Y
2	4221	Y
1	4096	Y
0	3442	Y

49	3603	Y
48	4495	Y
47	4544	Y
46	4382	Y
44	4059	Y
43	3837	Y
42	3714	Y
41	4589	Y
40	4530	Y
39	4588	Y
38	4454	Y
37	3832	Y
36	4556	Y
35	4481	Y
34	3949	Y
33	719	Y
32	4742	Y
31	4825	Y
30	4679	Y
29	4080	Y
28	3708	Y
27	4422	Y
26	4400	Y
25	4192	Y
24	3939	Y
23	4654	Y
22	4124	Y
21	4423	Y
20	4136	Y
19	3854	Y
18	4623	Y
17	4505	Y
16	3974	Y
15	4632	Y
14	4644	Y
13	4703	Y
12	4545	Y
11	4702	Y
10	4626	Y
9	4457	Y
8	4294	Y
7	3957	Y
6	3722	Y
5	4328	Y
4	4350	Y
3	4360	Y
2	4221	Y
1	4097	Y
0	3442	Y

49	3604	Y
48	4496	Y
47	4544	Y
46	4384	Y
44	4060	Y
43	3837	Y
42	3714	Y
41	4589	Y
40	4530	Y
39	4589	Y
38	4454	Y
37	3833	Y
36	4556	Y
35	4481	Y
34	3949	Y
33	726	Y
32	4742	Y
31	4826	Y
30	4679	Y
29	4080	Y
28	3708	Y
27	4422	Y
26	4400	Y
25	4192	Y
24	3949	Y
23	4654	Y
22	4123	Y
21	4423	Y
20	4136	Y
19	3855	Y
18	4624	Y
17	4505	Y
16	3974	Y
15	4632	Y
14	4644	Y
13	4703	Y
12	4545	Y
11	4703	Y
10	4627	Y
9	4457	Y
8	4294	Y
7	3957	Y
6	3723	Y
5	4329	Y
4	4351	Y
3	4361	Y
2	4220	Y
1	4097	Y
0	3447	Y

49	3606	Y
48	4496	Y
47	4544	Y
46	4386	Y
44	4061	Y
43	3838	Y
42	3718	Y
41	4589	Y
40	4532	Y
39	4590	Y
38	4456	Y
37	3835	Y
36	4558	Y
35	4482	Y
34	3949	Y
33	733	Y
32	4741	Y
31	4824	Y
30	4677	Y
29	4077	Y
28	3711	Y
27	4424	Y
26	4402	Y
25	4193	Y
24	4090	Y
23	4652	Y
22	4121	Y
21	4424	Y
20	4134	Y
19	3857	Y
18	4625	Y
17	4507	Y
16	3976	Y
15	4632	Y
14	4644	Y
13	4704	Y
12	4545	Y
11	4702	Y
10	4629	Y
9	4459	Y
8	4296	Y
7	3959	Y
6	3727	Y
5	4332	Y
4	4370	Y
3	4364	Y
2	4226	Y
1	4101	Y
0	3445	Y

49	3606	Y
48	4496	Y
47	4544	Y
46	4386	Y
45	4335	Y
44	4061	Y
43	3839	Y
42	3718	Y
41	4589	Y
40	4532	Y
39	4590	Y
38	4456	Y
37	3835	Y
36	4558	Y
35	4482	Y
34	3949	Y
33	731	Y
32	4740	Y
31	4824	Y
30	4676	Y
29	4078	Y
28	3711	Y
27	4424	Y
26	4402	Y
25	4193	Y
24	4091	Y
23	4652	Y
22	4122	Y
21	4425	Y
20	4135	Y
19	3858	Y
18	4625	Y
17	4507	Y
16	3976	Y
15	4632	Y
14	4645	Y
13	4704	Y
12	4546	Y
11	4702	Y
10	4629	Y
9	4459	Y
8	4297	Y
7	3959	Y
6	3726	Y
5	4331	Y
4	4370	Y
3	4364	Y
2	4225	Y
1	4100	Y
0	3445	Y

49	3606	Y
48	4496	Y
47	4544	Y
46	4386	Y
45	4335	Y
44	4061	Y
43	3839	Y
42	3718	Y
41	4589	Y
40	4532	Y
39	4590	Y
38	4456	Y
37	3835	Y
36	4558	Y
35	4482	Y
34	3949	Y
33	736	Y
32	4741	Y
31	4824	Y
30	4677	Y
29	4079	Y
28	3710	Y
27	4423	Y
26	4402	Y
25	4193	Y
24	4090	Y
23	4652	Y
22	4121	Y
21	4424	Y
20	4135	Y
19	3858	Y
18	4625	Y
17	4507	Y
16	3976	Y
15	4632	Y
14	4645	Y
13	4704	Y
12	4546	Y
11	4702	Y
10	4629	Y
9	4458	Y
8	4297	Y
7	3957	Y
6	3725	Y
5	4330	Y
4	4360	Y
3	4362	Y
2	4227	Y
1	4026	Y
0	3444	Y

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$\rho = 30.99 \text{ kg}$

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(1-50)

RUN NO. 10 T/C's 51-100

D-26

49 3479 Y
48 4001 Y
47 ---*---* Y
46 3329 Y
45 3945 Y
44 3511 Y
43 3495 Y
42 3882 Y
41 4048 Y
40 4026 Y
39 4004 Y
38 3836 Y
37 3658 Y
36 3686 Y
35 4040 Y
34 4185 Y
33 4138 Y
32 4154 Y
31 3940 Y
30 3811 Y
29 *** Y
28 *** Y
27 *** Y
26 2575 Y
25 2583 Y
24 2441 Y
23 2213 Y
22 3706 Y
21 3565 Y
20 3470 Y
19 3183 Y
18 3795 Y
17 3664 Y
16 3547 Y
15 3478 Y
14 3700 Y
13 3589 Y
12 3608 Y
11 3160 Y
10 2977 Y
9 2853 Y
8 2597 Y
7 2205 Y
6 3506 Y
5 4151 Y
4 4150 Y
3 4252 Y
2 4134 Y
1 3977 Y
0 3769 Y

49 3480 Y
48 4003 Y
47 ---*---* Y
46 3330 Y
45 3947 Y
44 3512 Y
43 3486 Y
42 3684 Y
41 4020 Y
40 4038 Y
39 4045 Y
38 3637 Y
37 3659 Y
36 3667 Y
35 4041 Y
34 4185 Y
33 4139 Y
32 4105 Y
31 3961 Y
30 3812 Y
29 *** Y
28 *** Y
27 *** Y
26 2577 Y
25 2584 Y
24 2442 Y
23 2213 Y
22 3706 Y
21 3566 Y
20 3481 Y
19 3184 Y
18 3786 Y
17 3665 Y
16 3549 Y
15 3476 Y
14 3701 Y
13 3589 Y
12 3408 Y
11 3159 Y
10 2975 Y
9 2454 Y
8 2598 Y
7 2208 Y
6 3508 Y
5 4152 Y
4 4152 Y
3 4259 Y
2 4135 Y
1 3978 Y
0 3769 Y

49 3482 Y
48 4004 Y
47 ---*---* Y
46 3331 Y
45 3948 Y
44 3513 Y
43 3487 Y
42 3885 Y
41 4021 Y
40 4039 Y
39 4006 Y
38 3838 Y
37 3660 Y
36 3688 Y
35 4042 Y
34 4186 Y
33 4140 Y
32 4105 Y
31 3962 Y
30 3812 Y
29 3813 Y
28 *** Y
27 *** Y
26 2575 Y
25 2582 Y
24 2440 Y
23 2212 Y
22 3705 Y
21 3563 Y
20 3325 Y
19 3184 Y
18 3734 Y
17 3664 Y
16 3547 Y
15 3474 Y
14 3639 Y
13 3586 Y
12 3404 Y
11 3155 Y
10 2977 Y
9 2855 Y
8 2596 Y
7 2208 Y
6 3509 Y
5 4152 Y
4 4153 Y
3 4260 Y
2 4135 Y
1 3979 Y
0 3770 Y

49 3481 Y
48 4003 Y
47 ---*---* Y
46 3331 Y
45 3947 Y
44 3513 Y
43 3487 Y
42 3884 Y
41 4021 Y
40 4038 Y
39 4005 Y
38 3836 Y
37 3659 Y
36 3689 Y
35 4042 Y
34 4186 Y
33 4140 Y
32 4105 Y
31 3962 Y
30 3812 Y
29 *** Y
28 *** Y
27 *** Y
26 2574 Y
25 2580 Y
24 2437 Y
23 2211 Y
22 3700 Y
21 3559 Y
20 3326 Y
19 3151 Y
18 3760 Y
17 3661 Y
16 3544 Y
15 3469 Y
14 3625 Y
13 3582 Y
12 3407 Y
11 3150 Y
10 2974 Y
9 2851 Y
8 2597 Y
7 2208 Y
6 3509 Y
5 4152 Y
4 4153 Y
3 4260 Y
2 4135 Y
1 3979 Y
0 3770 Y

49 3480 Y
48 4002 Y
47 ---*---* Y
46 3330 Y
45 3947 Y
44 3512 Y
43 3486 Y
42 3883 Y
41 4020 Y
40 4037 Y
39 4004 Y
38 3837 Y
37 3659 Y
36 3688 Y
35 4042 Y
34 4185 Y
33 4140 Y
32 4105 Y
31 3961 Y
30 3812 Y
29 *** Y
28 *** Y
27 *** Y
26 2571 Y
25 2577 Y
24 2434 Y
23 2208 Y
22 3683 Y
21 3553 Y
20 3321 Y
19 3176 Y
18 3775 Y
17 3656 Y
16 3539 Y
15 3462 Y
14 3680 Y
13 3576 Y
12 3394 Y
11 3143 Y
10 2970 Y
9 2854 Y
8 2596 Y
7 2209 Y
6 3510 Y
5 4153 Y
4 4183 Y
3 4260 Y
2 4136 Y
1 3979 Y
0 3770 Y

49 3479 Y
48 4001 Y
47 ---*---* Y
46 3329 Y
45 3945 Y
44 3511 Y
43 3484 Y
42 3881 Y
41 4068 Y
40 4035 Y
39 4003 Y
38 3836 Y
37 3657 Y
36 3688 Y
35 4041 Y
34 4184 Y
33 4139 Y
32 4103 Y
31 3960 Y
30 3811 Y
29 *** Y
28 *** Y
27 *** Y
26 2568 Y
25 2574 Y
24 2430 Y
23 2206 Y
22 3667 Y
21 3547 Y
20 3386 Y
19 3169 Y
18 3770 Y
17 3649 Y
16 3532 Y
15 3434 Y
14 3683 Y
13 3568 Y
12 3387 Y
11 3135 Y
10 2946 Y
9 2852 Y
8 2594 Y
7 2205 Y
6 3510 Y
5 4152 Y
4 4133 Y
3 4261 Y
2 4135 Y
1 3980 Y
0 3771 Y

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SCAN #6
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RUN NO. 11 - T/C's 1-50

49	4131	Y	49	4130	Y	49	4125	Y	49	4124	Y	49	4124	Y
48	5365	Y	48	5365	Y	48	5362	Y	48	5361	Y	48	5361	Y
47	***5*	Y	47	***5*	Y	47	***5*	Y	47	***5*	Y	47	***5*	Y
46	5338	Y	46	5338	Y	46	5336	Y	46	5335	Y	46	5335	Y
45	5161	Y	45	5161	Y	45	5156	Y	45	5155	Y	45	5156	Y
44	4778	Y	44	4778	Y	44	4773	Y	44	4771	Y	44	4771	Y
43	4362	Y	43	4361	Y	43	4356	Y	43	4354	Y	43	4355	Y
42	4233	Y	42	4232	Y	42	4229	Y	42	4228	Y	42	4229	Y
41	5359	Y	41	5359	Y	41	5357	Y	41	5356	Y	41	5356	Y
40	5326	Y	40	5327	Y	40	5326	Y	40	5324	Y	40	5325	Y
39	5286	Y	39	5288	Y	39	5287	Y	39	5287	Y	39	5287	Y
38	5176	Y	38	5176	Y	38	5174	Y	38	5174	Y	38	5173	Y
37	4393	Y	37	4394	Y	37	4391	Y	37	4391	Y	37	4391	Y
36	5374	Y	36	5374	Y	36	5372	Y	36	5372	Y	36	5372	Y
35	5229	Y	35	5229	Y	35	5227	Y	35	5227	Y	35	5227	Y
34	4425	Y	34	4425	Y	34	4423	Y	34	4423	Y	34	4423	Y
33	731	Y	33	730	Y	33	734	Y	33	737	Y	33	738	Y
32	5603	Y	32	5603	Y	32	5602	Y	32	5602	Y	32	5602	Y
31	5616	Y	31	5616	Y	31	5614	Y	31	5615	Y	31	5615	Y
30	5456	Y	30	5456	Y	30	5455	Y	30	5455	Y	30	5455	Y
29	4626	Y	29	4625	Y	29	4622	Y	29	4621	Y	29	4621	Y
28	4152	Y	28	4151	Y	28	4147	Y	28	4146	Y	28	4146	Y
27	5214	Y	27	5213	Y	27	5209	Y	27	5209	Y	27	5206	Y
26	5077	Y	26	5077	Y	26	5071	Y	26	5070	Y	26	5070	Y
25	4833	Y	25	4833	Y	25	4827	Y	25	4827	Y	25	4826	Y
24	4497	Y	24	4496	Y	24	4490	Y	24	4490	Y	24	4490	Y
23	5419	Y	23	5419	Y	23	5418	Y	23	5418	Y	23	5416	Y
22	4682	Y	22	4681	Y	22	4678	Y	22	4678	Y	22	4677	Y
21	5116	Y	21	5115	Y	21	5112	Y	21	5112	Y	21	5112	Y
20	4739	Y	20	4738	Y	20	4736	Y	20	4736	Y	20	4735	Y
19	4319	Y	19	4319	Y	19	4317	Y	19	4316	Y	19	4316	Y
18	5389	Y	18	5389	Y	18	5387	Y	18	5386	Y	18	5386	Y
17	5206	Y	17	5206	Y	17	5204	Y	17	5204	Y	17	5204	Y
16	4446	Y	16	4446	Y	16	4445	Y	16	4444	Y	16	4445	Y
15	5410	Y	15	5410	Y	15	5409	Y	15	5406	Y	15	5406	Y
14	5437	Y	14	5437	Y	14	5437	Y	14	5436	Y	14	5436	Y
13	5407	Y	13	5407	Y	13	5406	Y	13	5406	Y	13	5406	Y
12	5260	Y	12	5260	Y	12	5259	Y	12	5258	Y	12	5259	Y
11	5452	Y	11	5452	Y	11	5450	Y	11	5449	Y	11	5450	Y
10	5401	Y	10	5401	Y	10	5399	Y	10	5399	Y	10	5399	Y
9	5204	Y	9	5204	Y	9	5201	Y	9	5201	Y	9	5201	Y
8	4931	Y	8	4930	Y	8	4927	Y	8	4926	Y	8	4926	Y
7	4390	Y	7	4389	Y	7	4385	Y	7	4384	Y	7	4384	Y
6	4056	Y	6	4057	Y	6	4053	Y	6	4053	Y	6	4052	Y
5	4967	Y	5	4966	Y	5	4963	Y	5	4963	Y	5	4962	Y
4	5051	Y	4	5050	Y	4	5047	Y	4	5047	Y	4	5046	Y
3	4962	Y	3	4962	Y	3	4960	Y	3	4959	Y	3	4959	Y
2	4507	Y	2	4759	Y	2	4755	Y	2	4755	Y	2	4755	Y
1	4645	Y	1	4645	Y	1	4641	Y	1	4640	Y	1	4640	Y
0	3681	Y	0	3680	Y	0	3681	Y	0	3677	Y	0	3678	Y

RUN NO. 11 T/C's 51-100

D-28

49	3684	Y	49	3682	Y	49	3680	Y	49	3680	Y	49	3684	Y
48	4312	Y	48	4310	Y	48	4308	Y	48	4308	Y	48	4308	Y
47	***	Y	47	***	Y	47	***	Y	47	***	Y	47	***	Y
46	3681	Y	46	3680	Y	46	3678	Y	46	3678	Y	46	3677	Y
45	4321	Y	45	4319	Y	45	4318	Y	45	4318	Y	45	4317	Y
44	3811	Y	44	3809	Y	44	3808	Y	44	3808	Y	44	3807	Y
43	3714	Y	43	3713	Y	43	3711	Y	43	3710	Y	43	3710	Y
42	4194	Y	42	4192	Y	42	4191	Y	42	4190	Y	42	4189	Y
41	4404	Y	41	4402	Y	41	4400	Y	41	4399	Y	41	4398	Y
40	4364	Y	40	4361	Y	40	4358	Y	40	4357	Y	40	4356	Y
39	4313	Y	39	4311	Y	39	4308	Y	39	4307	Y	39	4306	Y
38	4120	Y	38	4119	Y	38	4117	Y	38	4116	Y	38	4115	Y
37	3856	Y	37	3854	Y	37	3853	Y	37	3852	Y	37	3851	Y
36	623	Y	36	3909	Y	36	3808	Y	36	3807	Y	36	3806	Y
35	4277	Y	35	4276	Y	35	4275	Y	35	4273	Y	35	4274	Y
34	4464	Y	34	4462	Y	34	4461	Y	34	4460	Y	34	4459	Y
33	4397	Y	33	4396	Y	33	4396	Y	33	4396	Y	33	4396	Y
32	4356	Y	32	4356	Y	32	4355	Y	32	4354	Y	32	4354	Y
31	4170	Y	31	4169	Y	31	4167	Y	31	4166	Y	31	4166	Y
30	94E	Y	30	3922	Y	30	3920	Y	30	3919	Y	30	3918	Y
29	***	Y	29	***	Y	29	***	Y	29	***	Y	29	***	Y
28	***	Y	28	***	Y	28	***	Y	28	***	Y	28	***	Y
27	***	Y	27	***	Y	27	***	Y	27	***	Y	27	***	Y
26	2242	Y	26	912	Y	26	2242	Y	26	2243	Y	26	2246	Y
25	2270	Y	25	2270	Y	25	2270	Y	25	2271	Y	25	2273	Y
24	2196	Y	24	2196	Y	24	2196	Y	24	2197	Y	24	2200	Y
23	2131	Y	23	2131	Y	23	2131	Y	23	2132	Y	23	2135	Y
22	3510	Y	22	3510	Y	22	3509	Y	22	3511	Y	22	3514	Y
21	3433	Y	21	3431	Y	21	3431	Y	21	3432	Y	21	3434	Y
20	3364	Y	20	3362	Y	20	3360	Y	20	3360	Y	20	3363	Y
19	3274	Y	19	3271	Y	19	3270	Y	19	3270	Y	19	3272	Y
18	3651	Y	18	3646	Y	18	3644	Y	18	3650	Y	18	3653	Y
17	3518	Y	17	3515	Y	17	3514	Y	17	3514	Y	17	3517	Y
16	3493	Y	16	3490	Y	16	3490	Y	16	3490	Y	16	3491	Y
15	3394	Y	15	3393	Y	15	3395	Y	15	3397	Y	15	3400	Y
14	3464	Y	14	3493	Y	14	3492	Y	14	3494	Y	14	3496	Y
13	3401	Y	13	3399	Y	13	3399	Y	13	3400	Y	13	3403	Y
12	3276	Y	12	3276	Y	12	3277	Y	12	3279	Y	12	3283	Y
11	3162	Y	11	3161	Y	11	3163	Y	11	3165	Y	11	3169	Y
10	2526	Y	10	2526	Y	10	2526	Y	10	2528	Y	10	2529	Y
9	2466	Y	9	2463	Y	9	2461	Y	9	2460	Y	9	2469	Y
8	2330	Y	8	2327	Y	8	2326	Y	8	2325	Y	8	2325	Y
7	1066	Y	7	1468	Y	7	2159	Y	7	2158	Y	7	2156	Y
6	4000	Y	6	3939	Y	6	3937	Y	6	3936	Y	6	3936	Y
5	4847	Y	5	4846	Y	5	4845	Y	5	4844	Y	5	4844	Y
4	4867	Y	4	4865	Y	4	4864	Y	4	4863	Y	4	4863	Y
3	4872	Y	3	4872	Y	3	4872	Y	3	4872	Y	3	4872	Y
2	4766	Y	2	4765	Y	2	4764	Y	2	4763	Y	2	4762	Y
1	4592	Y	1	4590	Y	1	4590	Y	1	4589	Y	1	4588	Y
0	4263	Y	0	4262	Y	0	4261	Y	0	4260	Y	0	4260	Y

RUN NO. 12 T/c's 1-50

49	3912	Y	49	3912	Y	49	3911	Y	49	3910	Y	49	3911	Y	49	3911	Y
48	4912	Y	48	4912	Y	48	4911	Y	48	4910	Y	48	4911	Y	48	4910	Y
47	4850	Y	47	4850	Y	47	4849	Y	47	4849	Y	47	4849	Y	47	4849	Y
46	4742	Y	46	4742	Y	46	4741	Y	46	4741	Y	46	4742	Y	46	4742	Y
45	4482	Y	45	4482	Y	45	4481	Y	45	4481	Y	45	4481	Y	45	4481	Y
44	4273	Y	44	4273	Y	44	4273	Y	44	4271	Y	44	4272	Y	44	4272	Y
43	4053	Y	43	4053	Y	43	4052	Y	43	4049	Y	43	4050	Y	43	4049	Y
42	5088	Y	42	5088	Y	42	5088	Y	42	5085	Y	42	5086	Y	42	5085	Y
41	4972	Y	41	4971	Y	41	4971	Y	41	4968	Y	41	4969	Y	41	4968	Y
40	4972	Y	40	4971	Y	40	4970	Y	40	4966	Y	40	4968	Y	40	4965	Y
39	4897	Y	39	4897	Y	39	4896	Y	39	4894	Y	39	4894	Y	39	4895	Y
38	4161	Y	38	4161	Y	38	4160	Y	38	4158	Y	38	4157	Y	38	4159	Y
37	5027	Y	37	5027	Y	37	5027	Y	37	5025	Y	37	5025	Y	37	5025	Y
36	4937	Y	36	4937	Y	36	4937	Y	36	4935	Y	36	4935	Y	36	4936	Y
35	4371	Y	35	4371	Y	35	4370	Y	35	4369	Y	35	4369	Y	35	4370	Y
34	804	Y	34	804	Y	34	802	Y	34	810	Y	34	810	Y	34	814	Y
33	5279	Y	33	5279	Y	33	5279	Y	33	5278	Y	33	5278	Y	33	5279	Y
32	5321	Y	32	5321	Y	32	5321	Y	32	5321	Y	32	5321	Y	32	5322	Y
31	5219	Y	31	5219	Y	31	5219	Y	31	5219	Y	31	5219	Y	31	5220	Y
30	4669	Y	30	4669	Y	30	4669	Y	30	4669	Y	30	4669	Y	30	4669	Y
29	4047	Y	29	4047	Y	29	4046	Y	29	4045	Y	29	4045	Y	29	4046	Y
28	4865	Y	28	4865	Y	28	4864	Y	28	4863	Y	28	4863	Y	28	4863	Y
27	4784	Y	27	4784	Y	27	4784	Y	27	4783	Y	27	4783	Y	27	4783	Y
26	4639	Y	26	4639	Y	26	4639	Y	26	4638	Y	26	4638	Y	26	4639	Y
25	4484	Y	25	4484	Y	25	4484	Y	25	4484	Y	25	4484	Y	25	4484	Y
24	5181	Y	24	5181	Y	24	5181	Y	24	5181	Y	24	5181	Y	24	5181	Y
23	4720	Y	23	4720	Y	23	4720	Y	23	4720	Y	23	4720	Y	23	4720	Y
22	4767	Y	22	4767	Y	22	4767	Y	22	4767	Y	22	4767	Y	22	4767	Y
21	4747	Y	21	4747	Y	21	4747	Y	21	4747	Y	21	4747	Y	21	4747	Y
20	4333	Y	20	4333	Y	20	4333	Y	20	4333	Y	20	4333	Y	20	4334	Y
19	5112	Y	19	5112	Y	19	5112	Y	19	5112	Y	19	5112	Y	19	5112	Y
18	4987	Y	18	4987	Y	18	4987	Y	18	4987	Y	18	4987	Y	18	4987	Y
17	4457	Y	17	4457	Y	17	4457	Y	17	4457	Y	17	4457	Y	17	4457	Y
16	5077	Y	16	5077	Y	16	5077	Y	16	5077	Y	16	5077	Y	16	5077	Y
15	5155	Y	15	5155	Y	15	5155	Y	15	5155	Y	15	5155	Y	15	5155	Y
14	5140	Y	14	5140	Y	14	5140	Y	14	5140	Y	14	5140	Y	14	5140	Y
13	5029	Y	13	5029	Y	13	5029	Y	13	5029	Y	13	5029	Y	13	5029	Y
12	5136	Y	12	5136	Y	12	5136	Y	12	5136	Y	12	5136	Y	12	5136	Y
11	4990	Y	11	4990	Y	11	4990	Y	11	4990	Y	11	4990	Y	11	4991	Y
10	4725	Y	10	4725	Y	10	4725	Y	10	4725	Y	10	4725	Y	10	4726	Y
9	4809	Y	9	4809	Y	9	4809	Y	9	4809	Y	9	4809	Y	9	4809	Y
8	4375	Y	8	4375	Y	8	4375	Y	8	4374	Y	8	4374	Y	8	4375	Y
7	4103	Y	7	4103	Y	7	4103	Y	7	4102	Y	7	4102	Y	7	4103	Y
6	4702	Y	6	4702	Y	6	4702	Y	6	4702	Y	6	4702	Y	6	4702	Y
5	4752	Y	5	4752	Y	5	4752	Y	5	4752	Y	5	4752	Y	5	4753	Y
4	4670	Y	4	4670	Y	4	4670	Y	4	4670	Y	4	4670	Y	4	4670	Y
3	4545	Y	3	4545	Y	3	4545	Y	3	4545	Y	3	4545	Y	3	4545	Y
2	4525	Y	2	4525	Y	2	4525	Y	2	4525	Y	2	4525	Y	2	4525	Y
1	3774	Y	1	3774	Y	1	3774	Y	1	3774	Y	1	3774	Y	1	3774	Y
0			0			0			0			0			0		

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RUN NO. 12 T/C'S 51-100

D-30

49	3680	Y	49	3689	Y	49	3690	Y	49	3691	Y	49	3692	Y	49	3694	Y
48	4097	Y	48	4098	Y	48	4098	Y	48	4100	Y	48	4100	Y	48	4102	Y
47	***	Y	47	***	Y	47	***	Y	47	***	Y	47	***	Y	47	***	Y
46	3612	Y	46	3612	Y	46	3613	Y	46	3614	Y	46	3614	Y	46	3616	Y
45	4075	Y	45	4075	Y	45	4076	Y	45	4077	Y	45	4077	Y	45	4079	Y
44	3805	Y	44	3805	Y	44	3806	Y	44	3806	Y	44	3806	Y	44	3808	Y
43	3707	Y	43	3707	Y	43	3708	Y	43	3710	Y	43	3710	Y	43	3712	Y
42	4023	Y	42	4024	Y	42	4025	Y	42	4027	Y	42	4027	Y	42	4029	Y
41	4120	Y	41	4121	Y	41	4121	Y	41	4122	Y	41	4123	Y	41	4124	Y
40	4090	Y	40	4090	Y	40	4091	Y	40	4092	Y	40	4093	Y	40	4095	Y
39	4097	Y	39	4097	Y	39	4098	Y	39	4099	Y	39	4099	Y	39	4101	Y
38	4015	Y	38	4015	Y	38	4016	Y	38	4017	Y	38	4018	Y	38	4019	Y
37	3871	Y	37	3872	Y	37	3880	Y	37	3880	Y	37	3881	Y	37	3882	Y
36	3938	Y	36	3836	Y	36	3839	Y	36	3839	Y	36	3840	Y	36	3842	Y
35	4155	Y	35	4156	Y	35	4156	Y	35	4157	Y	35	4158	Y	35	4159	Y
34	4242	Y	34	4243	Y	34	4242	Y	34	4244	Y	34	4245	Y	34	4246	Y
33	4207	Y	33	4207	Y	33	4208	Y	33	4208	Y	33	4210	Y	33	4211	Y
32	4158	Y	32	4158	Y	32	4159	Y	32	4208	Y	32	4209	Y	32	4209	Y
31	4115	Y	31	4114	Y	31	4116	Y	31	4200	Y	31	4117	Y	31	4119	Y
30	3962	Y	30	3962	Y	30	3963	Y	30	4116	Y	30	3984	Y	30	3986	Y
29	***	Y	29	***	Y	29	***	Y	29	3963	Y	29	***	Y	29	***	Y
28	***	Y	28	***	Y	28	***	Y	28	***	Y	28	***	Y	28	***	Y
27	***	Y	27	***	Y	27	***	Y	27	***	Y	27	***	Y	27	***	Y
26	2672	Y	26	2672	Y	26	2674	Y	26	2674	Y	26	2675	Y	26	2677	Y
25	2690	Y	25	2692	Y	25	2694	Y	25	2696	Y	25	2697	Y	25	2700	Y
24	2575	Y	24	2577	Y	24	2579	Y	24	2581	Y	24	2583	Y	24	2585	Y
23	2402	Y	23	2403	Y	23	2405	Y	23	2407	Y	23	2408	Y	23	2410	Y
22	3697	Y	22	3700	Y	22	3702	Y	22	3704	Y	22	3707	Y	22	3710	Y
21	3595	Y	21	3598	Y	21	3601	Y	21	3604	Y	21	3607	Y	21	3610	Y
20	3460	Y	20	3462	Y	20	3465	Y	20	3468	Y	20	3471	Y	20	3474	Y
19	3317	Y	19	3320	Y	19	3323	Y	19	3326	Y	19	3329	Y	19	3333	Y
18	3796	Y	18	3802	Y	18	3804	Y	18	3810	Y	18	3810	Y	18	3812	Y
17	3645	Y	17	3646	Y	17	3651	Y	17	3654	Y	17	3657	Y	17	3661	Y
16	3495	Y	16	3498	Y	16	3501	Y	16	3503	Y	16	3507	Y	16	3510	Y
15	3365	Y	15	3368	Y	15	3371	Y	15	3375	Y	15	3378	Y	15	3381	Y
14	3723	Y	14	3726	Y	14	3729	Y	14	3735	Y	14	3739	Y	14	3739	Y
13	3671	Y	13	3674	Y	13	3678	Y	13	3732	Y	13	3644	Y	13	3648	Y
12	3431	Y	12	3434	Y	12	3438	Y	12	3641	Y	12	3644	Y	12	3648	Y
11	3191	Y	11	3194	Y	11	3196	Y	11	3641	Y	11	3202	Y	11	3206	Y
10	3058	Y	10	3059	Y	10	3061	Y	10	3199	Y	10	3065	Y	10	3065	Y
9	2937	Y	9	2939	Y	9	2940	Y	9	3062	Y	9	2944	Y	9	2946	Y
8	2764	Y	8	2764	Y	8	2767	Y	8	2769	Y	8	2771	Y	8	2773	Y
7	2372	Y	7	2374	Y	7	2375	Y	7	2377	Y	7	2378	Y	7	2381	Y
6	3826	Y	6	3828	Y	6	3827	Y	6	3827	Y	6	3828	Y	6	3828	Y
5	4405	Y	5	4405	Y	5	4404	Y	5	4404	Y	5	4405	Y	5	4408	Y
4	4477	Y	4	4473	Y	4	4473	Y	4	4473	Y	4	4473	Y	4	4473	Y
3	4501	Y	3	4501	Y	3	4500	Y	3	4500	Y	3	4501	Y	3	4501	Y
2	4456	Y	2	4456	Y	2	4457	Y	2	4457	Y	2	4458	Y	2	4458	Y
1	4315	Y	1	4315	Y	1	4316	Y	1	4316	Y	1	4316	Y	1	4316	Y
0	4161	Y	0	4163	Y	0	4162	Y	0	4162	Y	0	4162	Y	0	4162	Y

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RUN NO. 13 T/C'S 1-50

D-31

43	4420	Y	48	4420	Y	49	4421	Y	49	4420	Y	49	4420	Y	49	4420	Y
46	4905	Y	46	4905	Y	43	4905	Y	48	4907	Y	48	4907	Y	48	4907	Y
47	4050	Y	47	4050	Y	47	4050	Y	47	4050	Y	47	4050	Y	47	4050	Y
46	4050	Y	46	4050	Y	46	4050	Y	46	4050	Y	46	4050	Y	46	4050	Y
45	4763	Y	45	4763	Y	45	4763	Y	45	4763	Y	45	4763	Y	45	4763	Y
44	4055	Y	44	4055	Y	44	4055	Y	44	4055	Y	44	4055	Y	44	4055	Y
43	3483	Y	43	3483	Y	43	3483	Y	43	3483	Y	43	3483	Y	43	3483	Y
42	4051	Y	42	4051	Y	42	4051	Y	42	4051	Y	42	4051	Y	42	4051	Y
41	5106	Y	41	5106	Y	41	5106	Y	41	5106	Y	41	5106	Y	41	5106	Y
40	4960	Y	40	4960	Y	40	4960	Y	40	4960	Y	40	4960	Y	40	4960	Y
39	4626	Y	39	4626	Y	39	4626	Y	39	4626	Y	39	4626	Y	39	4626	Y
38	4626	Y	38	4626	Y	38	4626	Y	38	4626	Y	38	4626	Y	38	4626	Y
37	4685	Y	37	4685	Y	37	4685	Y	37	4685	Y	37	4685	Y	37	4685	Y
36	5011	Y	36	5011	Y	36	5011	Y	36	5011	Y	36	5011	Y	36	5011	Y
35	4718	Y	35	4718	Y	35	4718	Y	35	4718	Y	35	4718	Y	35	4718	Y
34	5068	Y	34	5068	Y	34	5068	Y	34	5068	Y	34	5068	Y	34	5068	Y
33	652	Y	33	652	Y	33	652	Y	33	652	Y	33	652	Y	33	652	Y
32	5238	Y	32	5238	Y	32	5238	Y	32	5238	Y	32	5238	Y	32	5238	Y
31	5187	Y	31	5187	Y	31	5187	Y	31	5187	Y	31	5187	Y	31	5187	Y
30	4907	Y	30	4907	Y	30	4907	Y	30	4907	Y	30	4907	Y	30	4907	Y
29	3286	Y	29	3286	Y	29	3286	Y	29	3286	Y	29	3286	Y	29	3286	Y
28	4516	Y	28	4516	Y	28	4516	Y	28	4516	Y	28	4516	Y	28	4516	Y
27	4843	Y	27	4843	Y	27	4843	Y	27	4843	Y	27	4843	Y	27	4843	Y
26	4525	Y	26	4525	Y	26	4525	Y	26	4525	Y	26	4525	Y	26	4525	Y
25	4106	Y	25	4106	Y	25	4106	Y	25	4106	Y	25	4106	Y	25	4106	Y
24	3562	Y	24	3562	Y	24	3562	Y	24	3562	Y	24	3562	Y	24	3562	Y
23	4885	Y	23	4885	Y	23	4885	Y	23	4885	Y	23	4885	Y	23	4885	Y
22	3329	Y	22	3329	Y	22	3329	Y	22	3329	Y	22	3329	Y	22	3329	Y
21	4562	Y	21	4562	Y	21	4562	Y	21	4562	Y	21	4562	Y	21	4562	Y
20	3577	Y	20	3577	Y	20	3577	Y	20	3577	Y	20	3577	Y	20	3577	Y
19	4745	Y	19	4745	Y	19	4745	Y	19	4745	Y	19	4745	Y	19	4745	Y
18	5003	Y	18	5003	Y	18	5003	Y	18	5003	Y	18	5003	Y	18	5003	Y
17	4668	Y	17	4668	Y	17	4668	Y	17	4668	Y	17	4668	Y	17	4668	Y
16	4908	Y	16	4908	Y	16	4908	Y	16	4908	Y	16	4908	Y	16	4908	Y
15	4832	Y	15	4832	Y	15	4832	Y	15	4832	Y	15	4832	Y	15	4832	Y
14	5053	Y	14	5053	Y	14	5053	Y	14	5053	Y	14	5053	Y	14	5053	Y
13	4969	Y	13	4969	Y	13	4969	Y	13	4969	Y	13	4969	Y	13	4969	Y
12	4716	Y	12	4716	Y	12	4716	Y	12	4716	Y	12	4716	Y	12	4716	Y
11	5107	Y	11	5107	Y	11	5107	Y	11	5107	Y	11	5107	Y	11	5107	Y
10	4663	Y	10	4663	Y	10	4663	Y	10	4663	Y	10	4663	Y	10	4663	Y
9	4646	Y	9	4646	Y	9	4646	Y	9	4646	Y	9	4646	Y	9	4646	Y
8	4173	Y	8	4173	Y	8	4173	Y	8	4173	Y	8	4173	Y	8	4173	Y
7	3325	Y	7	3325	Y	7	3325	Y	7	3325	Y	7	3325	Y	7	3325	Y
6	4361	Y	6	4361	Y	6	4361	Y	6	4361	Y	6	4361	Y	6	4361	Y
5	4630	Y	5	4630	Y	5	4630	Y	5	4630	Y	5	4630	Y	5	4630	Y
4	4545	Y	4	4545	Y	4	4545	Y	4	4545	Y	4	4545	Y	4	4545	Y
3	4306	Y	3	4306	Y	3	4306	Y	3	4306	Y	3	4306	Y	3	4306	Y
2	4005	Y	2	4005	Y	2	4005	Y	2	4005	Y	2	4005	Y	2	4005	Y
1	2905	Y	1	2905	Y	1	2905	Y	1	2905	Y	1	2905	Y	1	2905	Y
0	2905	Y	0	2905	Y	0	2905	Y	0	2905	Y	0	2905	Y	0	2905	Y

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0-32

49 3801 Y
48 3952 Y
47 3052 Y
46 3052 Y
45 3206 Y
44 3052 Y
43 3610 Y
42 3960 Y
41 4041 Y
40 4049 Y
39 3945 Y
38 3626 Y
37 3228 Y
36 3750 Y
35 3961 Y
34 4046 Y
33 4041 Y
32 3945 Y
31 3626 Y
30 3246 Y
29 3052 Y
28 3052 Y
27 3052 Y
26 2465 Y
25 2502 Y
24 2483 Y
23 2501 Y
22 3364 Y
21 3365 Y
20 3334 Y
19 3413 Y
18 3430 Y
17 3461 Y
16 3518 Y
15 3486 Y
14 3269 Y
13 3260 Y
12 3139 Y
11 3259 Y
10 1660 Y
9 1820 Y
8 1822 Y
7 1801 Y
6 4264 Y
5 4462 Y
4 4511 Y
3 4466 Y
2 4266 Y
1 3949 Y
0 3052 Y

49 3730 Y
48 3949 Y
47 3052 Y
46 3948 Y
45 3963 Y
44 3052 Y
43 3807 Y
42 3961 Y
41 4040 Y
40 4047 Y
39 3745 Y
38 3623 Y
37 3225 Y
36 3780 Y
35 3954 Y
34 4044 Y
33 4007 Y
32 3943 Y
31 3623 Y
30 3284 Y
29 3052 Y
28 3052 Y
27 3052 Y
26 2469 Y
25 2507 Y
24 2485 Y
23 2507 Y
22 3355 Y
21 3363 Y
20 3383 Y
19 3405 Y
18 3482 Y
17 3456 Y
16 3516 Y
15 3480 Y
14 3263 Y
13 3254 Y
12 3251 Y
11 3251 Y
10 1859 Y
9 1816 Y
8 1820 Y
7 1800 Y
6 4264 Y
5 4461 Y
4 4510 Y
3 4466 Y
2 4265 Y
1 3949 Y
0 3406 Y

49 3735 Y
48 3946 Y
47 3052 Y
46 3844 Y
45 3961 Y
44 3052 Y
43 3800 Y
42 3955 Y
41 4076 Y
40 4044 Y
39 3942 Y
38 3621 Y
37 3223 Y
36 3785 Y
35 3954 Y
34 4052 Y
33 4005 Y
32 3943 Y
31 3620 Y
30 3281 Y
29 3052 Y
28 3052 Y
27 3052 Y
26 2468 Y
25 2502 Y
24 2479 Y
23 2498 Y
22 3353 Y
21 3356 Y
20 3389 Y
19 3339 Y
18 3475 Y
17 3489 Y
16 3508 Y
15 3482 Y
14 3254 Y
13 3256 Y
12 3253 Y
11 3252 Y
10 1857 Y
9 1816 Y
8 1816 Y
7 1738 Y
6 4263 Y
5 4460 Y
4 4529 Y
3 4465 Y
2 4269 Y
1 3947 Y
0 3405 Y

49 3732 Y
48 3944 Y
47 3052 Y
46 3844 Y
45 3955 Y
44 3052 Y
43 3807 Y
42 3953 Y
41 4071 Y
40 4041 Y
39 3939 Y
38 3667 Y
37 3220 Y
36 3726 Y
35 3949 Y
34 4039 Y
33 4003 Y
32 3939 Y
31 3667 Y
30 3274 Y
29 3052 Y
28 3052 Y
27 3052 Y
26 2464 Y
25 2497 Y
24 2426 Y
23 2498 Y
22 3344 Y
21 3349 Y
20 3383 Y
19 3389 Y
18 3470 Y
17 3442 Y
16 3489 Y
15 3476 Y
14 3247 Y
13 3236 Y
12 3235 Y
11 3234 Y
10 1855 Y
9 1814 Y
8 1816 Y
7 1736 Y
6 4263 Y
5 4459 Y
4 4529 Y
3 4465 Y
2 4241 Y
1 3946 Y
0 3403 Y

49 3784 Y
48 3941 Y
47 3052 Y
46 3849 Y
45 3955 Y
44 3052 Y
43 3810 Y
42 3954 Y
41 4071 Y
40 4006 Y
39 3936 Y
38 3664 Y
37 3266 Y
36 3723 Y
35 3949 Y
34 4036 Y
33 3956 Y
32 3934 Y
31 3663 Y
30 3274 Y
29 3052 Y
28 3052 Y
27 3052 Y
26 2459 Y
25 2437 Y
24 2470 Y
23 2495 Y
22 3340 Y
21 3346 Y
20 3376 Y
19 3383 Y
18 3463 Y
17 3435 Y
16 3484 Y
15 3470 Y
14 3239 Y
13 3230 Y
12 3226 Y
11 3226 Y
10 1853 Y
9 1812 Y
8 1814 Y
7 1734 Y
6 4262 Y
5 4459 Y
4 4526 Y
3 4463 Y
2 4266 Y
1 3944 Y
0 3402 Y

49 3784 Y
48 3937 Y
47 3052 Y
46 3847 Y
45 3953 Y
44 3052 Y
43 3810 Y
42 3958 Y
41 4070 Y
40 4006 Y
39 3934 Y
38 3661 Y
37 3243 Y
36 3722 Y
35 3945 Y
34 4051 Y
33 3936 Y
32 3932 Y
31 3661 Y
30 3270 Y
29 3052 Y
28 3052 Y
27 3052 Y
26 2457 Y
25 2466 Y
24 2467 Y
23 2491 Y
22 3330 Y
21 3340 Y
20 3376 Y
19 3382 Y
18 3436 Y
17 3430 Y
16 3489 Y
15 3464 Y
14 3231 Y
13 3225 Y
12 3219 Y
11 3219 Y
10 1820 Y
9 1810 Y
8 1813 Y
7 1732 Y
6 4265 Y
5 4457 Y
4 4527 Y
3 4463 Y
2 4265 Y
1 3943 Y
0 3461 Y

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D-33

49	4262	Y	49	4261	Y	49	4261	Y	49	4256	Y	49	4257	Y
48	5467	Y	48	5467	Y	48	5467	Y	48	5465	Y	48	5464	Y
47	5465	Y	47	5465	Y	47	5465	Y	47	5465	Y	47	5464	Y
46	5460	Y	46	5460	Y	46	5460	Y	46	5460	Y	46	5460	Y
45	5260	Y	45	5259	Y	45	5259	Y	45	5256	Y	45	5256	Y
44	4783	Y	44	4782	Y	44	4782	Y	44	4779	Y	44	4779	Y
43	4282	Y	43	4281	Y	43	4281	Y	43	4279	Y	43	4279	Y
42	4345	Y	42	4344	Y	42	4344	Y	42	4341	Y	42	4341	Y
41	5465	Y	41	5464	Y	41	5464	Y	41	5463	Y	41	5463	Y
40	5409	Y	40	5408	Y	40	5408	Y	40	5405	Y	40	5405	Y
39	5345	Y	39	5346	Y	39	5346	Y	39	5345	Y	39	5344	Y
38	5216	Y	38	5216	Y	38	5216	Y	38	5213	Y	38	5213	Y
37	4490	Y	37	4488	Y	37	4488	Y	37	4484	Y	37	4484	Y
36	5460	Y	36	5459	Y	36	5459	Y	36	5457	Y	36	5456	Y
35	5285	Y	35	5285	Y	35	5285	Y	35	5282	Y	35	5282	Y
34	4513	Y	34	4512	Y	34	4512	Y	34	4509	Y	34	4509	Y
33	607	Y	33	618	Y	33	626	Y	33	640	Y	33	629	Y
32	5680	Y	32	5679	Y	32	5678	Y	32	5678	Y	32	5676	Y
31	5682	Y	31	5681	Y	31	5680	Y	31	5680	Y	31	5680	Y
30	5497	Y	30	5497	Y	30	5496	Y	30	5496	Y	30	5496	Y
29	4461	Y	29	4462	Y	29	4461	Y	29	4460	Y	29	4460	Y
28	4243	Y	28	4244	Y	28	4243	Y	28	4240	Y	28	4240	Y
27	5277	Y	27	5277	Y	27	5276	Y	27	5273	Y	27	5273	Y
26	5109	Y	26	5109	Y	26	5107	Y	26	5104	Y	26	5104	Y
25	4874	Y	25	4874	Y	25	4873	Y	25	4871	Y	25	4871	Y
24	4366	Y	24	4366	Y	24	4365	Y	24	4363	Y	24	4363	Y
23	5462	Y	23	5462	Y	23	5461	Y	23	5458	Y	23	5458	Y
22	4523	Y	22	4523	Y	22	4522	Y	22	4522	Y	22	4521	Y
21	5173	Y	21	5173	Y	21	5171	Y	21	5170	Y	21	5170	Y
20	4607	Y	20	4607	Y	20	4606	Y	20	4606	Y	20	4606	Y
19	4372	Y	19	4373	Y	19	4372	Y	19	4366	Y	19	4367	Y
18	5414	Y	18	5414	Y	18	5413	Y	18	5410	Y	18	5410	Y
17	5228	Y	17	5228	Y	17	5227	Y	17	5225	Y	17	5224	Y
16	4484	Y	16	4484	Y	16	4483	Y	16	4481	Y	16	4480	Y
15	5469	Y	15	5469	Y	15	5467	Y	15	5467	Y	15	5467	Y
14	5486	Y	14	5485	Y	14	5485	Y	14	5483	Y	14	5483	Y
13	5457	Y	13	5457	Y	13	5457	Y	13	5456	Y	13	5456	Y
12	5287	Y	12	5287	Y	12	5287	Y	12	5285	Y	12	5285	Y
11	5516	Y	11	5515	Y	11	5515	Y	11	5514	Y	11	5514	Y
10	5448	Y	10	5448	Y	10	5448	Y	10	5446	Y	10	5446	Y
9	5273	Y	9	5273	Y	9	5273	Y	9	5271	Y	9	5270	Y
8	4976	Y	8	4976	Y	8	4976	Y	8	4973	Y	8	4972	Y
7	4161	Y	7	4161	Y	7	4160	Y	7	4159	Y	7	4159	Y
6	4057	Y	6	4056	Y	6	4056	Y	6	4052	Y	6	4052	Y
5	5024	Y	5	5024	Y	5	5024	Y	5	5023	Y	5	5023	Y
4	5067	Y	4	5066	Y	4	5065	Y	4	5063	Y	4	5063	Y
3	4991	Y	3	4991	Y	3	4991	Y	3	5003	Y	3	5004	Y
2	4605	Y	2	4605	Y	2	4605	Y	2	4605	Y	2	4609	Y
1	4585	Y	1	4585	Y	1	4584	Y	1	4582	Y	1	4582	Y
0	3511	Y	0	3510	Y	0	3510	Y	0	3506	Y	0	3508	Y

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RUN NO. 14 T/C's 51-100

D-34

49	3711	Y
48	4234	Y
47	3817	Y
46	3817	Y
45	4321	Y
44	3809	Y
43	4215	Y
42	4400	Y
41	4327	Y
40	4289	Y
39	4049	Y
38	3677	Y
37	604	Y
36	4165	Y
35	4382	Y
34	4331	Y
33	4297	Y
32	4038	Y
31	3610	Y
30	3610	Y
29	2162	Y
28	2209	Y
27	2182	Y
26	2182	Y
25	2182	Y
24	2182	Y
23	3232	Y
22	3243	Y
21	3288	Y
20	3311	Y
19	3407	Y
18	3345	Y
17	3473	Y
16	3431	Y
15	3179	Y
14	3170	Y
13	3171	Y
12	3176	Y
11	1706	Y
10	1674	Y
9	1678	Y
8	1665	Y
7	4130	Y
6	4917	Y
5	4931	Y
4	4926	Y
3	4786	Y
2	4567	Y
1	4168	Y
0		

49	3711	Y
48	4234	Y
47	3817	Y
46	3817	Y
45	4321	Y
44	3809	Y
43	4215	Y
42	4400	Y
41	4327	Y
40	4289	Y
39	4049	Y
38	3677	Y
37	604	Y
36	4165	Y
35	4382	Y
34	4331	Y
33	4297	Y
32	4038	Y
31	3610	Y
30	3610	Y
29	2162	Y
28	2209	Y
27	2182	Y
26	2182	Y
25	2182	Y
24	2182	Y
23	3232	Y
22	3243	Y
21	3288	Y
20	3311	Y
19	3407	Y
18	3345	Y
17	3473	Y
16	3431	Y
15	3179	Y
14	3170	Y
13	3171	Y
12	3176	Y
11	1706	Y
10	1674	Y
9	1678	Y
8	1665	Y
7	4130	Y
6	4917	Y
5	4931	Y
4	4926	Y
3	4786	Y
2	4567	Y
1	4168	Y
0		

49	3711	Y
48	4234	Y
47	3817	Y
46	3817	Y
45	4321	Y
44	3809	Y
43	4215	Y
42	4400	Y
41	4327	Y
40	4289	Y
39	4049	Y
38	3677	Y
37	604	Y
36	4165	Y
35	4382	Y
34	4331	Y
33	4297	Y
32	4038	Y
31	3610	Y
30	3610	Y
29	2162	Y
28	2209	Y
27	2182	Y
26	2182	Y
25	2182	Y
24	2182	Y
23	3232	Y
22	3243	Y
21	3288	Y
20	3311	Y
19	3407	Y
18	3345	Y
17	3473	Y
16	3431	Y
15	3179	Y
14	3170	Y
13	3171	Y
12	3176	Y
11	1706	Y
10	1674	Y
9	1678	Y
8	1665	Y
7	4130	Y
6	4917	Y
5	4931	Y
4	4926	Y
3	4786	Y
2	4567	Y
1	4168	Y
0		

49	3711	Y
48	4234	Y
47	3817	Y
46	3817	Y
45	4321	Y
44	3809	Y
43	4215	Y
42	4400	Y
41	4327	Y
40	4289	Y
39	4049	Y
38	3677	Y
37	604	Y
36	4165	Y
35	4382	Y
34	4331	Y
33	4297	Y
32	4038	Y
31	3610	Y
30	3610	Y
29	2162	Y
28	2209	Y
27	2182	Y
26	2182	Y
25	2182	Y
24	2182	Y
23	3232	Y
22	3243	Y
21	3288	Y
20	3311	Y
19	3407	Y
18	3345	Y
17	3473	Y
16	3431	Y
15	3179	Y
14	3170	Y
13	3171	Y
12	3176	Y
11	1706	Y
10	1674	Y
9	1678	Y
8	1665	Y
7	4130	Y
6	4917	Y
5	4931	Y
4	4926	Y
3	4786	Y
2	4567	Y
1	4168	Y
0		

49	3711	Y
48	4234	Y
47	3817	Y
46	3817	Y
45	4321	Y
44	3809	Y
43	4215	Y
42	4400	Y
41	4327	Y
40	4289	Y
39	4049	Y
38	3677	Y
37	604	Y
36	4165	Y
35	4382	Y
34	4331	Y
33	4297	Y
32	4038	Y
31	3610	Y
30	3610	Y
29	2162	Y
28	2209	Y
27	2182	Y
26	2182	Y
25	2182	Y
24	2182	Y
23	3232	Y
22	3243	Y
21	3288	Y
20	3311	Y
19	3407	Y
18	3345	Y
17	3473	Y
16	3431	Y
15	3179	Y
14	3170	Y
13	3171	Y
12	3176	Y
11	1706	Y
10	1674	Y
9	1678	Y
8	1665	Y
7	4130	Y
6	4917	Y
5	4931	Y
4	4926	Y
3	4786	Y
2	4567	Y
1	4168	Y
0		

49	3711	Y
48	4234	Y
47	3817	Y
46	3817	Y
45	4321	Y
44	3809	Y
43	4215	Y
42	4400	Y
41	4327	Y
40	4289	Y
39	4049	Y
38	3677	Y
37	604	Y
36	4165	Y
35	4382	Y
34	4331	Y
33	4297	Y
32	4038	Y
31	3610	Y
30	3610	Y
29	2162	Y
28	2209	Y
27	2182	Y
26	2182	Y
25	2182	Y
24	2182	Y
23	3232	Y
22	3243	Y
21	3288	Y
20	3311	Y
19	3407	Y
18	3345	Y
17	3473	Y
16	3431	Y
15	3179	Y
14	3170	Y
13	3171	Y
12	3176	Y
11	1706	Y
10	1674	Y
9	1678	Y
8	1665	Y
7	4130	Y
6	4917	Y
5	4931	Y
4	4926	Y
3	4786	Y
2	4567	Y
1	4168	Y
0		

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RUN NO. 15 T/C'S 1-50

D-35

49	3836	Y	49	3837	Y	49	3837	Y	49	3837	Y	49	3837	Y
48	4662	Y	48	4663	Y	48	4664	Y	48	4665	Y	48	4666	Y
47	4580	Y	47	4581	Y	47	4582	Y	47	4583	Y	47	4584	Y
46	4453	Y	46	4454	Y	46	4455	Y	46	4456	Y	46	4457	Y
45	4432	Y	45	4433	Y	45	4434	Y	45	4435	Y	45	4436	Y
44	4128	Y	44	4129	Y	44	4130	Y	44	4131	Y	44	4132	Y
43	3753	Y	43	3754	Y	43	3755	Y	43	3756	Y	43	3757	Y
42	3363	Y	42	3364	Y	42	3365	Y	42	3366	Y	42	3367	Y
41	4680	Y	41	4681	Y	41	4682	Y	41	4683	Y	41	4684	Y
40	4575	Y	40	4576	Y	40	4577	Y	40	4578	Y	40	4579	Y
39	4664	Y	39	4665	Y	39	4666	Y	39	4667	Y	39	4668	Y
38	4484	Y	38	4485	Y	38	4486	Y	38	4487	Y	38	4488	Y
37	4038	Y	37	4039	Y	37	4040	Y	37	4041	Y	37	4042	Y
36	4600	Y	36	4601	Y	36	4602	Y	36	4603	Y	36	4604	Y
35	4564	Y	35	4565	Y	35	4566	Y	35	4567	Y	35	4568	Y
34	4082	Y	34	4083	Y	34	4084	Y	34	4085	Y	34	4086	Y
33	637	Y	33	638	Y	33	639	Y	33	640	Y	33	641	Y
32	4753	Y	32	4754	Y	32	4755	Y	32	4756	Y	32	4757	Y
31	4832	Y	31	4833	Y	31	4834	Y	31	4835	Y	31	4836	Y
30	4665	Y	30	4666	Y	30	4667	Y	30	4668	Y	30	4669	Y
29	3765	Y	29	3766	Y	29	3767	Y	29	3768	Y	29	3769	Y
28	4425	Y	28	4426	Y	28	4427	Y	28	4428	Y	28	4429	Y
27	4402	Y	27	4403	Y	27	4404	Y	27	4405	Y	27	4406	Y
26	4162	Y	26	4163	Y	26	4164	Y	26	4165	Y	26	4166	Y
25	3808	Y	25	3809	Y	25	3810	Y	25	3811	Y	25	3812	Y
24	4664	Y	24	4665	Y	24	4666	Y	24	4667	Y	24	4668	Y
23	3838	Y	23	3839	Y	23	3840	Y	23	3841	Y	23	3842	Y
22	4425	Y	22	4426	Y	22	4427	Y	22	4428	Y	22	4429	Y
21	3906	Y	21	3907	Y	21	3908	Y	21	3909	Y	21	3910	Y
20	3939	Y	20	3940	Y	20	3941	Y	20	3942	Y	20	3943	Y
19	4573	Y	19	4574	Y	19	4575	Y	19	4576	Y	19	4577	Y
18	4470	Y	18	4471	Y	18	4472	Y	18	4473	Y	18	4474	Y
17	3974	Y	17	3975	Y	17	3976	Y	17	3977	Y	17	3978	Y
16	4638	Y	16	4639	Y	16	4640	Y	16	4641	Y	16	4642	Y
15	4580	Y	15	4581	Y	15	4582	Y	15	4583	Y	15	4584	Y
14	4664	Y	14	4665	Y	14	4666	Y	14	4667	Y	14	4668	Y
13	4509	Y	13	4510	Y	13	4511	Y	13	4512	Y	13	4513	Y
12	4665	Y	12	4666	Y	12	4667	Y	12	4668	Y	12	4669	Y
11	4665	Y	11	4666	Y	11	4667	Y	11	4668	Y	11	4669	Y
10	4559	Y	10	4560	Y	10	4561	Y	10	4562	Y	10	4563	Y
9	4468	Y	9	4469	Y	9	4470	Y	9	4471	Y	9	4472	Y
8	4189	Y	8	4190	Y	8	4191	Y	8	4192	Y	8	4193	Y
7	3619	Y	7	3620	Y	7	3621	Y	7	3622	Y	7	3623	Y
6	3644	Y	6	3645	Y	6	3646	Y	6	3647	Y	6	3648	Y
5	4246	Y	5	4247	Y	5	4248	Y	5	4249	Y	5	4250	Y
4	4286	Y	4	4287	Y	4	4288	Y	4	4289	Y	4	4290	Y
3	4289	Y	3	4290	Y	3	4291	Y	3	4292	Y	3	4293	Y
2	4175	Y	2	4176	Y	2	4177	Y	2	4178	Y	2	4179	Y
1	4062	Y	1	4063	Y	1	4064	Y	1	4065	Y	1	4066	Y
0	3139	Y	0	3140	Y	0	3141	Y	0	3142	Y	0	3143	Y

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RUN NO. 15 T/C's 51-100

D-36

49	3528	Y
48	4023	Y
47	3744	Y
46	4035	Y
45	3703	Y
44	3939	Y
43	4064	Y
42	4039	Y
41	4020	Y
40	3830	Y
39	3493	Y
38	3509	Y
37	3847	Y
36	4036	Y
35	4015	Y
34	4016	Y
33	3826	Y
32	3430	Y
31	3430	Y
30	3430	Y
29	3430	Y
28	3430	Y
27	3430	Y
26	3430	Y
25	2416	Y
24	2332	Y
23	2367	Y
22	3270	Y
21	3306	Y
20	3385	Y
19	3428	Y
18	3463	Y
17	3498	Y
16	3542	Y
15	3536	Y
14	3585	Y
13	3576	Y
12	3578	Y
11	3575	Y
10	1772	Y
9	1755	Y
8	1751	Y
7	1746	Y
6	1732	Y
5	4232	Y
4	4273	Y
3	4289	Y
2	4142	Y
1	4022	Y
0	3646	Y

49	3528	Y
48	4023	Y
47	3744	Y
46	4035	Y
45	3703	Y
44	3939	Y
43	4064	Y
42	4039	Y
41	4020	Y
40	3830	Y
39	3493	Y
38	3509	Y
37	3847	Y
36	4036	Y
35	4015	Y
34	4016	Y
33	3826	Y
32	3430	Y
31	3430	Y
30	3430	Y
29	3430	Y
28	3430	Y
27	3430	Y
26	3430	Y
25	2416	Y
24	2332	Y
23	2367	Y
22	3270	Y
21	3306	Y
20	3384	Y
19	3421	Y
18	3461	Y
17	3493	Y
16	3537	Y
15	3531	Y
14	3579	Y
13	3572	Y
12	3572	Y
11	3568	Y
10	1772	Y
9	1754	Y
8	1751	Y
7	1747	Y
6	3632	Y
5	4232	Y
4	4273	Y
3	4289	Y
2	4182	Y
1	4022	Y
0	3646	Y

49	3515	Y
48	4022	Y
47	3744	Y
46	3736	Y
45	4034	Y
44	3704	Y
43	3934	Y
42	4063	Y
41	4037	Y
40	4020	Y
39	3828	Y
38	3431	Y
37	3513	Y
36	3842	Y
35	4037	Y
34	4017	Y
33	4017	Y
32	4017	Y
31	3824	Y
30	3486	Y
29	3486	Y
28	3486	Y
27	3486	Y
26	2374	Y
25	2419	Y
24	2389	Y
23	2365	Y
22	3252	Y
21	3223	Y
20	3375	Y
19	3417	Y
18	3457	Y
17	3477	Y
16	3510	Y
15	3526	Y
14	3573	Y
13	3566	Y
12	3565	Y
11	3561	Y
10	1771	Y
9	1753	Y
8	1750	Y
7	1746	Y
6	3632	Y
5	4233	Y
4	4274	Y
3	4289	Y
2	4193	Y
1	4022	Y
0	3646	Y

49	3521	Y
48	4020	Y
47	3745	Y
46	3735	Y
45	4032	Y
44	3705	Y
43	3940	Y
42	4063	Y
41	4036	Y
40	4017	Y
39	3826	Y
38	3448	Y
37	3507	Y
36	3840	Y
35	4030	Y
34	4010	Y
33	4010	Y
32	4010	Y
31	3819	Y
30	3481	Y
29	3481	Y
28	3481	Y
27	3481	Y
26	2366	Y
25	2410	Y
24	2381	Y
23	2360	Y
22	3245	Y
21	3240	Y
20	3371	Y
19	3412	Y
18	3449	Y
17	3472	Y
16	3536	Y
15	3520	Y
14	3566	Y
13	3558	Y
12	3558	Y
11	3553	Y
10	1769	Y
9	1752	Y
8	1749	Y
7	1745	Y
6	3631	Y
5	4232	Y
4	4273	Y
3	4249	Y
2	4192	Y
1	4022	Y
0	3646	Y

49	3519	Y
48	4019	Y
47	3745	Y
46	3730	Y
45	4031	Y
44	3706	Y
43	3944	Y
42	4066	Y
41	4035	Y
40	4015	Y
39	3824	Y
38	3446	Y
37	3510	Y
36	3840	Y
35	4033	Y
34	4010	Y
33	4010	Y
32	4010	Y
31	3819	Y
30	3481	Y
29	3481	Y
28	3481	Y
27	3481	Y
26	2365	Y
25	2420	Y
24	2383	Y
23	2360	Y
22	3244	Y
21	3245	Y
20	3366	Y
19	3406	Y
18	3445	Y
17	3465	Y
16	3522	Y
15	3513	Y
14	3556	Y
13	3551	Y
12	3550	Y
11	3545	Y
10	1766	Y
9	1751	Y
8	1747	Y
7	1744	Y
6	3630	Y
5	4252	Y
4	4273	Y
3	4239	Y
2	4191	Y
1	4022	Y
0	3645	Y

49	3513	Y
48	4016	Y
47	3739	Y
46	3739	Y
45	4026	Y
44	3706	Y
43	3946	Y
42	4067	Y
41	4033	Y
40	4013	Y
39	3821	Y
38	3444	Y
37	3501	Y
36	3844	Y
35	4026	Y
34	4005	Y
33	4005	Y
32	4005	Y
31	3817	Y
30	3481	Y
29	3481	Y
28	3481	Y
27	3481	Y
26	2416	Y
25	2366	Y
24	2367	Y
23	2367	Y
22	3249	Y
21	3245	Y
20	3363	Y
19	3431	Y
18	3435	Y
17	3459	Y
16	3517	Y
15	3505	Y
14	3550	Y
13	3543	Y
12	3541	Y
11	3536	Y
10	1766	Y
9	1749	Y
8	1747	Y
7	1742	Y
6	3630	Y
5	4243	Y
4	4273	Y
3	4230	Y
2	4150	Y
1	4021	Y
0	3645	Y

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RUN NO. 16 T/C's 1-50

D-37

49	3421	Y	49	3420	Y	49	3421	Y	49	3420	Y	49	3420	Y
48	3527	Y	48	3526	Y	48	3526	Y	48	3526	Y	48	3526	Y
47	3421	Y	47	3421	Y	47	3421	Y	47	3421	Y	47	3421	Y
46	4021	Y	46	4021	Y	46	4021	Y	46	4021	Y	46	4021	Y
45	3925	Y	45	3924	Y	45	3924	Y	45	3925	Y	45	3925	Y
44	3747	Y	44	3746	Y	44	3747	Y	44	3747	Y	44	3747	Y
43	3421	Y	43	3420	Y	43	3420	Y	43	3420	Y	43	3420	Y
42	3520	Y	42	3519	Y	42	3520	Y	42	3521	Y	42	3522	Y
41	3927	Y	41	3928	Y	41	3927	Y	41	3926	Y	41	3926	Y
40	3926	Y	40	3927	Y	40	3925	Y	40	3925	Y	40	3925	Y
39	4023	Y	39	4023	Y	39	4023	Y	39	4023	Y	39	4023	Y
38	3926	Y	38	3926	Y	38	3927	Y	38	3927	Y	38	3927	Y
37	3523	Y	37	3523	Y	37	3522	Y	37	3521	Y	37	3522	Y
36	4022	Y	36	4022	Y	36	4022	Y	36	4020	Y	36	4021	Y
35	4024	Y	35	4023	Y	35	4023	Y	35	4022	Y	35	4022	Y
34	3520	Y	34	3520	Y	34	3520	Y	34	3520	Y	34	3520	Y
33	645	Y	33	645	Y	33	645	Y	33	645	Y	33	645	Y
32	4027	Y	32	4027	Y	32	4026	Y	32	4024	Y	32	4025	Y
31	4160	Y	31	4160	Y	31	4160	Y	31	4157	Y	31	4157	Y
30	4021	Y	30	4021	Y	30	4020	Y	30	4018	Y	30	4020	Y
29	3327	Y	29	3327	Y	29	3326	Y	29	3324	Y	29	3325	Y
28	3428	Y	28	3429	Y	28	3420	Y	28	3426	Y	28	3427	Y
27	3926	Y	27	3926	Y	27	3927	Y	27	3925	Y	27	3925	Y
26	3929	Y	26	3929	Y	26	3928	Y	26	3920	Y	26	3921	Y
25	3622	Y	25	3623	Y	25	3622	Y	25	3625	Y	25	3626	Y
24	3521	Y	24	3522	Y	24	3521	Y	24	3524	Y	24	3525	Y
23	4021	Y	23	4021	Y	23	4020	Y	23	4029	Y	23	4027	Y
22	3426	Y	22	3426	Y	22	3427	Y	22	3426	Y	22	3424	Y
21	3922	Y	21	3922	Y	21	3921	Y	21	3922	Y	21	3922	Y
20	3524	Y	20	3524	Y	20	3524	Y	20	3522	Y	20	3521	Y
19	3429	Y	19	3429	Y	19	3429	Y	19	3422	Y	19	3423	Y
18	3929	Y	18	3928	Y	18	3928	Y	18	3927	Y	18	3927	Y
17	3927	Y	17	3926	Y	17	3926	Y	17	3926	Y	17	3926	Y
16	3424	Y	16	3423	Y	16	3423	Y	16	3420	Y	16	3420	Y
15	4027	Y	15	4027	Y	15	4027	Y	15	4025	Y	15	4025	Y
14	3922	Y	14	3921	Y	14	3921	Y	14	3920	Y	14	3920	Y
13	4021	Y	13	4020	Y	13	4020	Y	13	4029	Y	13	4029	Y
12	4024	Y	12	4023	Y	12	4023	Y	12	4022	Y	12	4023	Y
11	3929	Y	11	3928	Y	11	3928	Y	11	3925	Y	11	3926	Y
10	4025	Y	10	4025	Y	10	4025	Y	10	4025	Y	10	4025	Y
9	3920	Y	9	3927	Y	9	3927	Y	9	3928	Y	9	3928	Y
8	3624	Y	8	3624	Y	8	3624	Y	8	3626	Y	8	3626	Y
7	3329	Y	7	3329	Y	7	3329	Y	7	3324	Y	7	3325	Y
6	3222	Y	6	3220	Y	6	3220	Y	6	3225	Y	6	3226	Y
5	3721	Y	5	3724	Y	5	3727	Y	5	3729	Y	5	3721	Y
4	3627	Y	4	3626	Y	4	3625	Y	4	3626	Y	4	3626	Y
3	3826	Y	3	3825	Y	3	3825	Y	3	3821	Y	3	3820	Y
2	3825	Y	2	3825	Y	2	3826	Y	2	3821	Y	2	3822	Y
1	3722	Y	1	3722	Y	1	3723	Y	1	3723	Y	1	3722	Y
0	2926	Y	0	2926	Y	0	2926	Y	0	2923	Y	0	2926	Y

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101:10:28:00

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101:10:29:00

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RUN NO. 16 T/C'S 51-100

D-38

49	3243	Y	49	3243	Y	49	3243	Y	49	3243	Y	49	3243	Y
48	3740	Y	48	3740	Y	48	3740	Y	48	3740	Y	48	3740	Y
47	3445	Y	47	3445	Y	47	3445	Y	47	3445	Y	47	3445	Y
46	3445	Y	46	3445	Y	46	3445	Y	46	3445	Y	46	3445	Y
45	3747	Y	45	3747	Y	45	3747	Y	45	3747	Y	45	3747	Y
44	3442	Y	44	3442	Y	44	3442	Y	44	3442	Y	44	3442	Y
43	3442	Y	43	3442	Y	43	3442	Y	43	3442	Y	43	3442	Y
42	3646	Y	42	3646	Y	42	3646	Y	42	3646	Y	42	3646	Y
41	3745	Y	41	3745	Y	41	3745	Y	41	3745	Y	41	3745	Y
40	3745	Y	40	3745	Y	40	3745	Y	40	3745	Y	40	3745	Y
39	3745	Y	39	3745	Y	39	3745	Y	39	3745	Y	39	3745	Y
38	3642	Y	38	3642	Y	38	3642	Y	38	3642	Y	38	3642	Y
37	3375	Y	37	3375	Y	37	3375	Y	37	3375	Y	37	3375	Y
36	3243	Y	36	3243	Y	36	3243	Y	36	3243	Y	36	3243	Y
35	3541	Y	35	3541	Y	35	3541	Y	35	3541	Y	35	3541	Y
34	3642	Y	34	3642	Y	34	3642	Y	34	3642	Y	34	3642	Y
33	3745	Y	33	3745	Y	33	3745	Y	33	3745	Y	33	3745	Y
32	3745	Y	32	3745	Y	32	3745	Y	32	3745	Y	32	3745	Y
31	3642	Y	31	3642	Y	31	3642	Y	31	3642	Y	31	3642	Y
30	3375	Y	30	3375	Y	30	3375	Y	30	3375	Y	30	3375	Y
29	3445	Y	29	3445	Y	29	3445	Y	29	3445	Y	29	3445	Y
28	3445	Y	28	3445	Y	28	3445	Y	28	3445	Y	28	3445	Y
27	2333	Y	27	2333	Y	27	2333	Y	27	2333	Y	27	2333	Y
26	2445	Y	26	2445	Y	26	2445	Y	26	2445	Y	26	2445	Y
25	2445	Y	25	2445	Y	25	2445	Y	25	2445	Y	25	2445	Y
24	2378	Y	24	2378	Y	24	2378	Y	24	2378	Y	24	2378	Y
23	2378	Y	23	2378	Y	23	2378	Y	23	2378	Y	23	2378	Y
22	3243	Y	22	3243	Y	22	3243	Y	22	3243	Y	22	3243	Y
21	3243	Y	21	3243	Y	21	3243	Y	21	3243	Y	21	3243	Y
20	3348	Y	20	3348	Y	20	3348	Y	20	3348	Y	20	3348	Y
19	3348	Y	19	3348	Y	19	3348	Y	19	3348	Y	19	3348	Y
18	3445	Y	18	3445	Y	18	3445	Y	18	3445	Y	18	3445	Y
17	3445	Y	17	3445	Y	17	3445	Y	17	3445	Y	17	3445	Y
16	3445	Y	16	3445	Y	16	3445	Y	16	3445	Y	16	3445	Y
15	3541	Y	15	3541	Y	15	3541	Y	15	3541	Y	15	3541	Y
14	3445	Y	14	3445	Y	14	3445	Y	14	3445	Y	14	3445	Y
13	3445	Y	13	3445	Y	13	3445	Y	13	3445	Y	13	3445	Y
12	3445	Y	12	3445	Y	12	3445	Y	12	3445	Y	12	3445	Y
11	3445	Y	11	3445	Y	11	3445	Y	11	3445	Y	11	3445	Y
10	1023	Y	10	1023	Y	10	1023	Y	10	1023	Y	10	1023	Y
9	1023	Y	9	1023	Y	9	1023	Y	9	1023	Y	9	1023	Y
8	1747	Y	8	1747	Y	8	1747	Y	8	1747	Y	8	1747	Y
7	1747	Y	7	1747	Y	7	1747	Y	7	1747	Y	7	1747	Y
6	3445	Y	6	3445	Y	6	3445	Y	6	3445	Y	6	3445	Y
5	3745	Y	5	3745	Y	5	3745	Y	5	3745	Y	5	3745	Y
4	3024	Y	4	3024	Y	4	3024	Y	4	3024	Y	4	3024	Y
3	3024	Y	3	3024	Y	3	3024	Y	3	3024	Y	3	3024	Y
2	3024	Y	2	3024	Y	2	3024	Y	2	3024	Y	2	3024	Y
1	3745	Y	1	3745	Y	1	3745	Y	1	3745	Y	1	3745	Y
0	3445	Y	0	3445	Y	0	3445	Y	0	3445	Y	0	3445	Y

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101110130100

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RUN NO. 17 T/c's 1-50

D-39

49	3657	Y	49	3657	Y	49	3652	Y	49	3651	Y	49	3650	Y
48	4413	Y	48	4413	Y	48	4412	Y	48	4411	Y	48	4411	Y
47	4455	Y	47	4455	Y	47	4455	Y	47	4455	Y	47	4455	Y
46	4438	Y	46	4438	Y	46	4437	Y	46	4437	Y	46	4436	Y
45	4323	Y	45	4323	Y	45	4320	Y	45	4319	Y	45	4319	Y
44	4084	Y	44	4084	Y	44	4080	Y	44	4059	Y	44	4059	Y
43	3663	Y	43	3663	Y	43	3659	Y	43	3658	Y	43	3658	Y
42	3702	Y	42	3702	Y	42	3701	Y	42	3700	Y	42	3700	Y
41	4410	Y	41	4410	Y	41	4410	Y	41	4417	Y	41	4417	Y
40	4413	Y	40	4413	Y	40	4412	Y	40	4411	Y	40	4411	Y
39	4434	Y	39	4434	Y	39	4433	Y	39	4433	Y	39	4433	Y
38	4321	Y	38	4321	Y	38	4320	Y	38	4320	Y	38	4320	Y
37	3786	Y	37	3786	Y	37	3787	Y	37	3747	Y	37	3747	Y
36	4420	Y	36	4421	Y	36	4420	Y	36	4420	Y	36	4420	Y
35	4401	Y	35	4401	Y	35	4401	Y	35	4401	Y	35	4401	Y
34	3816	Y	34	3817	Y	34	3817	Y	34	3816	Y	34	3816	Y
33	7160	Y	33	7162	Y	33	7163	Y	33	7163	Y	33	7163	Y
32	4602	Y	32	4602	Y	32	4603	Y	32	4603	Y	32	4603	Y
31	4630	Y	31	4630	Y	31	4631	Y	31	4630	Y	31	4630	Y
30	4518	Y	30	4518	Y	30	4519	Y	30	4518	Y	30	4518	Y
29	3685	Y	29	3685	Y	29	3686	Y	29	3685	Y	29	3685	Y
28	3641	Y	28	3641	Y	28	3637	Y	28	3636	Y	28	3636	Y
27	4362	Y	27	4362	Y	27	4339	Y	27	4336	Y	27	4336	Y
26	4295	Y	26	4295	Y	26	4292	Y	26	4291	Y	26	4291	Y
25	4076	Y	25	4076	Y	25	4072	Y	25	4071	Y	25	4071	Y
24	3724	Y	24	3724	Y	24	3721	Y	24	3714	Y	24	3714	Y
23	4436	Y	23	4439	Y	23	4439	Y	23	4436	Y	23	4436	Y
22	3730	Y	22	3730	Y	22	3730	Y	22	3730	Y	22	3730	Y
21	4310	Y	21	4310	Y	21	4307	Y	21	4306	Y	21	4307	Y
20	3826	Y	20	3827	Y	20	3827	Y	20	3827	Y	20	3827	Y
19	3706	Y	19	3706	Y	19	3703	Y	19	3703	Y	19	3702	Y
18	4434	Y	18	4434	Y	18	4432	Y	18	4432	Y	18	4432	Y
17	4369	Y	17	4369	Y	17	4366	Y	17	4366	Y	17	4367	Y
16	3764	Y	16	3764	Y	16	3763	Y	16	3763	Y	16	3762	Y
15	4430	Y	15	4430	Y	15	4430	Y	15	4430	Y	15	4430	Y
14	4483	Y	14	4483	Y	14	4482	Y	14	4483	Y	14	4482	Y
13	4486	Y	13	4486	Y	13	4486	Y	13	4486	Y	13	4486	Y
12	4396	Y	12	4398	Y	12	4398	Y	12	4398	Y	12	4397	Y
11	4423	Y	11	4423	Y	11	4422	Y	11	4421	Y	11	4421	Y
10	4409	Y	10	4420	Y	10	4416	Y	10	4416	Y	10	4417	Y
9	4374	Y	9	4374	Y	9	4372	Y	9	4372	Y	9	4372	Y
8	4107	Y	8	4106	Y	8	4104	Y	8	4104	Y	8	4103	Y
7	3566	Y	7	3565	Y	7	3562	Y	7	3562	Y	7	3561	Y
6	3545	Y	6	3524	Y	6	3510	Y	6	3516	Y	6	3517	Y
5	4161	Y	5	4150	Y	5	4136	Y	5	4136	Y	5	4135	Y
4	4250	Y	4	4249	Y	4	4245	Y	4	4245	Y	4	4244	Y
3	4215	Y	3	4215	Y	3	4210	Y	3	4210	Y	3	4210	Y
2	4130	Y	2	4130	Y	2	4131	Y	2	4131	Y	2	4131	Y
1	3921	Y	1	3920	Y	1	3904	Y	1	3904	Y	1	3904	Y
0	3124	Y	0	3124	Y	0	3121	Y	0	3121	Y	0	3121	Y

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RUN NO. 17 T/C'S 51-100

D-40

49	3387	Y	49	3384	Y	49	3346	Y	49	3386	Y	49	3383	Y
48	3382	Y	48	3345	Y	48	3345	Y	48	3385	Y	48	3382	Y
47	3381	Y	47	3344	Y	47	3344	Y	47	3384	Y	47	3381	Y
46	3380	Y	46	3343	Y	46	3343	Y	46	3383	Y	46	3380	Y
45	3379	Y	45	3342	Y	45	3342	Y	45	3382	Y	45	3379	Y
44	3378	Y	44	3341	Y	44	3341	Y	44	3381	Y	44	3378	Y
43	3377	Y	43	3340	Y	43	3340	Y	43	3380	Y	43	3377	Y
42	3376	Y	42	3339	Y	42	3339	Y	42	3379	Y	42	3376	Y
41	3375	Y	41	3338	Y	41	3338	Y	41	3378	Y	41	3375	Y
40	3374	Y	40	3337	Y	40	3337	Y	40	3377	Y	40	3374	Y
39	3373	Y	39	3336	Y	39	3336	Y	39	3376	Y	39	3373	Y
38	3372	Y	38	3335	Y	38	3335	Y	38	3375	Y	38	3372	Y
37	3371	Y	37	3334	Y	37	3334	Y	37	3374	Y	37	3371	Y
36	3370	Y	36	3333	Y	36	3333	Y	36	3373	Y	36	3370	Y
35	3369	Y	35	3332	Y	35	3332	Y	35	3372	Y	35	3369	Y
34	3368	Y	34	3331	Y	34	3331	Y	34	3371	Y	34	3368	Y
33	3367	Y	33	3330	Y	33	3330	Y	33	3370	Y	33	3367	Y
32	3366	Y	32	3329	Y	32	3329	Y	32	3369	Y	32	3366	Y
31	3365	Y	31	3328	Y	31	3328	Y	31	3368	Y	31	3365	Y
30	3364	Y	30	3327	Y	30	3327	Y	30	3367	Y	30	3364	Y
29	3363	Y	29	3326	Y	29	3326	Y	29	3366	Y	29	3363	Y
28	3362	Y	28	3325	Y	28	3325	Y	28	3365	Y	28	3362	Y
27	3361	Y	27	3324	Y	27	3324	Y	27	3364	Y	27	3361	Y
26	3360	Y	26	3323	Y	26	3323	Y	26	3363	Y	26	3360	Y
25	3359	Y	25	3322	Y	25	3322	Y	25	3362	Y	25	3359	Y
24	3358	Y	24	3321	Y	24	3321	Y	24	3361	Y	24	3358	Y
23	3357	Y	23	3320	Y	23	3320	Y	23	3360	Y	23	3357	Y
22	3356	Y	22	3319	Y	22	3319	Y	22	3359	Y	22	3356	Y
21	3355	Y	21	3318	Y	21	3318	Y	21	3358	Y	21	3355	Y
20	3354	Y	20	3317	Y	20	3317	Y	20	3357	Y	20	3354	Y
19	3353	Y	19	3316	Y	19	3316	Y	19	3356	Y	19	3353	Y
18	3352	Y	18	3315	Y	18	3315	Y	18	3355	Y	18	3352	Y
17	3351	Y	17	3314	Y	17	3314	Y	17	3354	Y	17	3351	Y
16	3350	Y	16	3313	Y	16	3313	Y	16	3353	Y	16	3350	Y
15	3349	Y	15	3312	Y	15	3312	Y	15	3352	Y	15	3349	Y
14	3348	Y	14	3311	Y	14	3311	Y	14	3351	Y	14	3348	Y
13	3347	Y	13	3310	Y	13	3310	Y	13	3350	Y	13	3347	Y
12	3346	Y	12	3309	Y	12	3309	Y	12	3349	Y	12	3346	Y
11	3345	Y	11	3308	Y	11	3308	Y	11	3348	Y	11	3345	Y
10	3344	Y	10	3307	Y	10	3307	Y	10	3347	Y	10	3344	Y
9	3343	Y	9	3306	Y	9	3306	Y	9	3346	Y	9	3343	Y
8	3342	Y	8	3305	Y	8	3305	Y	8	3345	Y	8	3342	Y
7	3341	Y	7	3304	Y	7	3304	Y	7	3344	Y	7	3341	Y
6	3340	Y	6	3303	Y	6	3303	Y	6	3343	Y	6	3340	Y
5	3339	Y	5	3302	Y	5	3302	Y	5	3342	Y	5	3339	Y
4	3338	Y	4	3301	Y	4	3301	Y	4	3341	Y	4	3338	Y
3	3337	Y	3	3300	Y	3	3300	Y	3	3340	Y	3	3337	Y
2	3336	Y	2	3299	Y	2	3299	Y	2	3339	Y	2	3336	Y
1	3335	Y	1	3298	Y	1	3298	Y	1	3338	Y	1	3335	Y
0	3334	Y	0	3297	Y	0	3297	Y	0	3337	Y	0	3334	Y

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103:10:45:00

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RUN NO. 18 T/C's 1-50

49	3601	Y	49	3603	Y	49	3601	Y	49	3600	Y
48	4184	Y	48	4183	Y	48	4184	Y	48	4184	Y
47	4182	Y	47	4183	Y	47	4184	Y	47	4184	Y
46	4180	Y	46	4182	Y	46	4183	Y	46	4182	Y
45	4180	Y	45	4182	Y	45	4181	Y	45	4181	Y
44	3782	Y	44	3784	Y	44	3783	Y	44	3782	Y
43	3342	Y	43	3343	Y	43	3341	Y	43	3340	Y
42	3910	Y	42	3911	Y	42	3915	Y	42	3916	Y
41	4249	Y	41	4300	Y	41	4302	Y	41	4303	Y
40	4247	Y	40	4249	Y	40	4251	Y	40	4251	Y
39	4240	Y	39	4242	Y	39	4245	Y	39	4245	Y
38	4129	Y	38	4130	Y	38	4133	Y	38	4133	Y
37	4044	Y	37	4045	Y	37	4050	Y	37	4051	Y
36	4285	Y	36	4286	Y	36	4289	Y	36	4289	Y
35	4163	Y	35	4164	Y	35	4166	Y	35	4168	Y
34	4135	Y	34	4135	Y	34	4139	Y	34	4139	Y
33	709	Y	33	712	Y	33	713	Y	33	713	Y
32	4420	Y	32	4420	Y	32	4422	Y	32	4422	Y
31	4433	Y	31	4434	Y	31	4435	Y	31	4435	Y
30	4269	Y	30	4269	Y	30	4271	Y	30	4271	Y
29	3141	Y	29	3141	Y	29	3142	Y	29	3141	Y
28	3781	Y	28	3781	Y	28	3782	Y	28	3781	Y
27	4170	Y	27	4171	Y	27	4172	Y	27	4171	Y
26	4049	Y	26	4050	Y	26	4050	Y	26	4048	Y
25	3804	Y	25	3805	Y	25	3804	Y	25	3803	Y
24	3388	Y	24	3388	Y	24	3388	Y	24	3387	Y
23	4235	Y	23	4235	Y	23	4237	Y	23	4237	Y
22	3229	Y	22	3229	Y	22	3230	Y	22	3230	Y
21	4044	Y	21	4044	Y	21	4045	Y	21	4045	Y
20	3366	Y	20	3366	Y	20	3367	Y	20	3367	Y
19	3930	Y	19	3930	Y	19	3935	Y	19	3936	Y
18	4270	Y	18	4271	Y	18	4273	Y	18	4273	Y
17	4129	Y	17	4131	Y	17	4134	Y	17	4134	Y
16	4038	Y	16	4039	Y	16	4043	Y	16	4044	Y
15	4240	Y	15	4241	Y	15	4243	Y	15	4244	Y
14	4309	Y	14	4310	Y	14	4312	Y	14	4313	Y
13	4231	Y	13	4232	Y	13	4235	Y	13	4235	Y
12	4159	Y	12	4161	Y	12	4163	Y	12	4164	Y
11	4248	Y	11	4249	Y	11	4251	Y	11	4251	Y
10	4162	Y	10	4164	Y	10	4165	Y	10	4164	Y
9	4059	Y	9	4060	Y	9	4060	Y	9	4059	Y
8	3831	Y	8	3832	Y	8	3833	Y	8	3832	Y
7	3200	Y	7	3201	Y	7	3196	Y	7	3193	Y
6	3702	Y	6	3704	Y	6	3706	Y	6	3705	Y
5	3986	Y	5	3987	Y	5	3987	Y	5	3986	Y
4	4053	Y	4	4054	Y	4	4055	Y	4	4054	Y
3	4022	Y	3	4023	Y	3	4023	Y	3	4022	Y
2	3436	Y	2	3437	Y	2	3439	Y	2	3445	Y
1	3740	Y	1	3742	Y	1	3743	Y	1	3739	Y
0	2689	Y	0	2671	Y	0	2665	Y	0	2646	Y

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105114135100

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105114140100

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105114142100

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105114144100

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105114146100

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105114148100

RUN NO. 18 T/C's 51-100

D-42

49 3471 Y
48 3760 Y
47 3487 Y
46 3520 Y
45 3746 Y
44 3487 Y
43 3681 Y
42 3762 Y
41 3720 Y
40 3757 Y
39 3586 Y
38 3263 Y
37 3463 Y
36 3657 Y
35 3761 Y
34 3760 Y
33 3752 Y
32 3584 Y
31 1252 Y
30 3487 Y
29 3487 Y
28 3487 Y
27 3487 Y
26 2487 Y
25 2502 Y
24 2487 Y
23 2503 Y
22 3342 Y
21 3352 Y
20 3372 Y
19 3384 Y
18 3502 Y
17 3484 Y
16 3516 Y
15 3416 Y
14 3416 Y
13 3416 Y
12 3420 Y
11 1987 Y
10 1908 Y
9 1909 Y
8 1893 Y
7 3697 Y
6 3659 Y
5 3536 Y
4 3486 Y
3 3423 Y
2 3718 Y
1 3313 Y
0

49 3473 Y
48 3757 Y
47 3514 Y
46 3746 Y
45 3487 Y
44 3681 Y
43 3762 Y
42 3720 Y
41 3757 Y
40 3586 Y
39 3263 Y
38 3463 Y
37 3657 Y
36 3761 Y
35 3760 Y
34 3752 Y
33 3584 Y
32 1252 Y
31 3487 Y
30 3487 Y
29 3487 Y
28 3487 Y
27 3487 Y
26 2487 Y
25 2502 Y
24 2487 Y
23 2503 Y
22 3342 Y
21 3352 Y
20 3372 Y
19 3384 Y
18 3502 Y
17 3484 Y
16 3516 Y
15 3416 Y
14 3416 Y
13 3416 Y
12 3420 Y
11 1987 Y
10 1908 Y
9 1909 Y
8 1893 Y
7 3697 Y
6 3659 Y
5 3536 Y
4 3486 Y
3 3423 Y
2 3718 Y
1 3313 Y
0

45 3472 Y
44 3756 Y
43 3514 Y
42 3746 Y
41 3487 Y
40 3681 Y
39 3762 Y
38 3720 Y
37 3757 Y
36 3586 Y
35 3263 Y
34 3463 Y
33 3657 Y
32 3761 Y
31 3760 Y
30 3752 Y
29 3584 Y
28 1252 Y
27 3487 Y
26 3487 Y
25 3487 Y
24 3487 Y
23 3487 Y
22 3487 Y
21 3487 Y
20 3487 Y
19 3487 Y
18 3487 Y
17 3487 Y
16 3487 Y
15 3487 Y
14 3487 Y
13 3487 Y
12 3487 Y
11 3487 Y
10 3487 Y
9 3487 Y
8 3487 Y
7 3487 Y
6 3487 Y
5 3487 Y
4 3487 Y
3 3487 Y
2 3487 Y
1 3487 Y
0

49 3471 Y
48 3753 Y
47 3514 Y
46 3746 Y
45 3487 Y
44 3681 Y
43 3762 Y
42 3720 Y
41 3757 Y
40 3586 Y
39 3263 Y
38 3463 Y
37 3657 Y
36 3761 Y
35 3760 Y
34 3752 Y
33 3584 Y
32 1252 Y
31 3487 Y
30 3487 Y
29 3487 Y
28 3487 Y
27 3487 Y
26 2487 Y
25 2502 Y
24 2487 Y
23 2503 Y
22 3342 Y
21 3352 Y
20 3372 Y
19 3384 Y
18 3502 Y
17 3484 Y
16 3516 Y
15 3416 Y
14 3416 Y
13 3416 Y
12 3420 Y
11 1987 Y
10 1908 Y
9 1909 Y
8 1893 Y
7 3697 Y
6 3659 Y
5 3536 Y
4 3486 Y
3 3423 Y
2 3718 Y
1 3313 Y
0

49 3471 Y
48 3750 Y
47 3514 Y
46 3504 Y
45 3758 Y
44 3487 Y
43 3487 Y
42 3636 Y
41 3756 Y
40 3758 Y
39 3745 Y
38 3584 Y
37 3270 Y
36 3453 Y
35 3647 Y
34 3745 Y
33 3746 Y
32 3743 Y
31 3582 Y
30 3276 Y
29 3487 Y
28 3487 Y
27 3487 Y
26 2448 Y
25 2480 Y
24 2462 Y
23 2487 Y
22 3311 Y
21 3318 Y
20 3337 Y
19 3352 Y
18 3460 Y
17 3461 Y
16 3487 Y
15 3485 Y
14 3377 Y
13 3326 Y
12 3378 Y
11 3381 Y
10 1940 Y
9 1902 Y
8 1903 Y
7 1886 Y
6 3636 Y
5 3853 Y
4 3934 Y
3 3967 Y
2 3921 Y
1 3717 Y
0 3310 Y

49 3489 Y
48 3746 Y
47 3514 Y
46 3500 Y
45 3758 Y
44 3487 Y
43 3487 Y
42 3636 Y
41 3756 Y
40 3758 Y
39 3745 Y
38 3582 Y
37 3266 Y
36 3452 Y
35 3652 Y
34 3748 Y
33 3753 Y
32 3741 Y
31 3529 Y
30 3274 Y
29 3487 Y
28 3487 Y
27 3487 Y
26 2445 Y
25 2480 Y
24 2466 Y
23 2487 Y
22 3312 Y
21 3313 Y
20 3321 Y
19 3336 Y
18 3483 Y
17 3484 Y
16 3486 Y
15 3479 Y
14 3369 Y
13 3373 Y
12 3375 Y
11 3375 Y
10 1936 Y
9 1901 Y
8 1903 Y
7 1885 Y
6 3635 Y
5 3852 Y
4 3935 Y
3 3967 Y
2 3921 Y
1 3716 Y
0 3309 Y

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RUN NO. 19 T/c's 1-50

D-43

49 4242 Y
48 5486 Y
47 5486 Y
46 5486 Y
45 5304 Y
44 4840 Y
43 4336 Y
42 4336 Y
41 5486 Y
40 5486 Y
39 5398 Y
38 5264 Y
37 4480 Y
36 5486 Y
35 5326 Y
34 4561 Y
33 673 Y
32 5720 Y
31 5720 Y
30 5540 Y
29 4524 Y
28 4232 Y
27 5317 Y
26 5157 Y
25 4860 Y
24 4432 Y
23 5504 Y
22 4540 Y
21 5217 Y
20 4665 Y
19 4365 Y
18 5473 Y
17 5269 Y
16 4475 Y
15 5510 Y
14 5527 Y
13 5502 Y
12 5329 Y
11 5545 Y
10 5431 Y
9 5317 Y
8 4927 Y
7 4228 Y
6 4052 Y
5 5052 Y
4 5113 Y
3 5036 Y
2 4050 Y
1 4637 Y
0 3561 Y

49 4241 Y
48 5486 Y
47 5486 Y
46 5486 Y
45 5304 Y
44 4840 Y
43 4336 Y
42 4336 Y
41 5486 Y
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39 5398 Y
38 5264 Y
37 4480 Y
36 5486 Y
35 5326 Y
34 4561 Y
33 673 Y
32 5720 Y
31 5720 Y
30 5540 Y
29 4524 Y
28 4232 Y
27 5317 Y
26 5157 Y
25 4860 Y
24 4432 Y
23 5504 Y
22 4540 Y
21 5217 Y
20 4665 Y
19 4365 Y
18 5473 Y
17 5269 Y
16 4475 Y
15 5510 Y
14 5527 Y
13 5502 Y
12 5328 Y
11 5544 Y
10 5431 Y
9 5317 Y
8 4926 Y
7 4227 Y
6 4052 Y
5 5051 Y
4 5112 Y
3 5035 Y
2 4847 Y
1 4636 Y
0 3559 Y

49 4242 Y
48 5487 Y
47 5486 Y
46 5486 Y
45 5304 Y
44 4840 Y
43 4336 Y
42 4336 Y
41 5486 Y
40 5486 Y
39 5398 Y
38 5264 Y
37 4480 Y
36 5486 Y
35 5326 Y
34 4561 Y
33 673 Y
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30 5540 Y
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26 5157 Y
25 4860 Y
24 4432 Y
23 5504 Y
22 4540 Y
21 5217 Y
20 4665 Y
19 4365 Y
18 5473 Y
17 5269 Y
16 4475 Y
15 5510 Y
14 5527 Y
13 5502 Y
12 5329 Y
11 5545 Y
10 5431 Y
9 5317 Y
8 4927 Y
7 4228 Y
6 4053 Y
5 5053 Y
4 5113 Y
3 5036 Y
2 4050 Y
1 4637 Y
0 3561 Y

49 4243 Y
48 5487 Y
47 5486 Y
46 5486 Y
45 5304 Y
44 4840 Y
43 4336 Y
42 4336 Y
41 5486 Y
40 5486 Y
39 5398 Y
38 5265 Y
37 4480 Y
36 5486 Y
35 5326 Y
34 4561 Y
33 673 Y
32 5720 Y
31 5720 Y
30 5540 Y
29 4524 Y
28 4231 Y
27 5317 Y
26 5157 Y
25 4860 Y
24 4431 Y
23 5504 Y
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21 5217 Y
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19 4365 Y
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17 5269 Y
16 4475 Y
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9 5317 Y
8 4927 Y
7 4228 Y
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5 5053 Y
4 5113 Y
3 5036 Y
2 4050 Y
1 4637 Y
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49 4242 Y
48 5487 Y
47 5486 Y
46 5486 Y
45 5304 Y
44 4840 Y
43 4336 Y
42 4336 Y
41 5486 Y
40 5486 Y
39 5398 Y
38 5266 Y
37 4480 Y
36 5486 Y
35 5326 Y
34 4561 Y
33 673 Y
32 5720 Y
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30 5540 Y
29 4524 Y
28 4231 Y
27 5317 Y
26 5157 Y
25 4860 Y
24 4431 Y
23 5504 Y
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21 5217 Y
20 4665 Y
19 4365 Y
18 5473 Y
17 5269 Y
16 4475 Y
15 5510 Y
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9 5317 Y
8 4927 Y
7 4228 Y
6 4052 Y
5 5052 Y
4 5113 Y
3 5036 Y
2 4050 Y
1 4637 Y
0 3561 Y

49 4242 Y
48 5486 Y
47 5486 Y
46 5486 Y
45 5304 Y
44 4840 Y
43 4336 Y
42 4336 Y
41 5486 Y
40 5486 Y
39 5398 Y
38 5266 Y
37 4480 Y
36 5486 Y
35 5326 Y
34 4561 Y
33 673 Y
32 5720 Y
31 5720 Y
30 5540 Y
29 4524 Y
28 4232 Y
27 5317 Y
26 5157 Y
25 4860 Y
24 4432 Y
23 5504 Y
22 4540 Y
21 5217 Y
20 4665 Y
19 4365 Y
18 5473 Y
17 5269 Y
16 4475 Y
15 5510 Y
14 5527 Y
13 5502 Y
12 5329 Y
11 5544 Y
10 5430 Y
9 5316 Y
8 4926 Y
7 4228 Y
6 4052 Y
5 5052 Y
4 5112 Y
3 5035 Y
2 4649 Y
1 4637 Y
0 3560 Y

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RUN NO. 19 T/c's 51-100

D-44

49	3700	Y	49	3701	Y	49	3630	Y	49	3657	Y
48	4346	Y	48	4347	Y	48	4346	Y	48	4344	Y
47	3800	Y	47	3801	Y	47	3800	Y	47	3800	Y
46	3800	Y	46	3801	Y	46	3801	Y	46	3800	Y
45	4346	Y	45	4347	Y	45	4342	Y	45	4340	Y
44	3797	Y	44	3798	Y	44	3796	Y	44	3795	Y
43	4240	Y	43	4241	Y	43	4239	Y	43	4237	Y
42	4436	Y	42	4437	Y	42	4436	Y	42	4435	Y
41	4346	Y	41	4347	Y	41	4346	Y	41	4345	Y
40	4346	Y	40	4347	Y	40	4346	Y	40	4345	Y
39	4346	Y	39	4347	Y	39	4346	Y	39	4345	Y
38	4120	Y	38	4121	Y	38	4119	Y	38	4118	Y
37	3763	Y	37	3764	Y	37	3761	Y	37	3759	Y
36	3761	Y	36	3762	Y	36	3760	Y	36	3758	Y
35	4226	Y	35	4227	Y	35	4223	Y	35	4221	Y
34	4457	Y	34	4458	Y	34	4455	Y	34	4453	Y
33	4346	Y	33	4347	Y	33	4344	Y	33	4342	Y
32	4346	Y	32	4347	Y	32	4340	Y	32	4339	Y
31	4100	Y	31	4101	Y	31	4100	Y	31	4102	Y
30	3754	Y	30	3755	Y	30	3752	Y	30	3750	Y
29	3754	Y	29	3755	Y	29	3752	Y	29	3750	Y
28	2120	Y	28	2121	Y	28	2119	Y	28	2118	Y
27	2120	Y	27	2121	Y	27	2119	Y	27	2118	Y
26	2120	Y	26	2121	Y	26	2119	Y	26	2118	Y
25	2120	Y	25	2121	Y	25	2119	Y	25	2118	Y
24	2120	Y	24	2121	Y	24	2119	Y	24	2118	Y
23	2120	Y	23	2121	Y	23	2119	Y	23	2118	Y
22	3306	Y	22	3307	Y	22	3305	Y	22	3305	Y
21	3306	Y	21	3307	Y	21	3300	Y	21	3291	Y
20	3306	Y	20	3307	Y	20	3300	Y	20	3300	Y
19	3306	Y	19	3307	Y	19	3300	Y	19	3300	Y
18	3432	Y	18	3433	Y	18	3428	Y	18	3425	Y
17	3432	Y	17	3433	Y	17	3427	Y	17	3420	Y
16	3530	Y	16	3531	Y	16	3534	Y	16	3526	Y
15	3530	Y	15	3531	Y	15	3485	Y	15	3476	Y
14	3260	Y	14	3261	Y	14	3245	Y	14	3234	Y
13	3253	Y	13	3254	Y	13	3238	Y	13	3226	Y
12	3249	Y	12	3250	Y	12	3234	Y	12	3221	Y
11	3254	Y	11	3255	Y	11	3237	Y	11	3225	Y
10	1731	Y	10	1732	Y	10	1727	Y	10	1721	Y
9	1630	Y	9	1631	Y	9	1634	Y	9	1630	Y
8	1703	Y	8	1704	Y	8	1680	Y	8	1686	Y
7	1692	Y	7	1693	Y	7	1630	Y	7	1634	Y
6	4117	Y	6	4118	Y	6	4117	Y	6	4115	Y
5	4950	Y	5	4951	Y	5	4950	Y	5	4949	Y
4	5002	Y	4	5003	Y	4	5001	Y	4	5000	Y
3	4950	Y	3	4951	Y	3	4954	Y	3	4953	Y
2	4629	Y	2	4630	Y	2	4642	Y	2	4641	Y
1	4629	Y	1	4630	Y	1	4638	Y	1	4627	Y
0	4245	Y	0	4246	Y	0	4245	Y	0	4244	Y

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RUN NO. 20 T/C'S 1-50

D-45

49	1742	Y	49	1742	Y	49	1739	Y	49	1739	Y	49	1739	Y
48	2466	Y	48	2466	Y	48	2466	Y	48	2466	Y	48	2466	Y
47	2439	Y	47	2439	Y	47	2439	Y	47	2439	Y	47	2439	Y
46	2381	Y	46	2381	Y	46	2381	Y	46	2381	Y	46	2381	Y
45	2131	Y	45	2131	Y	45	2131	Y	45	2131	Y	45	2131	Y
44	2035	Y	44	2035	Y	44	2035	Y	44	2035	Y	44	2035	Y
43	1837	Y	43	1837	Y	43	1837	Y	43	1837	Y	43	1837	Y
42	2444	Y	42	2444	Y	42	2444	Y	42	2444	Y	42	2444	Y
41	2569	Y	41	2569	Y	41	2569	Y	41	2569	Y	41	2569	Y
40	2578	Y	40	2578	Y	40	2578	Y	40	2578	Y	40	2578	Y
39	2525	Y	39	2525	Y	39	2525	Y	39	2525	Y	39	2525	Y
38	1873	Y	38	1873	Y	38	1873	Y	38	1873	Y	38	1873	Y
37	2605	Y	37	2605	Y	37	2605	Y	37	2605	Y	37	2605	Y
36	2543	Y	36	2543	Y	36	2543	Y	36	2543	Y	36	2543	Y
35	2116	Y	35	2116	Y	35	2116	Y	35	2116	Y	35	2116	Y
34	603	Y	34	603	Y	34	603	Y	34	603	Y	34	603	Y
33	2834	Y	33	2834	Y	33	2834	Y	33	2834	Y	33	2834	Y
32	2921	Y	32	2921	Y	32	2921	Y	32	2921	Y	32	2921	Y
31	2878	Y	31	2878	Y	31	2878	Y	31	2878	Y	31	2878	Y
30	2338	Y	30	2338	Y	30	2338	Y	30	2338	Y	30	2338	Y
29	1909	Y	29	1909	Y	29	1909	Y	29	1909	Y	29	1909	Y
28	2534	Y	28	2534	Y	28	2534	Y	28	2534	Y	28	2534	Y
27	2453	Y	27	2453	Y	27	2453	Y	27	2453	Y	27	2453	Y
26	2332	Y	26	2332	Y	26	2332	Y	26	2332	Y	26	2332	Y
25	2247	Y	25	2247	Y	25	2247	Y	25	2247	Y	25	2247	Y
24	2835	Y	24	2835	Y	24	2835	Y	24	2835	Y	24	2835	Y
23	2436	Y	23	2436	Y	23	2436	Y	23	2436	Y	23	2436	Y
22	2403	Y	22	2403	Y	22	2403	Y	22	2403	Y	22	2403	Y
21	2459	Y	21	2459	Y	21	2459	Y	21	2459	Y	21	2459	Y
20	2231	Y	20	2231	Y	20	2231	Y	20	2231	Y	20	2231	Y
19	2720	Y	19	2720	Y	19	2720	Y	19	2720	Y	19	2720	Y
18	2702	Y	18	2702	Y	18	2702	Y	18	2702	Y	18	2702	Y
17	2313	Y	17	2313	Y	17	2313	Y	17	2313	Y	17	2313	Y
16	2666	Y	16	2666	Y	16	2666	Y	16	2666	Y	16	2666	Y
15	2810	Y	15	2810	Y	15	2810	Y	15	2810	Y	15	2810	Y
14	2807	Y	14	2807	Y	14	2807	Y	14	2807	Y	14	2807	Y
13	2723	Y	13	2723	Y	13	2723	Y	13	2723	Y	13	2723	Y
12	2736	Y	12	2736	Y	12	2736	Y	12	2736	Y	12	2736	Y
11	2638	Y	11	2638	Y	11	2638	Y	11	2638	Y	11	2638	Y
10	2344	Y	10	2344	Y	10	2344	Y	10	2344	Y	10	2344	Y
9	2570	Y	9	2570	Y	9	2570	Y	9	2570	Y	9	2570	Y
8	2246	Y	8	2246	Y	8	2246	Y	8	2246	Y	8	2246	Y
7	2085	Y	7	2085	Y	7	2085	Y	7	2085	Y	7	2085	Y
6	2386	Y	6	2386	Y	6	2386	Y	6	2386	Y	6	2386	Y
5	2483	Y	5	2483	Y	5	2483	Y	5	2483	Y	5	2483	Y
4	2360	Y	4	2360	Y	4	2360	Y	4	2360	Y	4	2360	Y
3	2241	Y	3	2241	Y	3	2241	Y	3	2241	Y	3	2241	Y
2	2319	Y	2	2319	Y	2	2319	Y	2	2319	Y	2	2319	Y
1	2078	Y	1	2078	Y	1	2078	Y	1	2078	Y	1	2078	Y
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RUN NO. 20 T/c's 51-100

49 1668 ?
 48 1920 ?
 47 1606 ?
 46 1901 ?
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 43 1860 ?
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49 1669 ?
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49 1669 ?
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49 1669 ?
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49 1668 ?
 48 1919 ?
 47 1605 ?
 46 1900 ?
 45 1748 ?
 44 1676 ?
 43 1859 ?
 42 1948 ?
 41 1916 ?
 40 1921 ?
 39 1868 ?
 38 1779 ?
 37 1803 ?
 36 1977 ?
 35 2040 ?
 34 2016 ?
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49 1667 ?
 48 1918 ?
 47 1604 ?
 46 1899 ?
 45 1747 ?
 44 1675 ?
 43 1858 ?
 42 1947 ?
 41 1915 ?
 40 1920 ?
 39 1867 ?
 38 1778 ?
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 36 1976 ?
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RUN NO. 21 T/C's 1-50

49	2555	Y	47	2556	Y	49	2556	Y	49	2556	Y	49	2556	Y
48	2671	Y	48	2671	Y	48	2671	Y	48	2669	Y	48	2669	Y
47	2401	Y	47	2401	Y	47	2400	Y	47	2330	Y	47	2330	Y
46	2516	Y	46	2516	Y	46	2516	Y	46	2514	Y	46	2514	Y
45	1650	Y	45	1650	Y	45	1650	Y	45	1649	Y	45	1649	Y
44	1561	Y	44	1561	Y	44	1561	Y	44	1560	Y	44	1560	Y
43	2746	Y	43	2746	Y	43	2745	Y	43	2744	Y	43	2744	Y
42	2746	Y	42	2746	Y	42	2746	Y	42	2746	Y	42	2746	Y
41	2651	Y	41	2651	Y	41	2650	Y	41	2650	Y	41	2650	Y
40	2440	Y	40	2440	Y	40	2440	Y	40	2440	Y	40	2440	Y
39	2236	Y	39	2236	Y	39	2236	Y	39	2234	Y	39	2234	Y
38	2916	Y	38	2916	Y	38	2915	Y	38	2913	Y	38	2913	Y
37	2672	Y	37	2672	Y	37	2672	Y	37	2670	Y	37	2670	Y
36	2260	Y	36	2260	Y	36	2260	Y	36	2277	Y	36	2277	Y
35	3080	Y	35	3080	Y	35	3080	Y	35	3078	Y	35	3078	Y
34	705	Y	34	705	Y	34	705	Y	34	710	Y	34	710	Y
33	2805	Y	33	2805	Y	33	2805	Y	33	2803	Y	33	2803	Y
32	2632	Y	32	2632	Y	32	2631	Y	32	2630	Y	32	2630	Y
31	2334	Y	31	2334	Y	31	2334	Y	31	2332	Y	31	2332	Y
30	1517	Y	30	1517	Y	30	1517	Y	30	1515	Y	30	1515	Y
29	2645	Y	29	2645	Y	29	2645	Y	29	2643	Y	29	2643	Y
28	2537	Y	28	2537	Y	28	2537	Y	28	2535	Y	28	2535	Y
27	2148	Y	27	2148	Y	27	2148	Y	27	2147	Y	27	2146	Y
26	1662	Y	26	1662	Y	26	1661	Y	26	1660	Y	26	1659	Y
25	1606	Y	25	1606	Y	25	1606	Y	25	1604	Y	25	1604	Y
24	2386	Y	24	2386	Y	24	2386	Y	24	2384	Y	24	2384	Y
23	1560	Y	23	1560	Y	23	1560	Y	23	1558	Y	23	1558	Y
22	2165	Y	22	2165	Y	22	2165	Y	22	2163	Y	22	2163	Y
21	1636	Y	21	1636	Y	21	1636	Y	21	1636	Y	21	1636	Y
20	2837	Y	20	2837	Y	20	2837	Y	20	2835	Y	20	2835	Y
19	2657	Y	19	2657	Y	19	2657	Y	19	2655	Y	19	2655	Y
18	2241	Y	18	2241	Y	18	2241	Y	18	2239	Y	18	2239	Y
17	2967	Y	17	2967	Y	17	2967	Y	17	2965	Y	17	2965	Y
16	2430	Y	16	2430	Y	16	2430	Y	16	2429	Y	16	2429	Y
15	2635	Y	15	2635	Y	15	2635	Y	15	2633	Y	15	2633	Y
14	2502	Y	14	2502	Y	14	2502	Y	14	2500	Y	14	2500	Y
13	2277	Y	13	2277	Y	13	2277	Y	13	2276	Y	13	2276	Y
12	2749	Y	12	2749	Y	12	2749	Y	12	2747	Y	12	2746	Y
11	2374	Y	11	2374	Y	11	2374	Y	11	2372	Y	11	2372	Y
10	2220	Y	10	2220	Y	10	2220	Y	10	2220	Y	10	2220	Y
9	1906	Y	9	1906	Y	9	1906	Y	9	1905	Y	9	1905	Y
8	1472	Y	8	1472	Y	8	1472	Y	8	1472	Y	8	1471	Y
7	2565	Y	7	2565	Y	7	2565	Y	7	2564	Y	7	2564	Y
6	2472	Y	6	2472	Y	6	2472	Y	6	2471	Y	6	2470	Y
5	2434	Y	5	2434	Y	5	2434	Y	5	2433	Y	5	2432	Y
4	2241	Y	4	2241	Y	4	2241	Y	4	2239	Y	4	2239	Y
3	1946	Y	3	1946	Y	3	1946	Y	3	1946	Y	3	1946	Y
2	1806	Y	2	1806	Y	2	1806	Y	2	1804	Y	2	1804	Y
1	1379	Y	1	1379	Y	1	1379	Y	1	1377	Y	1	1377	Y
0			0			0			0			0		

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RUN NO. 22 T/C's 1-50

D-49

49 2719 Y
48 2956 Y
47 ***3* Y
46 3135 Y
45 3075 Y
44 2982 Y
43 2832 Y
42 2748 Y
41 2982 Y
40 3078 Y
39 3141 Y
38 3121 Y
37 2759 Y
36 3082 Y
35 3121 Y
34 2782 Y
33 639 Y
32 3097 Y
31 3145 Y
30 3124 Y
29 2818 Y
28 2798 Y
27 3105 Y
26 3139 Y
25 3047 Y
24 2925 Y
23 3125 Y
22 2837 Y
21 3124 Y
20 2884 Y
19 2841 Y
18 3122 Y
17 3156 Y
16 2846 Y
15 3124 Y
14 3126 Y
13 3166 Y
12 3156 Y
11 3026 Y
10 3170 Y
9 3119 Y
8 3090 Y
7 2940 Y
6 2866 Y
5 3034 Y
4 3132 Y
3 3169 Y
2 3146 Y
1 3090 Y
0 2738 Y

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49 2719 Y
48 2956 Y
47 ***3* Y
46 3135 Y
45 3075 Y
44 2982 Y
43 2832 Y
42 2748 Y
41 2982 Y
40 3078 Y
39 3141 Y
38 3122 Y
37 2759 Y
36 3082 Y
35 3121 Y
34 2782 Y
33 640 Y
32 3097 Y
31 3145 Y
30 3123 Y
29 2817 Y
28 2798 Y
27 3105 Y
26 3138 Y
25 3047 Y
24 2925 Y
23 3125 Y
22 2856 Y
21 3124 Y
20 2884 Y
19 2841 Y
18 3121 Y
17 3156 Y
16 2846 Y
15 3123 Y
14 3125 Y
13 3166 Y
12 3156 Y
11 3026 Y
10 3170 Y
9 3119 Y
8 3030 Y
7 2940 Y
6 2866 Y
5 3034 Y
4 3132 Y
3 3169 Y
2 3147 Y
1 3091 Y
0 2738 Y

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49 2719 Y
48 2955 Y
47 ***3* Y
46 3135 Y
45 3074 Y
44 2982 Y
43 2831 Y
42 2747 Y
41 2981 Y
40 3078 Y
39 3141 Y
38 3122 Y
37 2759 Y
36 3083 Y
35 3122 Y
34 2782 Y
33 641 Y
32 3097 Y
31 3145 Y
30 3124 Y
29 2817 Y
28 2798 Y
27 3105 Y
26 3138 Y
25 3047 Y
24 2925 Y
23 3125 Y
22 2857 Y
21 3124 Y
20 2884 Y
19 2841 Y
18 3121 Y
17 3155 Y
16 2846 Y
15 3123 Y
14 3126 Y
13 3165 Y
12 3155 Y
11 3026 Y
10 3169 Y
9 3119 Y
8 3090 Y
7 2940 Y
6 2866 Y
5 3034 Y
4 3132 Y
3 3169 Y
2 3146 Y
1 3090 Y
0 2737 Y

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49 2718 Y
48 2954 Y
47 ***3* Y
46 3133 Y
45 3073 Y
44 2981 Y
43 2830 Y
42 2747 Y
41 2980 Y
40 3077 Y
39 3140 Y
38 3120 Y
37 2758 Y
36 3081 Y
35 3120 Y
34 2781 Y
33 671 Y
32 3095 Y
31 3144 Y
30 3122 Y
29 2816 Y
28 2797 Y
27 3104 Y
26 3137 Y
25 3046 Y
24 2923 Y
23 3124 Y
22 2856 Y
21 3122 Y
20 2882 Y
19 2841 Y
18 3120 Y
17 3134 Y
16 2846 Y
15 3123 Y
14 3125 Y
13 3165 Y
12 3155 Y
11 3025 Y
10 3169 Y
9 3118 Y
8 3089 Y
7 2938 Y
6 2865 Y
5 3034 Y
4 3131 Y
3 3167 Y
2 3145 Y
1 3089 Y
0 2074 Y

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49 2718 Y
48 2954 Y
47 ***3* Y
46 3133 Y
45 3072 Y
44 2980 Y
43 2830 Y
42 2746 Y
41 2980 Y
40 3076 Y
39 3140 Y
38 3120 Y
37 2758 Y
36 3081 Y
35 3120 Y
34 2781 Y
33 672 Y
32 3095 Y
31 3144 Y
30 3122 Y
29 2816 Y
28 2797 Y
27 3104 Y
26 3137 Y
25 3045 Y
24 2923 Y
23 3123 Y
22 2855 Y
21 3122 Y
20 2882 Y
19 2840 Y
18 3120 Y
17 3134 Y
16 2845 Y
15 3121 Y
14 3124 Y
13 3164 Y
12 3154 Y
11 3024 Y
10 3168 Y
9 3117 Y
8 3088 Y
7 2938 Y
6 2865 Y
5 3033 Y
4 3131 Y
3 3167 Y
2 3145 Y
1 3089 Y
0 2073 Y

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49 2718 Y
48 2953 Y
47 ***3* Y
46 3133 Y
45 3073 Y
44 2981 Y
43 2830 Y
42 2746 Y
41 2980 Y
40 3076 Y
39 3139 Y
38 3120 Y
37 2758 Y
36 3081 Y
35 3120 Y
34 2781 Y
33 672 Y
32 3095 Y
31 3144 Y
30 3121 Y
29 2815 Y
28 2797 Y
27 3103 Y
26 3136 Y
25 3045 Y
24 2923 Y
23 3123 Y
22 2854 Y
21 3122 Y
20 2882 Y
19 2840 Y
18 3120 Y
17 3134 Y
16 2845 Y
15 3121 Y
14 3124 Y
13 3164 Y
12 3154 Y
11 3024 Y
10 3167 Y
9 3117 Y
8 3088 Y
7 2938 Y
6 2864 Y
5 3032 Y
4 3131 Y
3 3167 Y
2 3144 Y
1 3089 Y
0 2073 Y

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RUN NO. 22 T/C'S 51-100

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49	2631	Y	49	2631	Y	49	2831	Y	49	2831	Y	49	2831	Y
48	3143	Y	48	3142	Y	48	3142	Y	48	3142	Y	48	3142	Y
47	***5*	Y	47	***5*	Y	47	***5*	Y	47	***5*	Y	47	***5*	Y
46	2689	Y	46	2689	Y	46	2689	Y	46	2689	Y	46	2689	Y
45	3084	Y	45	3083	Y	45	3083	Y	45	3082	Y	45	3083	Y
44	2793	Y	44	2793	Y	44	2793	Y	44	2792	Y	44	2793	Y
43	2828	Y	43	2828	Y	43	2828	Y	43	2828	Y	43	2828	Y
42	3018	Y	42	3018	Y	42	3018	Y	42	3018	Y	42	3018	Y
41	3109	Y	41	3109	Y	41	3109	Y	41	3108	Y	41	3109	Y
40	3154	Y	40	3154	Y	40	3154	Y	40	3153	Y	40	3154	Y
39	3146	Y	39	3145	Y	39	3145	Y	39	3145	Y	39	3145	Y
38	3050	Y	38	3059	Y	38	3059	Y	38	3059	Y	38	3059	Y
37	2945	Y	37	2945	Y	37	2945	Y	37	2945	Y	37	2944	Y
36	582	Y	36	2947	Y	36	2947	Y	36	2947	Y	36	2946	Y
35	3101	Y	35	3101	Y	35	3101	Y	35	3101	Y	35	3100	Y
34	3158	Y	34	3158	Y	34	3157	Y	34	3158	Y	34	3157	Y
33	3195	Y	33	3194	Y	33	3194	Y	33	3195	Y	33	3194	Y
32	3189	Y	32	3188	Y	32	3188	Y	32	3188	Y	32	3187	Y
31	3139	Y	31	3138	Y	31	3137	Y	31	3138	Y	31	3137	Y
30	3053	Y	30	3053	Y	30	3053	Y	30	3053	Y	30	3052	Y
29	1-***5*	Y	29	***5*	Y	29	***5*	Y	29	***5*	Y	29	***5*	Y
28	1-***5*	Y	28	***5*	Y	28	***5*	Y	28	***5*	Y	28	***5*	Y
27	1-***5*	Y	27	***5*	Y	27	***5*	Y	27	***5*	Y	27	***5*	Y
26	583	Y	26	583	Y	26	2349	Y	26	2349	Y	26	2349	Y
25	2322	Y	25	2323	Y	25	2324	Y	25	2324	Y	25	2324	Y
24	2199	Y	24	2200	Y	24	2201	Y	24	2201	Y	24	2201	Y
23	2014	Y	23	2014	Y	23	2016	Y	23	2016	Y	23	2016	Y
22	3262	Y	22	3262	Y	22	3263	Y	22	3262	Y	22	3262	Y
21	3172	Y	21	3173	Y	21	3173	Y	21	3173	Y	21	3172	Y
20	3026	Y	20	3026	Y	20	3027	Y	20	3027	Y	20	3026	Y
19	2870	Y	19	2870	Y	19	2870	Y	19	2870	Y	19	2871	Y
18	3333	Y	18	3333	Y	18	3333	Y	18	3333	Y	18	3333	Y
17	3260	Y	17	3261	Y	17	3260	Y	17	3260	Y	17	3260	Y
16	3179	Y	16	3179	Y	16	3179	Y	16	3179	Y	16	3179	Y
15	3158	Y	15	3158	Y	15	3158	Y	15	3158	Y	15	3159	Y
14	3322	Y	14	3322	Y	14	3322	Y	14	3322	Y	14	3322	Y
13	3241	Y	13	3241	Y	13	3241	Y	13	3241	Y	13	3241	Y
12	3083	Y	12	3083	Y	12	3083	Y	12	3083	Y	12	3083	Y
11	2883	Y	11	2883	Y	11	2883	Y	11	2883	Y	11	2884	Y
10	2693	Y	10	2693	Y	10	2693	Y	10	2693	Y	10	2693	Y
9	2556	Y	9	2555	Y	9	2555	Y	9	2555	Y	9	2556	Y
8	2311	Y	8	2311	Y	8	2311	Y	8	2311	Y	8	2312	Y
7	2002	Y	7	2004	Y	7	2002	Y	7	2002	Y	7	2004	Y
6	2739	Y	6	2738	Y	6	2738	Y	6	2738	Y	6	2738	Y
5	2955	Y	5	2954	Y	5	2955	Y	5	2955	Y	5	2954	Y
4	3074	Y	4	3072	Y	4	3072	Y	4	3072	Y	4	3072	Y
3	3135	Y	3	3134	Y	3	3134	Y	3	3134	Y	3	3133	Y
2	3106	Y	2	3106	Y	2	3105	Y	2	3105	Y	2	3105	Y
1	2994	Y	1	2993	Y	1	2993	Y	1	2994	Y	1	2993	Y
0	2862	Y	0	2861	Y	0	2861	Y	0	2861	Y	0	2861	Y

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TABLE D-2. Top End Surface Temperatures (°F)
Run No.

Location No.	1	2	2r1	2r2	2r3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	170	157	145	140	133	168	168	151	169	160	145	150	157	136	161	148	134	154	156	144	152	133	83	102	138
2	164	157	147	140	134	169	168	156	157	156	143	153	158	133	160	146	136	156	155	142	151	133	84	102	137
3	169	158	149	137	133	168	163	157	166	156	148	148	156	134	162	148	136	153	155	142	153	134	84	102	141
4	171	157	142	140	133	167	168	152	167	157	146	153	157	135	162	142	135	155	158	142	154	133	83	102	136
5	166	157	142	135	134	166	168	150	165	160	147	151	157	132	162	147	135	155	155	145	153	133	83	103	135
6	166	158	146	141	133	172	169	154	169	161	147	149	157	134	161	151	134	155	156	144	154	134	83	103	141
7	167	156	141	136	134	164	170	152	168	160	143	148	156	134	159	146	135	153	157	143	153	130	84	104	136
8	167	159	143	138	135	163	168	153	170	151	146	145	157	136	159	148	134	154	155	142	154	134	82	103	137
9	170	155	142	138	138	171	167	153	169	156	140	146	158	134	160	146	136	153	157	142	151	134	84	103	142
10	165	159	146	140	137	165	165	147	167	159	145	150	152	128	155	146	134	152	159	140	153	133	83	103	140
11	180	165	150	149	145	179	164	160	175	163	149	160	164	142	169	153	139	162	160	147	160	139	86	106	152
12	177	165	151	149	144	180	175	159	172	167	154	160	163	142	167	157	142	162	161	148	161	141	86	106	149
13	170	165	152	142	145	177	176	161	174	167	152	161	163	142	166	158	141	164	166	149	161	141	85	106	145
14	177	161	151	147	144	173	173	160	172	168	153	164	164	140	165	156	139	163	164	147	161	140	86	106	146
15	180	167	155	152	149	179	160	145	156	169	159	164	168	150	171	-	-	-	-	-	-	-	86	-	151
16	172	163	141	130	137	165	165	160	169	163	144	155	156	136	161	148	138	155	161	142	158	139	83	102	143
17	170	162	152	141	141	173	153	156	160	165	160	154	158	131	150	149	138	158	161	148	159	141	80	104	144
18	162	162	153	146	141	165	159	156	159	163	151	159	155	142	164	147	134	155	159	147	161	139	83	103	128

Bottom End Surface Temperatures

Location No.	1	2	2r1	2r2	2r3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	137	135	126	118	114	134	137	133	135	165	153	154	158	139	168	116	111	119	125	124	124	112	87	83	140
2	134	134	124	115	114	132	132	132	132	163	148	149	154	140	164	114	113	120	124	123	125	113	85	83	139
3	129	130	122	115	110	128	127	127	128	157	143	148	150	137	159	116	113	120	125	125	125	113	84	83	135
4	125	128	119	112	108	127	125	126	124	154	144	146	148	135	157	116	113	120	124	124	125	113	83	83	133
5	125	127	117	110	107	126	121	125	123	148	137	142	146	130	150	115	112	119	124	124	124	112	83	83	129
6	127	127	117	114	109	126	121	125	120	149	139	141	147	134	157	112	108	119	124	123	126	113	83	83	128
7	131	131	120	116	111	131	123	130	129	155	145	149	150	138	160	116	112	119	124	121	125	113	86	83	135
8	129	131	121	115	111	130	129	127	129	155	143	148	152	134	159	111	107	118	122	124	127	110	84	83	133
9	141	144	137	129	121	141	143	132	135	175	150	170	176	145	201	125	132	130	133	137	134	131	101	87	149
10	139	141	132	115	121	139	135	135	122	180	146	161	164	144	187	125	130	129	134	136	132	131	97	86	147
11	132	138	130	125	119	129	121	133	121	171	143	156	158	142	177	125	130	129	133	139	133	132	94	86	139
12	138	140	132	125	120	137	131	136	126	186	152	169	169	144	189	126	131	128	133	137	135	134	98	86	145
13	134	130	120	117	112	129	129	131	122	155	146	147	153	133	163	112	110	118	123	122	123	110	83	83	134
14	128	128	118	112	107	125	122	127	123	152	138	145	147	132	157	111	108	117	120	121	121	111	81	83	132
15	123	125	116	108	105	123	120	123	117	147	140	140	144	127	152	112	108	116	119	119	121	109	81	83	126
16	128	128	119	115	108	128	124	122	126	148	145	147	148	132	157	112	108	116	120	121	124	111	84	83	134
17	129	126	118	115	113	131	130	128	123	158	137	144	152	131	157	115	102	111	123	120	123	110	81	83	133
18	129	133	121	108	113	130	126	129	129	151	140	150	152	137	160	113	109	112	123	119	118	110	84	82	132
19	129	130	122	113	110	128	123	128	127	155	144	145	151	135	159	114	109	118	122	120	122	111	84	83	132
20	124	127	119	107	106	123	102	121	125	153	133	136	146	132	149	111	110	117	122	119	119	111	81	83	128
21	120	129	114	110	106	121	120	118	116	140	141	133	145	128	143	113	110	118	122	120	123	113	81	83	118
22	124	128	118	104	109	121	120	120	121	145	132	135	145	129	150	114	109	119	122	122	125	109	84	83	129
23	127	129	119	112	110	125	124	127	126	154	141	137	148	134	157	110	107	117	119	121	122	109	84	82	131
24	120	123	118	106	110	123	123	124	119	143	134	135	152	129	149	110	100	113	120	117	120	109	81	82	125

TOP VIEW

SIDE VIEW

BOTTOM VIEW

SIDE VIEW

FIGURE D-1. Cask Surface Temperature Measurement Locations

FIGURE D-2. Axial Temperature Profiles - Run No. 1

FIGURE D-3. Axial Temperature Profiles - Run No. 2

FIGURE D-4. Axial Temperature Profiles - Run No. 2r1

FIGURE D-5. Axial Temperature Profiles - Run No. 2r2

FIGURE D-6. Axial Temperature Profiles - Run No. 2r3

FIGURE D-7. Axial Temperature Profiles - Run No. 3

FIGURE D-8. Axial Temperature Profiles - Run No. 4

FIGURE D-9. Axial Temperature Profiles - Run No. 5

FIGURE D-10. Axial Temperature Profiles - Run No. 6

FIGURE D-11. Axial Temperature Profiles - Run No. 7

FIGURE D-12. Axial Temperature Profiles - Run No. 8

FIGURE D-13. Axial Temperature Profiles - Run No. 9

FIGURE D-14. Axial Temperature Profiles - Run No. 10

FIGURE D-15. Axial Temperature Profiles - Run No. 11

FIGURE D-16. Axial Temperature Profiles - Run No. 12

FIGURE D-17. Axial Temperature Profiles - Run No. 13

FIGURE D-18. Axial Temperature Profiles - Run No. 14

FIGURE D-19. Axial Temperature Profiles - Run No. 15

FIGURE D-20. Axial Temperature Profiles - Run No. 16

FIGURE D-21. Axial Temperature Profiles - Run No. 17

FIGURE D-22. Axial Temperature Profiles - Run No. 18

FIGURE D-23. Axial Temperature Profiles - Run No. 19

FIGURE D-24. Axial Temperature Profiles - Run No. 20

FIGURE D-25. Axial Temperature Profiles - Run No. 21

FIGURE D-26. Axial Temperature Profiles - Run No. 22

FIGURE D-27. Orientation Effects on Axial Temperature Profiles for Vacuum, 0.5 KW, Vertical, Horizontal, and 25° Conditions.

FIGURE D-28. Orientation Effects on Diagonal Temperature Profiles for Vacuum, 0.5 KW, Vertical, Horizontal, and 25° Conditions.

FIGURE D-29. Orientation Effects on Axial Temperature Profiles for Air, 0.5 KW, Vertical, Horizontal, and 25° Conditions.

FIGURE D-30. Orientation Effects on Diagonal Temperature Profiles for Air, 0.5 KW, Vertical, Horizontal, and 25° Conditions.

FIGURE D-31. Orientation Effects on Axial Temperature Profiles for Helium, 0.5 KW, Vertical, Horizontal, and 25° Conditions.

FIGURE D-32. Orientation Effects on Diagonal Temperature Profiles for Helium, 0.5 KW, Vertical, Horizontal, and 25° Conditions.

FIGURE D-33. Backfill Effects on Axial Temperature Profiles for Vertical, 0.5 KW, Vacuum, Air, and Helium Conditions.

FIGURE D-34. Backfill Effects on Diagonal Temperature Profiles for Vertical, 0.5 KW, Vacuum, Air, and Helium Conditions.

FIGURE D-35. Backfill Effects on Axial Temperature Profiles for 25°, 0.5 KW, Vacuum, Air, and Helium Conditions.

FIGURE D-36. Backfill Effects on Diagonal Temperature Profiles for 250, 0.5 KW, Vacuum, Air, and Helium Conditions.

FIGURE D-37. Backfill Effects on Axial Temperature Profiles for Horizontal, 0.5 KW, Vacuum, Air, and Helium Conditions.

FIGURE D-38. Backfill Effects on Diagonal Temperature Profiles for Horizontal, 0.5 KW, Vacuum, Air, and Helium Conditions.

THE FOLLOWING TABLES ARE FOR THE PURPOSE OF
DETERMINING THE CORRECTION FACTOR FOR THE
DENSITY OF THE SAMPLES.

TABLE 1
CORRECTION FACTOR FOR DENSITY OF SAMPLES

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