

Report of Tests  
Elesco Type "TP" Exhaust Steam Injector  
With L-18 and L-19 Injector Nozzles  
Locomotive 3911  
September - December 1940

Report of Tests of Elesco Type "TP"  
Exhaust Steam Injector with L-18 and  
L-19 Injector Nozzles  
Locomotive 3911

This report covers the tests conducted on Locomotive 3911 on the Elesco Type "TP" Exhaust Steam Injector.

The exhaust steam injector was tested with two different sets of tubes, designated as L-18 and L-19.

Tests were also run using the Nathan Type 4000 Live Steam Injector for comparative purposes.

Summary

No differences were found between the fuel savings and evaporation with the L-18 and L-19 injector tubes. Therefore all curves apply to either set of tubes.

The Elesco injector proved to be simple to operate and reliable with a good range. Compared with the live steam injector, it showed fuel savings, and an increase in boiler capacity.

Fuel savings are shown by the following tabulation:

Lbs. of Coal Fired Per Hr. With Elesco Injector	Elesco Compared with Live Steam Injector	
	Ibs. Coal Saved Per Hour	Per Cent Saving
7000	470	6.29
8000	560	6.54
9000	650	7.02
10000	790	7.32
11000	930	7.80
12000	1080	8.26
13000	1240	8.71
14000	1420	9.21
15000	1620	9.75
16000	1820	10.21
17000	2040	10.71
18000	2300	11.33
19000	2620	12.12
20000	3080	13.34

Figure No. 3 shows fuel savings graphically.

The following tabulation shows the evaporation ratios and evaporations with both the Elesco and Live Steam Injector.

Lbs. of Coal Fired per Hr. Both Injectors	Lbs of Water Evaporated per Lb. of Coal Fired		Lbs. Water Evaporated Per Hr.		Per cent Increase in Evap- oration
	Elesco Injector	Live Steam Injector	Elesco Injector	Live Steam Injector	
7000	5.39	5.05	37730	35350	6.73
8000	5.30	4.94	42400	39520	7.29
9000	5.20	4.83	46800	43470	7.66
10000	5.11	4.72	51100	47200	8.26
11000	5.02	4.61	55220	50710	8.89
12000	4.92	4.50	59040	54000	9.33
13000	4.83	4.39	62790	57070	10.02
14000	4.74	4.28	66560	59920	10.75
15000	4.64	4.17	69600	62550	11.27
16000	4.55	4.06	72800	64960	12.07
17000	4.46	3.95	75820	67150	12.91
18000	4.37	3.84	78660	69120	13.80
19000	4.27	3.73	81130	70870	14.48
20000	4.18	3.62	83600	72400	15.47

Fuel savings are shown graphically by Figure No. 3 and evaporation ratios and evaporation ratios are shown by Fig. No. 1 in this report.

#### Territory and Trains

Tests were run in both directions between Laramie and Green River, and Green River and Ogden. All tests were made in freight service taking whatever train and tonnage was available. The tests therefore represent every day performance.

#### Locomotive:

Locomotive 3911 is equipped with multiple stacks, multiple jet exhaust nozzles, a Labyrinth front end, and secondary air admitted over the fire with 28-2 1/4 inch tubes.

The front end dimensions are shown by the following tabulation.

Type Nozzle----- Multiple Jet

Area Nozzle - Square inches -----	56.55
Nozzle tip to Bottom of Front End - Inches -----	25 3/32
Nozzle Tip to Bottom of Stack Flare - Inches -----	15 3/4
Total Length of Stack Including Flare - Inches -----	57 7/8
Inside Diameter of Stack at Choke - Inches -----	24 1/2
Inside Diameter of Stack at Top - Inches -----	29 1/2

The important locomotive dimensions are shown by the following tabulation.

General Classification -----	4-6-6-4
Union Pacific Classification -----	CSA
Service-----	Freight
Starting Tractive Effort - Pounds -----	97400
Weight Locomotive - Pounds -----	566000
Weight Locomotive and Tender Loaded - Pounds -----	876000
Tender Water Capacity - Gallons -----	18106
Tender Coal Capacity - Pounds -----	44000
Expansion of Steam -----	Single
Number of Cylinders -----	4
Cylinder Diameter - Inches -----	22
Cylinder Stroke - Inches -----	32
Valve Gear -----	Walschaert

#### Valves

Diameter - Inches -----	12
Full Gear Travel - Inches -----	7 1/2
Lap - Inches -----	1 3/8
Lead - Inches -----	1/4
Exhaust Clearance - Inches -----	1/8

#### Boiler

Working Pressure - Lbs per Sq. In. -----	255
Length Between Flue Sheets - Feet-Inches -----	22-0
Number 2 1/4 inch Diameter Tubes -----	222
Number 5 1/2 inch Diameter Flues -----	60

#### Firebox

Length - Inches -----	313 1/16
Width - Inches -----	108 1/4
Grate Area - Square Feet -----	108.25
Number Arch Tubes -----	5
Gaines Wall in Firebox	

#### Heating Surface - Square Feet

Firebox and Combustion Charber -----	548
Arch Tubes -----	77
Boiler Tubes -----	2864
Boiler Flues -----	1892
Total Evaporative Heating Surface -----	5581

Superheater Heating Surface	-----	1650
Total Heating Surface	-----	7031

Description of Elesco Type "TP" Exhaust Steam Injector

The Type "TP" Elesco Exhaust Steam Injector tested on Locomotive 3911 uses exhaust steam supplemented by high pressure steam for its operation.

In case exhaust steam is not available as when standing or working very low back pressures, live steam throttled to a low pressure is automatically supplied to the low pressure injector nozzles.

The change from live to exhaust or exhaust to live operation is automatically controlled by back pressure. Whenever the exhaust steam pressure is high enough, the injector will automatically operate on exhaust steam. Likewise whenever the exhaust steam pressure is too low for exhaust steam operation, the injector will automatically operate on live steam.

The injector stability is good primarily due to the exhaust steam flow regulator. The regulator is actuated by two bellows, one low and one high pressure. The low pressure bellows is connected to the overflow chamber. Its movement is resisted by the high pressure bellows which is connected to the high steam pressure chamber in the injector. If it were not for the regulator, whenever too much exhaust steam were condensed for the water being handled the injector would spill. The regulator automatically throttles exhaust steam to the secondary exhaust passage whenever conditions are such that throttling is necessary to maintain stability. The high pressure bellows automatically compensates for variations in boiler pressure.

On Locomotive 3911, the injector is located on the bottom of the smoke box door. A centrifugal pump, located under the cab, pumps water from the tender to the injector.

Only two operating levers are required in the cab, one for the steam valve, and one for water regulation. A light is located in the cab which lights up whenever the injector spills.

Operating Characteristics of the Elesco Type "TP" Exhaust Steam Injector.

The injector is started by opening the steam valve first to its priming position. This starts the pump and as soon as it delivers water to the injector the steam valve

is opened wide and the injector is in operation. To shut off the injector takes the single operation of closing the steam valve.

With the injector operating, in case the water valve is opened too wide and the injector spills or the water valve is cut too fine and the injector breaks it is only necessary to readjust the water and the injector will automatically restart.

The range of the injector is good. With L-18 nozzles and 80 degree Fahr. tank water the minimum delivery is 42500 pounds while the maximum delivery is 103000 pounds of tank water and condensate per hour. With L-19 nozzles and 80 degree Fahr. tank water the minimum delivery is 48400 pounds and the maximum delivery is 117300 pounds of tank water and condensate per hour.

An injector without a pump loses capacity as the water level in the tank falls. With the pump there is no loss of capacity. It is due to the pump delivering water under pressure to the injector, that the injector will restart by merely increasing the water valve adjustment in case the injector breaks because of cutting the water too fine.

Data:

All data necessary for the determination of boiler and injector performance were taken. Coal consumption was determined by measurements of the coal space at the start of a run, before and after taking coal, and at the end of a run. Tank water consumption was determined by measurements of the water in the tank at the start of a run, before and after taking water, and at the end of a run. All blow downs were timed in order to determine the weight of water blown off. A continuous record was kept of the train movement. A continuous record was also kept of the time the injector was operating on exhaust steam, on live steam, or shut off. A venturi meter was applied to the suction line between the pump and the tank. Thus the rate at which tank water was being delivered to the injector was always known. The venturi meter was of great value during the test not only for determining the range but also for determining the amount of tank water delivered to the injector on live steam operation.

Pertaining to the injector tests the following pressures were taken, (1) boiler, (2) exhaust stand, (3) exhaust in the injector, and (4) live steam nozzle. The following temperatures were taken, (1) tank water, (2) delivery to the boiler, and (3) exhaust steam in the injector.

Delivery temperatures were taken with a distant reading cable thermometer and also with the potentiometer on the tests of the L-18 tubes. On tests of the L-19 tubes the cable thermometer was checked against a mercury thermometer whenever the locomotive was standing and the injector operating.

All instruments were calibrated before and frequently during the tests.

Of interest but not necessary for determining the performance of the injector, pressures were taken of the pump delivery, secondary exhaust, and overflow.

#### Compiled Data and Graphical Presentation

The data taken during the tests and all the calculated results are shown in condensed form on sheets in this report under the following headings:

1. General Performance
2. Average Pressures and Temperatures
3. Injector Performance
4. Fuel, Water, and Evaporation
5. Evaporation and Temperature Rise Due to Exhaust Steam Condensed by Exhaust Steam Injector
6. Fuel Saved by Operation of Exhaust Steam Injector

The boiler performance and fuel savings by operation of the exhaust steam injector are shown graphically by three figures, namely:

Figure No. 1. Relation between Firing Rate and Evaporation Ratio and Relation between Firing Rate and Evaporation, Live Steam and Elesco Exhaust Steam Injectors.

Figure No. 2. Relation between Firing Rate and Boiler Heat Absorption Rate.

Figure No. 3. Relation between Fuel Fired and Fuel Saved by the Elesco Exhaust Steam Injector.

#### Criterion of Performance for Evaluating Heat and Fuel Savings by Operation of the Exhaust Steam Injector.

If it were possible to exactly duplicate runs, always pulling the same train, running at the same speed under the same weather conditions, the fuel saved by an exhaust steam injector could be determined directly by making a number of runs with the live steam injector and then comparing them with a number of runs using the exhaust steam injector.

On this test, runs were made with the live steam injector to determine evaporation, evaporation ratios, and the heat absorbed by the boiler. As shown by Figure No. 2 and the tabulation on Page 2, the Elesco Exhaust Steam Injector compared with the live steam injector shows a decided increase in evaporation and evaporation ratios. However, this data was not used directly for the determination of fuel savings.

Fuel savings were determined by making use of the known fact that regardless of what device is used to feed the boiler, a definite relation exists between the firing rate and the boiler heat absorption rate. It follows that the fuel saved by feed water heating is due to the fact that the boiler is required to supply less heat for a given evaporation. That is, the boiler is relieved of furnishing the heat supplied by the feedwater heater which is recovered in the exhaust steam condensed.

Referring to Figure No. 2, an example is given of the determination of fuel saved by operation of the exhaust steam injector. Figure No. 2 shows the relation between the firing rate and the boiler heat absorption rate. This curve holds true regardless of what device is used to feed the boiler. On any run the heat absorbed by the boiler is calculated and from Figure No. 2 the corresponding firing rate is determined. If the live steam injector had been used for the same run, the required heat absorption is determined from the temperature rise due to exhaust steam and the corresponding firing rate determined from Figure No. 2. The fuel saved for the run is the difference in the firing rates multiplied by the running time.

In this report all exhaust steam injector performances are based upon data for the entire trip. As an example if when working the locomotive the temperature rise due to exhaust steam were 100 degrees Fahr. but due to some of the territory being down grade one half of the tank water were fed to the boiler with the injector on live steam operation, the net temperature rise due to exhaust steam for the trip would be only slightly more than 50 degrees Fahr.

Since the territory between Laramie and Ogden is up and down grade, the fuel savings are less than would be obtained on a more nearly level territory.

#### L-18 versus L-19 Injector Tubes

Tests showed no difference between the fuel savings and boiler performance with L-18 and L-19 tubes. Also the L-18 tubes have ample capacity to supply the boiler.

However, from an operating standpoint the L-19 tubes are preferred mostly because minimum delivery temperatures are about 200 while with the L-18 they are as low as 180 degrees Fahr. on live steam operation with maximum delivery.

On the same operation delivery temperatures are always higher with the L-19 tubes due to a larger live steam nozzle.

Conclusions:

The Elesco Type "TP" Exhaust Steam Injector is a reliable boiler feeding device. The injector is stable with a good range. Compared with the live steam injector substantial fuel savings are shown and the evaporation of the boiler is increased.

Office of the Vice President  
Research and Mechanical Standards  
Omaha, February 5, 1941

#### FUEL SAVED BY OPERATION OF ELESCO EXHAUST STEAM INJECTOR

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DATE 1940	BOILER PRESSURE POUNDS PER SQ. IN. GAUGE	TANK WATER TEMP. °F	TEMP. RISE DUE TO EXHAUST STEAM °F	BLOW DOWN POUNDS TOTAL	WATER ACT- UALLY EVAPO- RATED BY BOILER POUNDS TOTAL	RUNNING TIME HOURS	MILLIONS OF BTU'S AB- SORBED BY EVAPORATIVE HEATING SURFACE PER HOUR IF BOILER WERE FED BY LIVE STEAM INJ.	COAL PER HOUR FROM CURVE EXHAUST STEAM INJECTOR OPER.	COAL RATE DIFFERENCE POUNDS PER HOUR	COAL SAVED FOR TRIP POUNDS		
<b>ELESKO INJECTOR WITH L-18 TUBES</b>												
SEPT. 28	249.3	58	94.0	0	94208	1.3403	75.41	82.01	15174	17132	1958	2624
OCT. 1-2	253.1	57	75.5	0	83593	1.0567	85.98	91.93	18474	20877	2403	2563
OCT. 16	247.2	56	71.8	0	92742	1.3833	73.55	78.36	14662	16002	1340	1854
OCT. 18	248.4	54	88.2	2439	92627	1.3167	76.67	83.03	15534	17461	1927	2537
OCT. 22	245.4	56	87.6	1616	94265	1.1333	90.30	97.72	20136	23800	3764	4266
OCT. 31	240.0	51	75.7	0	87629	1.1333	84.88	90.74	18057	20336	2269	2571
<b>OGDEN TO ECHO 39.9 MILES EASTBOUND</b>												
SEPT. 28	249.6	60	77.6	4112	192895	3.0667	68.77	73.78	13370	14724	1354	4152
OCT. 1-2	247.5	56	75.4	3016	168389	2.5556	72.36	77.42	14341	15749	1408	3598
OCT. 16	250.3	56	66.9	10908	192208	3.2167	66.83	71.05	12850	13986	1136	3654
OCT. 18	245.4	55	76.7	5286	146500	2.3167	69.72	74.75	13627	14986	1359	3148
OCT. 22	247.7	54	68.1	2521	183780	2.7334	74.40	79.04	14892	16224	1332	3641
OCT. 31	249.2	52	56.0	3546	144735	2.4500	66.45	69.83	12750	13657	907	2222
<b>ECHO TO CARTER 77.3 MILES EASTBOUND</b>												
SEPT. 28	248.5	58	75.5	2056	90101	1.4830	66.68	71.37	12811	14072	1261	1870
OCT. 1-2	244.4	54	63.1	1508	78147	1.2500	68.08	73.62	13184	14681	1497	1871
OCT. 16	245.1	55	45.8	7953	76836	1.3833	64.22	67.02	12163	12900	737	1019
OCT. 18	249.4	55	70.3	1627	68348	1.1667	64.82	69.03	12321	13441	1120	1307
OCT. 22	250.3	52	66.5	689	82662	1.6000	57.29	60.75	10437	11288	851	1362
OCT. 31	241.4	51	41.4	1773	47419	1.2500	43.40	45.03	7000	7446	446	558
<b>CARTER TO GREEN RIVER 58.4 MILES EASTBOUND</b>												
SEPT. 28	248.5	58	75.5	2056	90101	1.4830	66.68	71.37	12811	14072	1261	1870
OCT. 1-2	244.4	54	63.1	1508	78147	1.2500	68.08	73.62	13184	14681	1497	1871
OCT. 16	245.1	55	45.8	7953	76836	1.3833	64.22	67.02	12163	12900	737	1019
OCT. 18	249.4	55	70.3	1627	68348	1.1667	64.82	69.03	12321	13441	1120	1307
OCT. 22	250.3	52	66.5	689	82662	1.6000	57.29	60.75	10437	11288	851	1362
OCT. 31	241.4	51	41.4	1773	47419	1.2500	43.40	45.03	7000	7446	446	558
<b>OGDEN TO GREEN RIVER 175.3 MILES EASTBOUND</b>												
SEPT. 28	249.1	59	81.1	6168	377204	5.8903	69.76	75.05	13649	15071	1422	8646
OCT. 1-2	248.4	56	77.3	4524	330489	4.8722	74.25	79.62	14851	16400	1549	8032
OCT. 16	248.2	56	63.4	18861	361786	5.9833	67.78	71.81	13102	14191	1089	6527
OCT. 18	247.5	55	78.7	9352	307475	4.8001	70.43	75.63	13657	15229	1372	6992
OCT. 22	247.7	54	72.9	4826	360707	5.4667	72.69	77.56	14432	15800	1368	9269
OCT. 31	245.2	51	59.5	5319	279783	4.8333	64.81	68.32	12318	13243	925	5351
<b>GREEN RIVER TO CARTER 58.4 MILES WESTBOUND</b>												
OCT. 1	243.8	56	76.8	4187	133473	1.9500	75.33	80.76	15151	16745	1594	3108
OCT. 17	241.4	53	70.1	189	121315	1.6347	81.81	87.02	17068	18859	1791	2928
OCT. 18-19	246.7	57	62.0	1220	92884	1.4167	72.77	76.89	14451	15597	1146	1624
<b>CARTER TO OGDEN 117.2 MILES WESTBOUND</b>												
OCT. 17	247.4	57	42.6	11182	150378	4.3972	39.29	40.86	6046	6429	383	1684
OCT. 18-19	251.1	54	34.6	8266	124993	2.9000	49.43	51.50	8520	9024	504	1462
<b>GREEN RIVER TO OGDEN 175.6 MILES WESTBOUND</b>												
OCT. 17	244.1	55	54.4	11371	271693	5.0319	50.81	53.35	8853	9487	634	4612
OCT. 18-19	248.5	55	46.0	9486	217877	4.3167	57.09	59.83	10390	12050	1660	3086

#### FUEL SAVED BY OPERATION OF ELESCO EXHAUST STEAM INJECTOR

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DATE 1940	BOILER PRESSURE POUNDS PER SQ. IN. GAUGE	TANK WATER TEMP. OF	TEMP. RISE DUE TO EXHAUST STEAM OF	BLOW DOWN POUNDS TOTAL	WATER ACT- UALLY EVAP- RATED BY BOILER POUNDS TOTAL	RUNNING TIME HOURS	MILLIONS OF BTU'S AB- SORBED BY EVAPORATIVE HEATING SURFACE PER HOUR		COAL PER HOUR FROM CURVE	COAL RATE DIFFERENCE POUNDS PER HOUR	COAL SAVED FOR TRIP POUNDS
							ACTUAL	IF BOILER WERE FED BY LIVE STEAM INJ.			
<b>ELESCO INJECTOR WITH L-19 TUBES</b>											
							OGDEN TO ECHO 39.9 MILES EASTBOUND				
DEC. 2	250.5	50	80.0	283	85952	1,1333	83.80	89.20	17484	19692	2208
DEC. 4	248.5	49	84.7	566	91136	1,1833	84.18	90.69	17832	20314	2482
DEC. 6	246.0	50	65.1	0	93256	1,2333	82.40	88.83	17258	19550	2292
							ECHO TO CARTER 77.3 MILES EASTBOUND				
DEC. 2	247.1	53	50.3	3388	173783	2,6833	73.01	76.33	14516	15437	921
DEC. 4	246.9	55	77.7	6338	157404	2,4000	72.39	77.69	14619	15826	1207
DEC. 6	246.2	52	79.4	7228	187993	2,7167	76.45	82.16	15471	17181	1710
							CARTER TO GREEN RIVER 58.4 MILES EASTBOUND				
DEC. 2	247.3	48	71.9	5807	71314	1,3167	61.13	65.34	11383	12458	1075
DEC. 4	242.6	46	85.3	3843	77660	1,2667	67.87	73.06	13127	14530	1403
DEC. 6	244.0	49	77.8	4089	80467	1,2000	74.59	80.07	14943	16536	1593
							OGDEN TO GREEN RIVER 175.6 MILES EASTBOUND				
DEC. 2	248.3	51	62.7	9478	331049	5,1333	72.19	76.35	14295	15443	1148
DEC. 4	246.1	51	81.5	10747	326200	4,8500	74.08	81.19	14805	16876	2071
DEC. 6	245.7	51	80.5	11317	361716	5,1500	77.44	83.27	15754	17534	1780
							GREEN RIVER TO CARTER 58.4 MILES WESTBOUND				
DEC. 3	251.0	47	72.9	378	99910	1,5500	71.30	76.02	14054	15349	1295
DEC. 5	249.6	47	86.1	808	125220	1,7500	78.25	84.45	15986	17919	1933
DEC. 7	244.6	49	84.0	0	111222	1,4167	85.79	92.38	16404	21090	2686
							CARTER TO OGDEN 117.2 MILES WESTBOUND				
DEC. 3	253.9	54	46.9	9174	142140	3,2500	49.15	52.23	8451	9202	751
DEC. 5	250.8	55	57.8	3405	160582	3,4667	51.83	54.56	9105	9771	666
DEC. 7	246.9	53	40.1	9503	120277	3,2000	43.48	45.11	7068	7466	398
							GREEN RIVER TO OGDEN 175.6 MILES WESTBOUND				
DEC. 3	252.1	52	57.3	9552	242050	4,8000	56.30	59.91	10195	11078	883
DEC. 5	250.2	52	70.1	4213	285802	5,2167	60.69	64.59	11273	12263	990
DEC. 7	245.6	51	60.3	9503	231499	4,6167	56.46	59.61	10234	11000	766

## FUEL SAVED BY OPERATION OF ELESCO EXHAUST STEAM INJECTOR

- 3 -

DATE 1940	BOILER PRESSURE POUNDS PER SQ. IN. GAUGE	TANK WATER TEMP. °F	TEMP. RISE DUE TO EXHAUST STEAM °F	BLOW DOWN POUNDS TOTAL	WATER ACT- UALLY EVAP- ORATED BY BOILER		RUNNING TIME HOURS	MILLIONS OF BTU'S AB- SORBED BY EVAPORATIVE HEATING SURFACE PER HOUR IF BOILER WERE FED BY LIVE STEAM INJ.		COAL PER HOUR FROM CURVE EXHAUST STEAM INJECTOR OPER.		COAL RATE DIFFERENCE POUNDS PER HOUR	COAL SAVED FOR TRIP POUNDS							
					POUNDS	TOTAL		ACTUAL	LIVE STEAM INJECTOR OPER.	LIVE STEAM INJECTOR OPER.										
<b>ELESCO INJECTOR WITH L-18 TUBES</b>																				
LARAMIE TO HANNA 77.1 MILES WESTBOUND																				
OCT. 24	245.9	52	80.9	1532	92639	1.4000	73.75	79.28	14716	16297	1581	2213								
OCT. 28	243.1	49	67.5	944	87893	1.7667	55.28	58.68	9946	10776	830	1466								
NOV. 6	247.8	44	78.9	1021	99603	1.8167	60.58	64.95	11245	12365	1110	2017								
HANNA TO GREEN RIVER 173.9 MILES WESTBOUND																				
OCT. 24	244.9	55	54.6	2877	191068	3.8667	55.36	58.10	9966	10634	668	2583								
OCT. 28	246.3	47	67.9	4465	199042	4.3500	51.05	54.23	8915	9690	775	3371								
NOV. 6	248.7	45	70.2	7391	215063	4.0667	59.23	63.07	10910	11868	958	3896								
LARAMIE TO GREEN RIVER 251.0 MILES WESTBOUND																				
OCT. 25	245.3	54	63.2	4409	283707	5.2667	60.25	63.73	11148	12034	886	4796								
OCT. 28	245.3	48	67.8	5409	286935	6.1167	52.27	55.52	9212	10005	793	4837								
NOV. 6	248.4	45	72.9	8412	314666	5.8834	59.64	63.65	11010	12013	1003	5913								
GREEN RIVER TO BITTER CREEK 60.3 MILES EASTBOUND																				
OCT. 25	245.5	53	76.0	5331	104890	1.8000	64.68	69.34	12284	13524	1240	2232								
NOV. 1	251.9	45	85.0	1160	128551	1.8167	77.66	83.73	15817	17687	1870	3397								
NOV. 7	248.8	43	79.1	1375	122295	1.8167	74.46	79.84	14808	16467	1659	3014								
BITTER CREEK TO HANNA 113.6 MILES EASTBOUND																				
OCT. 25	249.9	56	65.1	12967	188204	3.4667	61.07	64.71	11368	12292	924	3203								
NOV. 1	251.6	48	70.6	2320	197115	3.2000	68.40	72.80	13270	14459	1189	3805								
NOV. 7	248.4	49	76.5	4957	201957	3.2000	69.85	74.79	13662	14997	1335	4272								
HANNA TO LARAMIE 77.1 MILES EASTBOUND																				
OCT. 25	246.4	57	58.7	10615	116264	2.2500	58.71	62.02	10783	11655	872	1962								
NOV. 1	245.9	51	84.4	1160	133574	1.9500	74.79	80.62	14997	16703	1706	3327								
NOV. 7	251.5	49	83.3	3583	140700	2.1000	73.69	79.41	14700	16336	1636	3436								
GREEN RIVER TO LARAMIE 251.0 MILES EASTBOUND																				
OCT. 25	247.7	55	66.0	28913	409358	7.5167	61.23	65.01	11354	12371	1017	7397								
NOV. 1	250.5	48	78.6	4640	459240	6.9667	72.60	77.84	14405	15869	1464	10529								
NOV. 7	249.5	46	79.2	9915	464952	7.1167	72.16	77.45	14270	15757	1487	10722								

## GENERAL PERFORMANCE - LOCOMOTIVE 3911

DATE 1940	NUMBER OF CARS LOADS    EMPTYs	NO. OF STOPS	TONS	TON MILES NOT CORRECTED FOR HELPER G.M.T.M.	DURATION OF TEST						TOTAL POUNDS OF WATER AC- TUALLY EVAP. BY BOILER	TOTAL POUNDS OF COAL FIRED	PER G.M.T.M.			AVERAGE SPEED M.P.H.	HELPER USED				
					TOTAL HOURS MINUTES		DEAD HOURS MINUTES		RUNNING HOURS MINUTES				POUNDS WATER		POUNDS COAL						
<b>ELESCO INJECTOR WITH L-18 TUBES</b>																					
SEPT. 28	63	1	2	3043	121,416	1 22	0 2	1 20	94208	19002	1337.1	269.7	29.9	NOTE 1							
OCT. 1-2	63	0	1	3100	123,690	1 4	0 0	1 4	83953	19070	1169.6	265.7	37.4	" 1							
OCT. 16	65	4	2	3307	131,949	1 25	0 2	1 23	92742	20837	1211.2	272.1	28.8	" 1							
OCT. 18	56	13	4	3240	129,276	1 31	0 12	1 19	92627	19033	1433.0	294.5	30.3	" 2							
OCT. 22	63	11	1	3250	129,675	1 8	0 0	1 8	94265	20206	1252.7	268.5	35.2	" 1							
OCT. 31	56	11	1	3000	119,700	1 8	0 0	1 8	87629	19095	1464.1	319.0	35.2	" 2							
OGDEN TO ECHO 39.9 MILES EASTBOUND																					
SEPT. 28	63-71	8	5	3354	259,293	4 6	1 2	3 4	192895	41052	854.9	181.9	25.2	NOTE 1							
OCT. 1-2	63	0	4	3100	239,630	3 10	0 37	2 33	168389	39700	813.6	191.8	30.2	" 1							
OCT. 16	65-68	4	9	3348	258,808	5 8	1 55	3 13	192208	40655	858.2	181.5	24.0	" 1							
OCT. 18	56	13	4	3240	250,452	3 20	1 1	2 19	146500	38016	1031.2	267.6	33.4	" 2							
OCT. 22	63	11	4	3250	251,225	3 16	0 32	2 44	183780	41888	847.0	193.0	28.3	" 1							
OCT. 31	56-57-58	18	6	3187	246,328	3 30	1 10	2 20	144735	33438	1035.3	239.2	33.1	" 2							
ECHO TO CARTER 77.3 MILES EASTBOUND																					
SEPT. 28	76	8	1	3591	209,714	1 29	0 0	1 29	90101	15304	429.6	73.0	39.4	NOTE 1							
OCT. 1-2	63	0	1	3100	181,040	1 15	0 0	1 15	78147	16526	431.7	91.3	46.7	" 1							
OCT. 16	68	4	1	3383	197,567	1 23	0 0	1 23	76836	17212	388.9	87.1	42.2	" 1							
OCT. 18	56	25	1	3480	203,232	1 10	0 0	1 10	68348	15652	672.6	154.0	50.1	" 2							
OCT. 22	63	11	1	3250	189,800	1 36	0 0	1 36	82662	16716	435.5	88.1	36.5	" 1							
OCT. 31	60	0	1	3300	192,720	1 15	0 0	1 15	47419	9750	492.1	101.2	46.7	" 2							
CARTER TO GREEN RIVER 58.4 MILES EASTBOUND																					
SEPT. 28	63-71-76	1-8	8	3362	590,423	7 38	1 45	5 53	377204	75358	745.7	149.0	29.8	NOTE 1							
OCT. 1-2	63	0	6	3100	544,360	6 0	1 8	4 52	330489	75296	718.8	163.8	36.0	" 1							
OCT. 16	65-68	4	12	3350	588,325	8 13	2 12	6 1	361786	78704	726.3	158.0	29.2	" 1							
OCT. 18	56	13-25	9	3320	582,960	6 50	2 2	4 48	307475	72701	997.2	235.8	36.6	" 2							
OCT. 22	63	11	6	3250	570,700	6 21	0 53	5 28	360707	78810	748.3	163.5	32.1	" 1							
OCT. 31	58	10	8	3182	558,748	6 37	1 54	4 43	279783	62283	945.2	210.4	37.2	" 2							
OGDEN TO GREEN RIVER 175.6 MILES EASTBOUND																					
OCT. 1	0	108	1	2940	171,695	1 57	0 0	1 57	133473	28439	777.4	165.6	29.9	NO HELPER							
OCT. 17	1	97	2	2700	157,680	1 40	0 2	1 38	121315	27280	769.4	173.0	35.8	"							
OCT. 18-19	44	1	2	1800	105,120	1 35	0 10	1 25	92884	22270	883.6	211.9	41.2	"							
GREEN RIVER TO CARTER 58.4 MILES WESTBOUND																					
OCT. 17	1	97	9	2700	316,440	5 8	0 44	4 24	150378	32704	475.2	103.3	26.6	NO HELPER							
OCT. 18-19	44-43-42	1	3	1754	205,550	3 20	0 26	2 54	124993	31893	608.1	155.2	40.4	"							
CARTER TO OGDEN 117.2 MILES WESTBOUND																					
OCT. 17	1	97	11	2700	474,120	6 59	0 57	6 2	271693	59984	573.0	126.5	29.1	NO HELPER							
OCT. 18-19	44-43-42	1	5	1769	310,670	5 8	0 49	4 19	217877	54163	701.3	174.3	40.7	"							

NOTE 1: 5000 CLASS HELPER OGDEN TO WAHSATCH

NOTE 2: 3900 CLASS HELPER OGDEN TO WAHSATCH AND EVANSTON TO GREEN RIVER

## GENERAL PERFORMANCE - LOCOMOTIVE 3911

DATE 1940	NUMBER OF CARS LOADS	NUMBER OF CARS EMPTY'S	NO. OF STOPS	TONS	TON MILES NOT CORRECTED FOR HELPER G.M.T.M.	DURATION OF TEST			TOTAL POUNDS OF WATER ACTUALLY EVAP. BY BOILER	TOTAL POUNDS OF COAL FIRED	PER G.M.T.M.		AVERAGE SPEED M.P.H.	HELPER USED	
						TOTAL HOURS MINUTES	DEAD HOURS MINUTES	RUNNING HOURS MINUTES			POUNDS WATER	POUNDS COAL			
<b>ELESCO INJECTOR WITH L-19 TUBES</b>															
DEC. 2	62	0	1	2991	119,341	1 8	0 0	1 8	85952	16407	1241.1	236.9	35.2	NOTE 1	
DEC. 4	70	1	1	3000	119,700	1 11	0 0	1 11	91136	18584	1522.7	310.5	33.7	" 2	
DEC. 6	50	19	1	3170	126,483	1 14	0 0	1 14	93256	17318	1270.6	235.9	32.4	" 1	
OGDEN TO ECHO 39.9 MILES EASTBOUND															
DEC. 2	62	0	6	2991	231,204	3 20	0 39	2 41	173783	36546	870.2	183.0	28.8	NOTE 1	
DEC. 4	70	1	4	3000	231,900	3 4	0 40	2 24	157404	34541	1357.5	297.9	32.2	" 2	
DEC. 6	50-51	25	5	3325	256,987	3 19	0 36	2 43	187993	41518	846.5	187.0	28.5	" 1	
ECHO TO CARTER 77.3 MILES EASTBOUND															
DEC. 2	62	0	1	2991	174,674	1 19	0 0	1 19	71314	17051	408.3	97.6	44.4	NOTE 1	
DEC. 4	70	1	1	3000	175,200	1 16	0 0	1 16	77660	17628	886.5	201.2	46.1	" 2	
DEC. 6	51	25	1	3368	196,691	1 12	0 0	1 12	80467	11451	409.1	88.7	46.7	" 1	
CARTER TO GREEN RIVER 58.4 MILES EASTBOUND															
DEC. 2	62	0	8	2991	525,219	6 4	0 56	5 8	331049	70004	746.2	157.8	34.2	NOTE 1	
DEC. 4	70	1	6	3000	526,800	5 50	0 59	4 51	326200	70753	1238.4	268.6	36.2	" 2	
DEC. 6	50-51	19-25	7	3304	580,161	6 15	1 6	5 9	361716	76287	734.9	155.0	34.1	" 1	
OGDEN TO GREEN RIVER 175.6 MILES EASTBOUND															
DEC. 2	62	0	8	2991	525,219	6 4	0 56	5 8	331049	70004	746.2	157.8	34.2	NOTE 1	
DEC. 4	70	1	6	3000	526,800	5 50	0 59	4 51	326200	70753	1238.4	268.6	36.2	" 2	
DEC. 6	50-51	19-25	7	3304	580,161	6 15	1 6	5 9	361716	76287	734.9	155.0	34.1	" 1	
GREEN RIVER TO CARTER 58.4 MILES WESTBOUND															
DEC. 3	50	2	1	2300	134,320	1 33	0 0	1 33	99910	19067	743.8	142.0	37.7	NO HELPER	
DEC. 5	19	66	1	3100	181,040	1 45	0 0	1 45	125220	24688	691.7	136.4	33.4	"	
DEC. 7	23-22	24	3	1798	104,974	1 58	0 33	1 25	111222	18323	1059.5	174.5	41.2	"	
CARTER TO OGDEN 117.2 MILES WESTBOUND															
DEC. 3	50	2	3	2300	269,560	3 50	0 35	3 15	142140	29358	527.3	108.9	36.1	NO HELPER	
DEC. 5	19	66	4	3100	363,320	3 56	0 28	3 28	160582	31741	442.0	87.4	33.8	"	
DEC. 7	22-18-20	24	8	1699	199,097	4 20	1 8	3 12	120277	22570	604.1	113.4	36.6	"	
GREEN RIVER TO OGDEN 175.6 MILES WESTBOUND															
DEC. 3	50	2	4	2300	403,880	5 30	0 42	4 48	242050	48425	599.3	119.9	36.6	NO HELPER	
DEC. 5	19	66	5	3100	544,360	5 49	0 36	5 13	285802	56429	525.0	103.7	33.7	"	
DEC. 7	23-22-18-20	24	11	1731	304,071	6 31	1 54	4 37	231499	50893	761.3	134.5	40.2	"	

NOTE 1: 5000 CLASS HELPER OGDEN TO WAHSATCH

NOTE 2: 3900 CLASS HELPER OGDEN TO WAHSATCH AND EVANSTON TO GREEN RIVER

## GENERAL PERFORMANCE - LOCOMOTIVE 3911

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DATE 1940	NUMBER OF CARS LOADS    EMPTY'S	NO. OF STOPS	TONS	TON MILES NOT CORRECTED FOR HELPER		DURATION OF TEST						TOTAL POUNDS OF WATER ACTUALLY EVAP. BY BOILER	TOTAL POUNDS OF COAL FIRED	PER G.M.T.H.			AVERAGE SPEED M.P.H.	HELPER USED							
				G.M.T.H.		TOTAL HOURS MINUTES	DEAD HOURS MINUTES	RUNNING HOURS MINUTES						POUNDS WATER	POUNDS COAL	CORRECTED FOR HELPER									
<b>ELESCO INJECTOR WITH L-18 TUBES</b>																									
LARAMIE TO HANNA 77.1 MILES WESTBOUND																									
OCT. 24	46	0	1	1736	133,846	1 24	0 0	1 24				92639	17389	692.1	129.9	55.1	NO HELPER								
OCT. 28	52	0	1	1620	124,902	1 46	0 0	1 46				87893	16911	703.7	135.4	43.6	"								
NOV. 6	42	16	1	2280	175,788	1 49	0 0	1 49				99603	19873	566.6	113.1	42.4	"								
HANNA TO GREEN RIVER 173.9 MILES WESTBOUND																									
OCT. 24	46-30	0	5	1589	276,406	6 13	2 11	4 2				191068	33740	691.3	122.1	43.1	NO HELPER								
OCT. 28	52	0	4	1620	281,718	4 41	0 30	4 11				199042	37651	706.5	133.6	41.6	"								
NOV. 6	42-39-37-35	16	5	2120	368,711	5 30	1 26	4 4				215063	41426	583.3	112.4	42.8	"								
LARAMIE TO GREEN RIVER 251.0 MILES WESTBOUND																									
OCT. 24	46-30	0	6	1634	410,252	8 13	2 47	5 26				283707	51129	691.5	124.6	46.2	NO HELPER								
OCT. 28	52	0	5	1620	406,620	6 36	0 39	5 57				286935	54562	705.7	134.2	42.2	"								
NOV. 6	42-39-37-35	16	6	2169	544,499	7 35	1 42	5 53				314666	61299	577.9	112.6	42.7	"								
GREEN RIVER TO BITTER CREEK 60.3 MILES EASTBOUND																									
OCT. 25	45	0	2	3000	180,900	1 50	0 2	1 48				104890	23284	579.8	128.7	33.5	NO HELPER								
NOV. 1	57-53	51-18	2	3485	210,130	2 3	0 14	1 49				128551	30836	611.8	146.7	33.2	"								
NOV. 7	56	15	1	3250	195,975	1 49	0 0	1 49				122295	24270	624.0	123.9	33.2	"								
BITTER CREEK TO HANNA 113.6 MILES EASTBOUND																									
OCT. 25	50-47	0	4	3353	380,889	4 28	1 0	3 28				188204	41247	494.1	108.3	32.8	NO HELPER								
NOV. 1	53	18	2	3250	369,200	3 33	0 21	3 12				197115	43365	533.9	117.9	35.5	"								
NOV. 7	56-57	15	3	3256	369,858	3 43	0 31	3 12				201957	41754	546.0	112.9	35.5	"								
HANNA TO LARAMIE 77.1 MILES EASTBOUND																									
OCT. 25	47	0	1	3312	255,355	2 15	0 0	2 15				116264	24747	455.3	96.9	24.3	NO HELPER								
NOV. 1	53	18	1	3250	250,575	1 57	0 0	1 57				133574	28096	533.1	112.1	39.5	"								
NOV. 7	57	15	1	3285	253,274	2 6	0 0	2 6				140700	27551	555.5	108.6	36.7	"								
GREEN RIVER TO LARAMIE 251.0 MILES EASTBOUND																									
OCT. 25	45-50-47	0	7	3256	817,154	9 4	1 33	7 31				409358	89278	501.0	109.3	33.4	NO HELPER								
NOV. 1	57-53	51-18	5	3306	829,905	8 15	1 17	6 58				459240	102297	553.4	123.3	36.0	"								
NOV. 7	56-57	15	5	3263	819,107	8 6	0 59	7 7				464952	93584	567.6	114.3	35.3	"								

## GENERAL PERFORMANCE - LOCOMOTIVE 3911

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DATE 1940	NUMBER OF CARS LOADS	NUMBER OF CARS EMPTYs	NO. OF STOPS	TONS	TON MILES NOT CORRECTED FOR HELPER G.M.T.M.	DURATION OF TEST				TOTAL POUNDS OF WATER AC- TUALLY EVAP. BY BOILER	TOTAL POUNDS OF COAL FIRED	PER G.M.T.M. CORRECTED FOR HELPER		AVERAGE SPEED M.P.H.	HELPER USED		
						TOTAL HOURS	MINUTES	DEAD HOURS	MINUTES	RUNNING HOURS	MINUTES	POUNDS WATER	POUNDS COAL				
<b>NATHAN TYPE "4000" LIVE STEAM INJECTOR</b>																	
LARAMIE TO HANNA 77.1 MILES WESTBOUND																	
NOV. 2	36	0	2	1490	114,879	1	35	0	1	1	34	85799	20592	746.7	179.2	49.2	NO HELPER
NOV. 4	46	3	1	1735	133,769	1	47	0	0	1	47	98020	25293	732.8	189.1	43.2	"
NOV. 8	49	7	1	2350	181,185	1	39	0	0	1	39	88983	21262	491.1	117.3	46.7	"
HANNA TO GREEN RIVER 173.9 MILES WESTBOUND																	
NOV. 2	36	0	3	1490	259,111	4	28	0	35	3	53	194425	38308	750.4	147.8	44.8	NO HELPER
NOV. 4	46-43	3	7	1723	299,705	4	59	0	35	4	24	199257	38308	664.8	127.8	39.5	"
NOV. 8	49	7	3	2350	408,665	4	36	0	29	4	7	214976	44800	526.0	109.6	42.2	"
LARAMIE TO GREEN RIVER - 251.0 MILES WESTBOUND																	
NOV. 2	36	0	5	1490	373,990	6	10	0	43	5	27	280224	58900	749.3	157.5	46.1	NO HELPER
NOV. 4	46-43	3	8	1727	433,474	6	54	0	43	6	11	297277	63601	685.8	146.7	40.6	"
NOV. 8	49	7	4	2350	589,850	6	25	0	39	5	46	303959	66062	515.3	112.0	43.5	"
GREEN RIVER TO BITTER CREEK 60.3 MILES EASTBOUND																	
NOV. 3	60-58	8-7	4	3185	192,081	2	30	0	36	1	54	127697	35587	604.8	185.3	31.7	NO HELPER
NOV. 5	52	13	1	2900	174,870	1	50	0	0	1	50	116441	27008	665.9	154.4	32.9	"
NOV. 9	43	22	4	3200	192,960	2	17	0	14	2	3	130398	32340	675.8	167.6	29.4	"
BITTER CREEK TO HANNA 113.6 MILES EASTBOUND																	
NOV. 3	58	7	7	3158	358,749	4	46	1	12	3	34	210140	53565	585.8	149.3	31.9	NO HELPER
NOV. 5	52	13	2	2900	329,440	3	49	0	31	3	18	198859	44977	603.6	136.5	34.4	"
NOV. 9	43	22	2	3200	363,520	3	51	0	37	3	14	207562	41659	571.0	114.6	35.1	"
HANNA TO LARAMIE 77.1 MILES EASTBOUND																	
NOV. 3	58	7	1	3158	243,482	2	8	0	0	2	8	118712	29957	487.6	123.0	36.1	NO HELPER
NOV. 5	52	13	1	2900	223,590	2	2	0	0	2	2	121064	25476	541.5	113.9	37.9	"
NOV. 9	43	22	1	3200	246,720	2	4	0	0	2	4	126955	25996	514.6	105.4	37.3	"
GREEN RIVER TO LARAMIE 251.0 MILES EASTBOUND																	
NOV. 3	58	7	12	3165	794,312	9	24	1	48	7	36	456549	119109	574.8	150.0	33.0	NO HELPER
NOV. 5	52	13	4	2900	727,900	8	5	0	55	7	10	436364	97461	599.5	133.9	35.0	"
NOV. 9	43	22	7	3200	803,200	8	36	1	15	7	21	464915	100003	578.8	124.5	34.1	"

## AVERAGE PRESSURES AND TEMPERATURES

8905

## AVERAGE PRESSURES AND TEMPERATURES

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DATE 1940	PRESSURE - POUNDS PER SQUARE INCH GAUGE						TEMPERATURES						SMOKE BOX GASES		
	VALVE BOILER	EXHAUST CHAMBER	EXHAUST IN STANDS	INJECTOR	LIVE STEAM NOZZLE	TANK WATER	DELIVERY TO BOILER	STEAM TO CYLINDERS RIGHT SIDE	EXHAUST BACK ENGINE	STEAM FRONT ENGINE	LEAVING 2-1/4" TUBES	LEAVING 5-1/2" FLUES	ENTERING SMOKE STACK		
<b>ELESCO INJECTOR WITH L-19 TUBES</b>															
								OGDEN TO ECHO							
DEC. 2	250.5	-	12.9	6.4	229.0	50	217	THIS DATA NOT TAKEN ON THESE TRIPS.							
DEC. 4	248.5	219.9	11.0	6.8	231.5	49	218				- DO -				
DEC. 6	246.0	223.0	12.1	7.8	228.6	50	230				- DO -				
								ECHO TO CARTER							
DEC. 2	247.1	-	12.7	7.7	231.8	53	213				- DO -				
DEC. 4	246.9	202.2	11.6	7.3	229.4	55	225				- DO -				
DEC. 6	246.2	199.8	12.8	8.8	228.0	52	236				- DO -				
								CARTER TO GREEN RIVER							
DEC. 2	247.3	-	7.6	3.9	229.0	48	222				- DO -				
DEC. 4	242.6	170.0	9.2	5.5	224.5	46	221				- DO -				
DEC. 6	244.0	177.7	11.2	7.9	225.6	49	223				- DO -				
								OGDEN TO GREEN RIVER							
DEC. 2	248.3	-	11.4	6.3	229.9	51	217				- DO -				
DEC. 4	246.1	198.4	10.7	6.6	228.6	51	222				- DO -				
DEC. 6	245.7	200.9	12.1	8.3	227.7	51	231				- DO -				
								GREEN RIVER TO CARTER							
DEC. 3	251.0	-	8.7	4.9	231.6	47	226				- DO -				
DEC. 5	249.6	217.5	11.7	7.2	230.0	47	228				- DO -				
DEC. 7	244.6	220.4	8.2	5.5	225.2	48	233				- DO -				
								CARTER TO OGDEN							
DEC. 3	253.9	-	12.2	7.7	234.7	54	231				- DO -				
DEC. 5	250.8	216.7	12.9	8.3	231.1	55	226				- DO -				
DEC. 7	246.9	202.7	9.4	6.3	225.3	53	236				- DO -				
								GREEN RIVER TO OGDEN							
DEC. 3	252.1	-	10.0	6.0	232.7	52	228				- DO -				
DEC. 5	250.2	217.1	12.3	6.6	232.4	52	227				- DO -				
DEC. 7	245.6	213.4	8.7	5.8	225.3	51	226				- DO -				

AVERAGE PRESSURES AND TEMPERATURES															
DATE 1940	PRESSURE - POUNDS PER SQUARE INCH GAUGE						TEMPERATURES								
	BOILER	VALVE CHAMBER	EXHAUST STANDS	EXHAUST INJECTOR	LIVE STEAM NOZZLE	TANK WATER	DELIVERY TO BOILER	STEAM TO CYLINDERS	EXHAUST BACK ENGINE	STEAM FRONT ENGINE	SMOKE LEAVING 2-1/4" TUBES	BOX LEAVING 5-1/2" FLUES	GASES ENTERING SMOKE STACK		
<b>ELESCO INJECTOR WITH L-18 TUBES</b>															
<b>LARAMIE TO HANNA</b>															
OCT. 24	245.9	190.5	9.8	8.3	226.0	52	218	688.0	691.2	351.8	332.0	360.8	650.0	645.0	627.0
OCT. 28	243.1	193.6	7.4	4.6	216.2	49	228	654.0	653.1	276.1	268.7	297.3	611.9	612.6	581.4
NOV. 6	247.8	209.7	7.1	5.1	228.5	44	219	695.7	687.3	296.1	274.3	308.8	643.7	654.7	615.3
<b>HANNA TO GREEN RIVER</b>															
OCT. 24	244.9	186.0	8.3	5.9	224.4	55	228	676.7	674.2	317.5	305.6	333.8	636.0	640.6	614.0
OCT. 28	246.3	195.5	8.0	3.9	226.1	47	231	662.2	658.8	286.7	280.4	310.1	623.6	621.2	591.9
NOV. 6	248.7	184.7	8.7	5.0	228.9	45	215	681.8	673.8	314.6	297.1	329.2	635.2	641.4	606.9
<b>LARAMIE TO GREEN RIVER</b>															
OCT. 24	245.3	187.6	8.9	6.8	225.0	54	224	681.2	681.0	331.2	317.3	345.8	642.2	642.6	619.8
OCT. 28	245.5	194.8	7.8	4.1	223.6	48	230	659.4	356.8	283.0	276.3	305.6	619.5	618.2	588.2
NOV. 6	248.4	192.2	8.0	5.0	228.8	45	216	686.1	678.3	308.8	290.0	322.9	637.7	645.5	609.5
<b>GREEN RIVER TO BITTER CREEK</b>															
OCT. 25	245.5	212.4	9.9	6.9	225.5	53	219	686.0	680.6	303.9	287.0	319.4	636.7	632.2	618.9
Nov. 1	251.9	219.2	10.6	7.4	232.9	45	216	706.0	696.6	330.0	310.6	338.2	656.6	651.2	636.4
Nov. 7	248.8	207.8	11.4	7.1	228.6	43	214	691.9	682.5	316.5	328.7	328.7	646.4	651.4	624.4
<b>BITTER CREEK TO HANNA</b>															
OCT. 25	249.9	207.5	9.8	7.1	229.8	56	220	675.0	674.7	307.8	304.5	327.1	625.3	624.3	604.2
NOV. 1	251.6	198.4	9.9	6.9	231.8	48	216	681.9	678.6	316.4	287.4	330.8	639.8	639.8	624.4
NOV. 7	248.4	195.0	10.9	7.6	229.1	49	221	684.7	675.3	323.4	309.9	337.9	646.8	651.4	622.7
<b>HANNA TO LARAMIE</b>															
OCT. 25	246.4	217.1	10.7	8.0	226.4	57	215	668.3	667.1	304.0	302.1	321.4	627.4	624.6	602.3
Nov. 1	245.9	205.2	11.8	8.8	224.8	51	217	679.5	674.3	321.4	310.5	337.9	651.7	642.9	625.8
NOV. 7	251.5	200.8	10.6	7.0	232.8	49	219	681.1	668.6	309.1	291.0	323.1	671.6	666.1	640.1
<b>GREEN RIVER TO LARAMIE</b>															
OCT. 25	247.7	211.1	10.1	7.2	227.6	55	219	676.7	674.7	305.8	298.9	323.6	629.7	626.5	607.7
NOV. 1	250.5	206.8	10.6	7.6	230.2	48	216	689.1	683.4	322.1	307.2	335.0	648.3	644.3	628.6
NOV. 7	249.5	200.2	10.6	7.3	230.1	46	218	687.7	675.0	317.0	301.4	330.7	654.8	656.2	628.8

## AVERAGE PRESSURES AND TEMPERATURES

## FUEL — WATER — EVAPORATION

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## FUEL → WATER → EVAPORATION

- 13 -

DATE 1940	TOTAL TANK WATER POUNDS	CONDENSATE FROM EX- HAUST STACK INJECTOR POUNDS	BLOW DOWN POUNDS	TOTAL POUNDS WATER EVAPORATED BY BOILER		POUNDS OF WATER EVAPORATED PER POUND OF COAL FIRED				POUNDS OF COAL FIRED PER HOUR OF RUNNING TIME	MILLIONS OF BTU'S ACTUALLY ABSORBED BY EVAPORATIVE HEAT- ING SURFACE PER HOUR OF RUNNING TIME	
				ADJUSTED FOR ACTUAL	ADJUSTED FOR BLOW DOWN	TOTAL POUNDS OF COAL FIRED	ADJUSTED FOR ACTUAL	ADJUSTED FOR BLOW DOWN	RUNNING TIME HOURS			
<b>ELESCO INJECTOR WITH L-19 TUBES</b>												
DEC. 2	79940	6295	283	85952	86025	16407	5.24	5.24	1.1333	14477	83.10	
DEC. 4	84680	7022	566	91136	91280	18584	4.90	4.91	1.1833	15705	84.18	
DEC. 6	86055	7201	0	93256	93256	17318	5.38	5.38	1.2333	14042	82.40	
OGDEN TO ECHO												
DEC. 2	168894	8277	3388	173783	174746	36546	4.76	4.78	2.6833	13620	73.01	
DEC. 4	152132	11610	6338	157404	159041	34541	4.56	4.60	2.4000	14392	72.39	
DEC. 6	181287	13934	7228	187993	189854	41518	4.53	4.57	2.7167	15283	76.45	
ECHO TO CARTER												
DEC. 2	72005	5116	5807	71314	72648	17051	4.18	4.27	1.3167	12950	61.13	
DEC. 4	75207	6296	3843	77660	78640	17628	4.41	4.46	1.2667	13916	67.87	
DEC. 6	78580	5976	4089	80467	81524	17451	4.61	4.67	1.2000	14543	74.59	
CARTER TO GREEN RIVER												
DEC. 2	320839	19688	9478	331049	333619	70004	4.73	4.77	5.1333	13637	72.19	
DEC. 4	312019	24928	10747	326200	328961	70753	4.61	4.65	4.8500	14588	74.08	
DEC. 6	345922	27111	11317	361716	364634	76287	4.74	4.78	5.1500	14813	77.44	
OGDEN TO GREEN RIVER												
DEC. 3	93542	6746	378	99910	100010	19067	5.24	5.25	1.5500	12301	71.30	
DEC. 5	116280	9748	808	125220	125427	24688	5.07	5.08	1.7500	14107	78.25	
DEC. 7	102660	8562	0	111222	111222	18323	6.07	6.07	1.4167	12934	85.79	
GREEN RIVER TO CARTER												
DEC. 3	144475	6839	9174	142140	144837	29358	4.84	4.93	3.2500	9033	49.15	
DEC. 5	155095	8892	3405	160582	161510	31741	5.06	5.09	3.4667	9156	51.83	
DEC. 7	124572	5208	9503	120277	122988	22570	5.33	5.45	3.2000	7053	43.48	
CARTER TO OGDEN												
DEC. 3	238017	13585	9552	242050	244847	48425	5.00	5.06	4.8000	10089	56.30	
DEC. 5	271375	18640	4213	285802	286937	56429	5.06	5.08	5.2167	10817	60.69	
DEC. 7	227232	13770	9503	231499	234210	40893	5.66	5.73	4.6167	8858	56.46	

## FUEL — WATER — EVAPORATION

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DATE 1940	TOTAL TANK WATER POUNDS	CONDENSATE FROM EX- HAUST STEAM INJECTOR POUNDS	BLOW DOWN POUNDS	TOTAL POUNDS WATER EVAPORATED BY BOILER		POUNDS OF WATER EVAPORATED PER POUND OF COAL FIRED				POUNDS OF COAL FIRED PER HOUR OF RUNNING TIME	MILLIONS OF BTU'S ACTUALLY ABSORBED BY EVAPORATIVE HEAT- ING SURFACE PER HOUR OF RUNNING TIME						
				ADJUSTED FOR ACTUAL	ADJUSTED FOR BLOW DOWN	TOTAL POUNDS OF COAL FIRED	ADJUSTED FOR ACTUAL	ADJUSTED FOR BLOW DOWN	RUNNING TIME HOURS								
<b>ELESKO INJECTOR WITH L-18 TUBES</b>																	
<b>LARAMIE TO HANNA</b>																	
OCT. 24	87235	6936	1532	92639	93030	17389	5.33	5.35	1.4000	12421	73.75						
OCT. 28	83070	5767	944	87893	88143	16911	5.20	5.21	1.7667	9572	55.28						
NOV. 6	93175	7449	1021	99603	99871	19873	5.01	5.03	1.8167	10939	60.58						
<b>HANNA TO GREEN RIVER</b>																	
OCT. 24	183732	10213	2877	191068	191825	33740	5.66	5.69	3.8667	8726	55.36						
OCT. 28	190249	13258	4465	199042	200247	37651	5.29	5.32	4.3500	8655	51.05						
NOV. 6	207969	14485	7391	215063	217035	41426	5.19	5.24	4.0667	10187	59.23						
<b>LARAMIE TO GREEN RIVER</b>																	
OCT. 24	270967	17149	4409	283707	284855	51129	5.55	5.57	5.2667	9708	60.25						
OCT. 28	273319	19025	5409	286935	288390	54562	5.26	5.29	6.1167	8920	52.27						
NOV. 6	301144	21934	8412	314666	316906	61299	5.13	5.17	5.8834	10419	59.64						
<b>GREEN RIVER TO BITTER CREEK</b>																	
OCT. 25	102505	7716	5331	104890	106263	23284	4.50	4.56	1.8000	12936	64.68						
NOV. 1	119732	9979	1160	128551	128851	30836	4.17	4.18	1.0167	16974	77.66						
NOV. 7	114725	8945	1375	122295	122657	24279	5.04	5.05	1.8167	13364	74.46						
<b>BITTER CREEK TO HANNA</b>																	
OCT. 25	188947	12224	12967	188204	191668	41347	4.56	4.65	3.4667	11898	61.07						
NOV. 1	186397	13038	2320	197115	197735	43365	4.55	4.56	3.2000	13552	68.40						
NOV. 7	192340	14574	4957	201957	203242	41754	4.84	4.87	3.2000	13048	69.85						
<b>HANNA TO LARAMIE</b>																	
OCT. 25	119820	7059	10615	116264	119096	24747	4.70	4.81	2.2500	10999	58.71						
NOV. 1	124392	10342	1160	133574	133868	28096	4.75	4.77	1.9500	14408	74.79						
NOV. 7	133212	11073	3583	140700	141622	27551	5.11	5.14	2.1000	13120	73.69						
<b>GREEN RIVER TO LARAMIE</b>																	
OCT. 25	341272	26999	28913	409358	417027	89278	4.59	4.67	7.5167	11877	61.23						
NOV. 1	430521	33359	4640	459240	460454	102297	4.49	4.50	6.9667	14684	72.60						
NOV. 7	440277	34590	9915	464952	467521	99584	4.97	5.00	7.1167	13150	72.16						

## FUEL — WATER — EVAPORATION

- 15 -

DATE 1940	TOTAL TANK WATER POUNDS	CONDENSATE FROM EX- HAUST STEAM INJECTOR POUNDS	BLOW DOWN POUNDS	TOTAL POUNDS WATER EVAPORATED BY BOILER		TOTAL POUNDS OF COAL FIRED	POUNDS OF WATER EVAPORATED PER POUND OF COAL FIRED		RUNNING TIME HOURS	POUNDS OF COAL FIRED PER HOUR OF RUNNING TIME — ACTUAL	MILLIONS OF BTU'S ACTUALLY ABSORBED BY EVAPORATIVE HEAT- ING SURFACE PER HOUR OF RUNNING TIME							
				ADJUSTED FOR ACTUAL	ADJUSTED FOR BLOW DOWN		ADJUSTED FOR ACTUAL	ADJUSTED FOR BLOW DOWN										
<b>NATHAN TYPE "4000" LIVE STEAM INJECTOR</b>																		
<b>LARAMIE TO HANNA</b>																		
Nov. 2	92565	0	6766	85799	87896	20592	4.17	4.27	1.5667	13144	64.45							
Nov. 4	102675	0	4655	98020	99449	25293	3.88	3.93	1.7833	14183	65.61							
Nov. 8	92690	0	3707	88983	90114	21262	4.19	4.24	1.6500	12886	63.53							
<b>HANNA TO GREEN RIVER</b>																		
Nov. 2	207957	0	13532	194425	198590	38308	5.08	5.18	3.8833	9865	58.91							
Nov. 4	208567	0	9310	199257	202147	38308	5.20	5.28	4.4000	8706	53.30							
Nov. 8	222390	0	7414	214976	217280	44800	4.80	4.85	4.1167	10883	61.56							
<b>LARAMIE TO GREEN RIVER</b>																		
Nov. 2	300522	0	20298	280224	286486	58900	4.76	4.86	5.4500	10806	60.50							
Nov. 4	311242	0	13965	297277	301596	63601	4.67	4.74	6.1833	10286	56.85							
Nov. 8	315080	0	11121	303959	307394	66062	4.60	4.65	5.7667	11456	62.13							
<b>GREEN RIVER TO BITTER CREEK</b>																		
Nov. 3	129380	0	1683	127697	128218	35587	3.59	3.60	1.9000	18730	79.10							
Nov. 5	112043	0	4398	107645	109015	27008	3.99	4.04	1.8333	14732	69.18							
Nov. 9	130398	0	7267	123131	125390	32348	3.81	3.88	2.0500	15779	70.81							
<b>BITTER CREEK TO HANNA</b>																		
Nov. 3	210140	0	1683	208457	208977	53565	3.89	3.90	3.5667	15018	68.78							
Nov. 5	203257	0	4398	198859	200214	44977	4.42	4.45	3.3000	13629	70.96							
Nov. 9	207562	0	7267	200295	202556	41659	4.81	4.86	3.2333	12884	73.85							
<b>HANNA TO LARAMIE</b>																		
Nov. 3	120395	0	1683	118712	119235	29957	3.96	3.98	2.1333	14043	65.50							
Nov. 5	125462	0	4398	121064	122434	25476	4.75	4.81	2.0333	12529	70.14							
Nov. 9	126955	0	7267	119688	121958	25996	4.60	4.69	2.0667	12579	68.28							
<b>GREEN RIVER TO LARAMIE</b>																		
Nov. 3	459915	0	5049	454866	456430	119109	3.82	3.83	7.6000	15672	70.44							
Nov. 5	440762	0	13194	427568	431663	97461	4.39	4.43	7.1667	13599	70.27							
Nov. 9	464915	0	21801	443114	449904	100003	4.43	4.50	7.3500	13606	71.44							

## EXHAUST STEAM INJECTOR PERFORMANCE

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DATE 1940	ELESCO INJECTOR			TANK WATER DELIVERED TO BOILER						STEAM USED						CONDENSATE		NET TEMPERATURE						
	TIME ON EXHAUST STEAM OPERATION		BY ELESCO INJECTOR LIVE STEAM OPERATION		BY RIGHT EXHAUST STEAM OPERATION		LIVE STEAM OPERATION		LIVE STEAM TOTAL		TEMPERATURE DEGREES F		USED ON EX- HAUST STEAM OPERATION		LIVE & EX- HAUST STEAM OPERATION		CONDENSATE POUNDS - X		TOTAL WATER POUNDS - #2 + X		RETURN - % OF TOTAL WATER FED TO BOILER		RISE DUE TO EX- HAUST STEAM DEGREES F - RE	
											HOURS	TANK DELIVERY WATER TO BOILER	POUNDS - S	POUNDS - P	POUNDS - X									
<b>ELESCO INJECTOR WITH L-18 TUBES</b>																								
SEPT. 28	.99305	.08615	80688	5524	0	86212	1.3403	58	224	5405	399	7996	94208	8.49	94.0									
OCT. 1-2	.94167	.12777	67882	10260	1741	78142	1.0667	57	220	5212	379	5811	83953	6.92	75.5									
OCT. 16	1.1931	.05005	82815	3760	0	86575	1.3833	56	210	6415	467	6167	92742	6.65	71.8									
OCT. 18	.95833	.09334	76338	11129	5833	87467	1.3167	54	222	5235	406	7599	95066	7.99	88.2									
OCT. 22	.98333	.06387	83803	4537	0	88340	1.1333	56	212	5298	417	7541	95881	7.86	87.6									
OCT. 31	.93333	.05278	70880	10720	3889	81600	1.1333	51	208	4913	386	6029	87629	6.88	75.7									
OGDEN TO ECHO																								
SEPT. 28	1.7806	.61944	144943	38247	0	183190	3.0667	60	224	9770	871	13817	197007	7.01	77.6									
OCT. 1-2	1.7722	.35689	133258	26365	1356	159623	2.5556	56	219	9613	753	11782	171405	6.87	75.4									
OCT. 16	1.8097	.67082	144384	46278	1389	190662	3.2167	56	214	10005	962	12454	203116	6.13	66.9									
OCT. 18	1.3806	.38612	110811	30369	3334	141180	2.3167	55	220	7445	689	10606	151786	6.99	76.7									
OCT. 22	1.9944	.30556	154220	20532	0	174752	2.7334	54	204	10851	889	11549	186301	6.20	68.1									
OCT. 31	1.5667	.30227	108906	31601	2500	140507	2.4500	52	205	8593	709	7774	148281	5.24	56.0									
ECHO TO CARTER																								
SEPT. 28	.80833	.27777	66649	19071	0	85720	1.4883	58	220	4403	400	6437	92157	6.98	75.5									
OCT. 1-2	.94167	.15833	64620	8932	0	73552	1.2500	54	225	5041	378	6103	79655	7.66	83.1									
OCT. 16	.94720	.35834	57679	23276	1528	80955	1.3833	55	212	5158	477	3834	84789	4.52	45.8									
OCT. 18	.93333	.10000	59003	6402	0	65405	1.1667	55	220	5109	367	4570	69975	6.53	70.3									
OCT. 22	.92778	.20555	63829	14291	0	78120	1.6000	52	214	5094	426	5231	83351	6.28	66.5									
OCT. 31	.48333	.35555	28137	18991	0	47128	1.2500	51	216	2577	299	2064	49192	4.20	41.4									
CARTER TO GREEN RIVER																								
SEPT. 28	3.5820	.98333	292280	62842	0	355122	5.8903	59	223	19578	1670	28250	383372	7.37	81.1									
OCT. 1-2	3.6556	.64299	265760	45557	3097	311317	4.8722	56	220	19866	1510	23696	335013	7.07	77.3									
OCT. 16	3.9500	1.0792	284878	73314	2917	358192	5.9833	56	213	21578	1906	22455	358192	5.90	63.4									
OCT. 18	3.2722	.57946	246152	47900	9167	294052	4.8001	55	220	17789	1462	22775	316827	7.19	78.7									
OCT. 22	3.9056	.57498	301852	39360	0	341212	5.4667	54	208	21243	1732	24321	365533	6.65	72.9									
OCT. 31	2.9834	.71110	207923	61312	6389	269235	4.8333	51	207	16083	1394	15867	285102	5.57	59.5									
OGDEN TO GREEN RIVER																								
OCT. 1	1.4944	.33890	106625	21347	774	127972	1.9500	56	222	7968	642	9688	137660	7.04	76.8									
OCT. 17	1.3306	.16940	98458	15222	5139	113680	1.6347	53	207	7064	573	7824	121504	6.44	70.1									
OCT. 18-19	.91667	.28333	69628	19004	0	88632	1.4167	57	209	4966	461	5472	94104	5.81	62.0									
GREEN R																								

## EXHAUST STEAM INJECTOR PERFORMANCE

DATE 1940	ELESCO INJECTOR												STEAM USED												CONDENSATE		NET TEMPERATURE	
	TIME ON EXHAUST STEAM OPERATION			TANK WATER DELIVERED TO BOILER BY ELESCO INJECTOR			BY RIGHT EXHAUST STEAM OPERATION			TEMPERATURE DEGREES F			LIVE STEAM USED ON EX- HAUST STEAM OPERATION			LIVE & EX- HAUST STEAM OPERATION			CONDENSATE POUNDS - X			TOTAL WATER FED TO BOILER POUNDS - W <sub>2</sub> + X		RETURN-% OF TOTAL WATER FED TO BOILER		RISE DUE TO EX- HAUST STEAM DEGREES F - RE		
	EXHAUST STEAM OPERATION	LIVE STEAM OPERATION	LIVE STEAM OPERATION	EXHAUST STEAM OPERATION	LIVE STEAM OPERATION	LIVE STEAM OPERATION	TOTAL W <sub>2</sub>	RUNNING TIME HOURS	TANK WATER TO BOILER	DELIVERY POUNDS - S	POUNDS - P	POUNDS - X	POUNDS - P	POUNDS - X	POUNDS - P	POUNDS - X	POUNDS - P	POUNDS - X	POUNDS - P	POUNDS - X	POUNDS - P	POUNDS - X	POUNDS - P	POUNDS - X	POUNDS - P	POUNDS - X		
<b>ELESCO INJECTOR WITH L-19 TUBES</b>																												
<b>OGDEN TO ECHO</b>																												
DEC. 2	1.0111	.01944	75678	4262	2917	79940	1.1333	50	217	6277	397	6295	86235	7.30												80.0		
DEC. 4	1.0833	.01940	82344	2336	833	84680	1.1833	49	218	6794	428	7022	91702	7.66												84.7		
DEC. 6	1.0528	.14722	75901	10154	0	86055	1.2333	50	230	6525	456	7201	93256	7.72												85.1		
<b>ECHO TO CARTER</b>																												
DEC. 2	1.54167	.30554	114152	54742	35834	168894	2.6833	53	213	9684	703	8277	177171	4.67												50.3		
DEC. 4	1.6876	.31388	130000	22132	0	152132	2.4000	55	225	10494	775	11610	163742	7.09												77.7		
DEC. 6	2.0515	.38330	143570	37717	13194	181287	2.7167	52	236	12674	917	13934	195221	7.14												79.4		
<b>CARTER TO GREEN RIVER</b>																												
DEC. 2	.97778	.10000	64442	7563	0	72005	1.3167	48	222	6070	403	5116	77121	6.63												71.9		
DEC. 4	.97500	.09722	68439	6768	0	75207	1.2667	46	221	5635	405	6296	81503	7.72												85.3		
DEC. 6	.96250	.12917	68515	10065	1250	78580	1.2000	49	223	5891	413	5976	84556	7.07												77.8		
<b>OGDEN TO GREEN RIVER</b>																												
DEC. 2	3.5306	.42498	254272	66567	38751	320839	5.1333	51	217	22031	1503	19688	340527	5.78												62.7		
DEC. 4	3.7459	.43050	280783	31236	833	312019	4.8500	51	222	22923	1608	24928	336947	7.40												81.5		
DEC. 6	4.0668	.65969	287986	57936	14444	345922	5.1500	51	231	25090	1786	27111	373033	7.27												80.5		
<b>GREEN RIVER TO CARTER</b>																												
DEC. 3	1.2625	.17500	81783	11759	9	93542	1.5500	47	226	7922	532	6746	100288	6.73												72.9		
DEC. 5	1.3931	.16720	101810	14470	3195	116280	1.7500	47	228	8684	594	9748	126028	7.73												86.1		
DEC. 7	1.0631	.30765	80027	22633	3194	102660	1.4167	48	233	6496	524	8562	111222	7.70												84.0		
<b>CARTER TO OGDEN</b>																												
DEC. 3	1.0069	1.0834	73926	70549	2639	144475	3.2500	54	231	6406	781	6839	151314	4.52												46.9		
DEC. 5	1.3333	.76944	100432	54663	2916	155095	3.4667	55	226	8350	800	8892	163987	5.42												57.8		
DEC. 7	.95833	1.1833	59932	64640	2084	124572	3.2000	53	236	5856	713	5208	129780	4.01												40.1		
<b>GREEN RIVER TO OGDEN</b>																												
DEC. 3	2.2694	1.2584	155709	82308	2639	238017	4.8000	52	228	14328	1313	13585	251602	5.40												57.3		
DEC. 5	2.7264	.93664	202242	69133	6111	271375	5.2167	52																				

## EXHAUST STEAM INJECTOR PERFORMANCE

- 18 -

DATE 1940	ELESCO INJECTOR			TANK WATER DELIVERED TO BOILER						LIVE STEAM			STEAM USED			CONDENSATE RETURN-% OF TOTAL WATER	NET TEMPERATURE RISE DUE TO EX- HAUST STEAM DEGREES F - RE			
	TIME ON		BY ELESCO INJECTOR		BY RIGHT		TEMPERATURE		LIVE & EX-		BY PUMP ON									
	EXHAUST STEAM OPERATION	LIVE STEAM OPERATION	EXHAUST STEAM OPERATION	LIVE STEAM OPERATION	LIVE STEAM OPERATION	TOTAL W <sub>2</sub>	RUNNING TIME HOURS	TANK WATER	DELIVERY TO BOILER	HAUST STEAM OPERATION	HAUST STEAM OPERATION	CONDENSATE RETURN	TOTAL WATER FED TO BOILER							
<b>ELESCO INJECTOR WITH L-18 TUBES</b>																				
<b>LARAMIE TO HANNA</b>																				
OCT. 24	.94167	.19583	72865	14370	0	87235	1.4000	52	218	5084	440	6936	94171	7.37		80.9				
OCT. 28	1.0375	.37920	60958	22112	0	83070	1.7667	49	228	5372	510	5767	88837	6.49		67.5				
NOV. 6	1.2500	.20830	80693	12482	0	93175	1.8167	44	219	6820	537	7449	100624	7.40		78.9				
<b>HANNA TO GREEN RIVER</b>																				
OCT. 24	1.6500	1.2375	108584	75148	1667	183732	3.8667	55	228	8851	1058	10213	193945	5.27		54.6				
OCT. 28	2.6250	.78889	145844	44405	2501	190249	4.3500	47	231	14135	1204	13258	203507	6.51		67.9				
NOV. 6	2.3583	.62500	161876	46093	3333	207969	4.0667	45	215	12688	1146	14485	222454	6.51		70.2				
<b>LARAMIE TO GREEN RIVER</b>																				
OCT. 24	2.5917	1.4333	181449	89518	1667	270967	5.2667	54	224	13935	1498	17149	286116	5.95		63.2				
OCT. 28	3.6525	1.16809	206802	66517	2501	273319	6.1167	48	230	19507	1714	19025	292344	6.51		67.8				
NOV. 6	3.6083	.83330	242569	58575	3333	301144	5.8834	45	216	19708	1683	21934	323078	6.79		72.9				
<b>GREEN RIVER TO BITTER CREEK</b>																				
OCT. 25	1.2306	.20000	86665	15840	2083	102505	1.8000	53	219	6630	541	7716	110221	7.00		76.0				
NOV. 1	1.5667	.15000	110233	9499	0	119732	1.8167	45	216	8703	647	9979	129711	7.69		85.0				
NOV. 7	1.4417	.21666	99062	15663	0	114725	1.8167	43	214	7869	625	8945	123670	7.23		79.1				
<b>BITTER CREEK TO HANNA</b>																				
OCT. 25	2.1028	.63469	144049	44898	2500	188947	3.4667	56	220	11541	1025	12224	201171	6.08		65.1				
NOV. 1	2.2667	.54168	152150	34247	1250	186397	3.2000	48	216	12538	1044	13038	199435	6.54		70.6				
NOV. 7	2.3834	.50692	160494	31846	1666	192340	3.2000	49	221	13007	1073	14574	206914	7.04		76.5				
<b>HANNA TO LARAMIE</b>																				
OCT. 25	1.3667	.42220	92204	27616	1250	119820	2.2500	57	215	7392	665	7059	126879	5.56		58.7				
NOV. 1	1.5167	.18333	112162	12230	0	124392	1.9500	51	217	8148	651	10342	134734	7.68		84.4				
NOV. 7	1.8250	.15000	124611	8601	0	133212	2.1000	49	219	10134	739	11071	144283	7.67		83.3				
<b>GREEN RIVER TO LARAMIE</b>																				
OCT. 25	4.7001	1.2569	322918	88354	5833	341272	7.5167	55	219	25563	2231	26999	438271	6.16		66.0				
NOV. 1	5.3500	.87501	374545	55976	1250	430521	6.9667	48	216	29389	2342	33359	463880	7.19		78.6				
NOV. 7	5.6501	.87358	384167	56110	1666	440277	7.1167	46	218	31010	2437	34590	474867	7.28		79.2				

## EVAPORATION AND TEMPERATURE RISE DUE TO EXHAUST STEAM CONDENSED BY EXHAUST STEAM INJECTOR

- 19 -

DATE 1940	RUNNING TIME HOURS	TOTAL TANK WATER FED TO BOILER - POUNDS				CONDENSATE RETURN POUNDS - X	TOTAL POUNDS WATER EVAPORATED BY BOILER			TEMPERATURE RISE DUE TO EXHAUST STEAM °F - RE	PERCENT RETURN	MILLIONS OF BTU'S AB- SORBED BY EVAPORATIVE HEATING SURFACE PER HOUR RUNNING TIME
		BY ELESKO INJECTOR	BY RIGHT STEAM OPER	ON EXHAUST STEAM OPER	TOTAL TANK WATER		TOTAL DOWN POUNDS BD	ACTUAL AE	ADJ. FOR BLOW DOWN			
<b>ELESKO INJECTOR WITH L=18 TUBES</b>												
SEPT. 28	1.3403	0	80688	5524	86212	7996	0	94208	94208	94.0	8.49	75.41
OCT. 1-2	1.0667	1741	67882	10260	78142	5811	0	83953	83953	75.5	6.92	85.98
OCT. 16	1.3833	0	82815	3760	86575	6167	0	92742	92742	71.8	6.65	73.55
OCT. 18	1.3167	5833	76338	11129	87467	7599	2439	92627	93236	88.2	7.99	76.67
OCT. 22	1.1333	0	83803	4537	88340	7541	1616	94265	94665	87.6	7.86	90.30
OCT. 31	1.1333	3889	70880	10720	81600	6029	0	87629	87629	75.7	6.88	84.88
OGDEN TO ECHO												
SEPT. 28	1.4000	0	91509	15896	107405	8774	2056	114123	114635	84.1	7.55	88.57
OCT. 1-2	1.2889	0	79034	12358	91392	7508	1508	97392	97769	84.0	7.59	82.11
OCT. 16	1.6667	1389	81610	21837	103447	6962	2955	107454	108224	69.0	6.31	71.35
OCT. 18	1.2500	1667	73598	13622	87220	6401	3659	89962	90897	74.9	6.84	79.47
OCT. 22	1.4667	0	91578	11552	103130	7134	2521	107743	108400	71.5	6.47	81.18
OCT. 31	1.3667	5556	74071	16914	90985	4932	1773	94144	94630	55.1	5.14	77.40
ECHO TO EVANSTON												
SEPT. 28	1.6667	0	53434	22351	75785	5043	2056	78772	79305	68.0	6.24	52.15
OCT. 1-2	1.2667	1356	54224	14007	68231	4274	1508	70997	71396	63.8	5.89	62.34
OCT. 16	1.5500	0	62774	24441	87215	5492	7953	84754	86873	64.4	5.92	61.97
OCT. 18	1.0667	1667	37213	16747	53960	4205	1627	56538	56953	79.7	7.23	58.30
OCT. 22	1.2667	0	62642	8980	71622	4415	0	76037	76037	63.2	5.81	66.55
OCT. 31	1.0833	2500	34835	14687	49522	2842	1773	50591	51071	57.5	5.43	52.62
EVANSTON TO CARTER												
SEPT. 28	1.4833	0	66649	19071	85720	6437	2056	90101	90626	75.5	6.98	66.68
OCT. 1-2	1.2500	0	64620	8932	73552	6103	1508	78147	78527	83.1	7.66	68.08
OCT. 16	1.3833	1528	57679	23276	80955	3834	7953	76836	79032	45.8	4.52	64.22
OCT. 18	1.1667	0	59003	6402	65405	4570	1627	68348	68773	70.3	6.53	64.82
OCT. 22	1.6000	0	63829	14291	78120	5231	689	82662	82845	66.5	6.28	57.29
OCT. 31	1.2500	0	28137	18991	47126	2064	1773	47419	47916	41.4	4.20	43.40
CARTER TO GREEN RIVER												
SEPT. 28	1.4833	0	66649	19071	85720	6437	2056	90101	90626	75.5	6.98	66.68
OCT. 1-2	1.2500	0	64620	8932	73552	6103	1508	78147	78527	83.1	7.66	68.08
OCT. 16	1.3833	1528	57679	23276	80955	3834	7953	76836	79032	45.8	4.52	64.22
OCT. 18	1.1667	0	59003	6402	65405	4570	1627	68348	68773	70.3	6.53	64.82
OCT. 22	1.6000	0	63829	14291	78120	5231	689	82662	82845	66.5	6.28	57.29
OCT. 31	1.2500	0	28137	18991	47126	2064	1773	47419	47916	41.4	4.20	43.40
GREEN RIVER TO CARTER												
OCT. 1	1.9500	774	106625	21347	127972	9688	4187	133473	134538	76.8	7.04	75.33
OCT. 17	1.6347	5139	98458	15222	113680	7824	189	121315	121364	70.1	6.44	81.81
OCT. 18-19	1.4167	0	69628	19004	88632	5472	1220	92884	93209	62.0	5.81	72.77
CARTER TO EVANSTON												
OCT. 1	1.7250	1743	88610	16742	105352	8175	4187	109340	110399	79.6	7.20	69.64
OCT. 17	1.8500	4167	67189	29861	97050	5444	3566	98928	99890	56.7	5.31	60.05
OCT. 18-19	1.0500	0	49972	16873	66845	3613	1220	69238	69570	54.1	5.13	73.99
EVANSTON TO OGDEN												
OCT. 17	2.5472	4306	15939	41893	57832	1234	7616	51450	53662	18.1	2.09	24.21
OCT. 18-19	1.8500	1667	11302	50468	61770	1031	7046	55755	57855	12.7	1.64	35.50

## EVAPORATION AND TEMPERATURE RISE DUE TO EXHAUST STEAM CONDENSED BY EXHAUST STEAM INJECTOR

- 20 -

DATE 1940	RUNNING TIME HOURS	TOTAL TANK WATER FED TO BOILER - POUNDS					TOTAL POUNDS WATER EVAPORATED BY BOILER			TEMPERATURE RISE DUE TO EXHAUST STEAM °F - RE	PERCENT RETURN	MILLIONS OF BTU'S AB- SORBED BY EVAPORATIVE HEATING SURFACE PER HOUR RUNNING TIME		
		BY ELESKO INJECTOR	ON EXHAUST STEAM OPER	ON LIVE STEAM OPER	TOTAL TANK WATER	CONDENSATE RETURN POUNDS - X	TOTAL BLOW DOWN POUNDS BD	ACTUAL AE	ADJ. FOR BLOW DOWN					
<b>ELESKO INJECTOR WITH L-19 TUBES</b>														
OGDEN TO ECHO														
DEC. 2	1.1333	2917	75678	4262	79940	6295	283	85952	86025	80.0	7.30	83.10		
DEC. 4	1.1833	833	82344	2336	84680	7022	566	91136	91280	84.7	7.66	84.18		
DEC. 6	1.2333	0	75901	10154	86055	7201	0	93256	93256	85.1	7.72	82.40		
ECHO TO EVANSTON														
DEC. 2	1.3333	6805	79955	15602	95557	6339	689	101207	101389	68.0	6.22	83.87		
DEC. 4	1.2667	0	87422	6413	93835	7682	2238	99279	99843	83.7	7.57	85.62		
DEC. 6	1.3667	3333	83267	12845	96112	8322	3232	101202	102012	89.4	7.97	81.02		
EVANSTON TO CARTER														
DEC. 2	1.3500	29029	34197	39140	73337	1938	2699	72576	73357	26.3	2.57	62.29		
DEC. 4	1.1333	0	42578	15719	58297	3928	4100	58125	59198	68.0	6.31	57.60		
DEC. 6	1.3500	9861	60303	24872	65175	5612	3996	86791	87842	68.0	6.18	71.82		
CARTER TO GREEN RIVER														
DEC. 2	1.3167	0	64442	7563	72005	5116	5807	71314	72848	71.9	6.63	61.13		
DEC. 4	1.2667	0	68439	6768	75207	6296	3843	77660	78640	85.3	7.72	67.87		
DEC. 6	1.2000	1250	68515	10065	78580	5976	4089	80467	81524	77.8	7.07	74.59		
GREEN RIVER TO CARTER														
DEC. 3	1.5500	0	81783	11759	93542	6746	378	99910	100010	72.9	6.73	71.30		
DEC. 5	1.7500	3195	101810	14470	116280	9748	808	125220	125427	86.1	7.73	78.25		
DEC. 7	1.4167	3194	80027	22633	102660	8562	0	111222	111222	84.0	7.70	85.79		
CARTER TO EVANSTON														
DEC. 3	1.2500	0	55529	12326	67855	5333	732	72456	72644	80.1	7.29	63.40		
DEC. 5	1.5167	0	83039	16256	99295	7364	1960	104699	105206	75.5	6.90	75.92		
DEC. 7	1.1333	0	46954	16163	63117	4156	3822	63451	64458	65.4	6.18	62.81		
EVANSTON TO OGDEN														
DEC. 3	2.0000	2639	18397	58223	76620	1506	8442	69684	72193	16.0	1.93	41.69		
DEC. 5	1.9500	2916	17393	38407	55800	1528	1445	55883	56304	24.7	2.67	33.10		
DEC. 7	2.0667	2084	12978	48477	61455	1052	5681	56826	58530	12.9	1.68	32.88		

## EVAPORATION AND TEMPERATURE RISE DUE TO EXHAUST STEAM CONDENSED BY EXHAUST STEAM INJECTOR

- 21

DATE 1940	RUNNING TIME HOURS	TOTAL TANK WATER FED TO BOILER - POUNDS				CONDENSATE RETURN POUNDS - X	TOTAL BLOW DOWN POUNDS BD	TOTAL POUNDS WATER EVAPORATED BY BOILER			TEMPERATURE RISE DUE TO EXHAUST STEAM °F - RE	PERCENT RETURN	MILLIONS OF BTU'S AB- SORBED BY EVAPORATIVE HEATING SURFACE PER HOUR RUNNING TIME				
		BY ELESCO INJECTOR	BY RIGHT STEAM OPER	ON EXHAUST STEAM OPER	ON LIVE STEAM OPER			ACTUAL AE	ADJ. FOR BLOW DOWN								
<b>ELESCO INJECTOR WITH L-18 TUBES</b>																	
<b>LARAMIE TO HANNA</b>																	
OCT. 24	1,4000	0	72865	14370	87235	6936	1532	92639	93030	80.9	7.37	73.75					
OCT. 28	1,7667	0	60958	22112	83070	5767	944	87893	88143	67.5	6.49	55.28					
NOV. 6	1,8167	0	80693	12482	93175	7449	1021	99603	99871	78.9	7.40	60.58					
<b>HANNA TO RAWLINS</b>																	
OCT. 24	.88333	1667	40492	18488	58980	3888	2877	59991	60748	66.4	6.18	76.00					
OCT. 28	1,0167	0	34183	11492	45675	3938	1017	48596	48852	84.4	7.94	52.46					
NOV. 6	1,0167	3333	42151	14274	56425	3486	1022	58889	55169	61.2	5.82	65.10					
<b>RAWLINS TO BITTER CREEK</b>																	
OCT. 24	1,5500	0	45905	25687	71592	4232	0	75824	75824	57.6	5.58	54.46					
OCT. 28	1,7000	1667	61087	22648	83735	6014	980	88769	89030	71.2	6.70	57.91					
<b>BITTER CREEK TO GREEN RIVER</b>																	
OCT. 24	1,4333	0	22187	30973	53160	2093	0	55253	55253	37.1	3.79	43.62					
OCT. 28	1,6333	834	50574	10265	60839	3306	2468	61677	62365	50.6	5.15	43.03					
<b>GREEN RIVER TO BITTER CREEK</b>																	
OCT. 25	1,8000	2083	86665	15840	102505	7716	5331	104890	106263	76.0	7.00	64.68					
NOV. 1	1,8167	0	110233	9499	119732	9979	1160	128551	128851	85.0	7.69	77.66					
NOV. 7	1,8167	0	99062	15663	114725	8945	1375	122295	122657	79.1	7.23	74.46					
<b>BITTER CREEK TO RAWLINS</b>																	
OCT. 24	2,2167	0	97227	23483	120710	8465	4610	124565	125774	70.5	6.55	62.43					
NOV. 1	1,9833	0	104623	18559	123182	9190	1160	131212	131518	75.7	6.94	73.16					
NOV. 7	2,0000	1667	100563	20537	121100	8983	1375	128708	129069	75.2	6.91	71.04					
<b>RAWLINS TO HANNA</b>																	
OCT. 25	1,2500	2500	46822	21415	68237	3759	8357	63639	65894	55.4	5.22	58.65					
NOV. 1	1,2167	1250	47527	15688	63215	3848	1160	65903	66217	60.4	5.74	60.65					
NOV. 7	1,2000	0	59931	11309	71240	5591	3582	73249	74173	78.6	7.28	67.87					
<b>HANNA TO LARAMIE</b>																	
OCT. 25	2,2500	1250	92204	27616	119820	7059	10615	116264	119096	58.7	5.56	58.71					
NOV. 1	1,9500	0	112162	12230	124392	10342	1160	133574	133868	84.4	7.68	74.79					
NOV. 7	2,1000	0	124611	8601	133212	11071	3583	140700	141622	83.3	7.67	73.69					

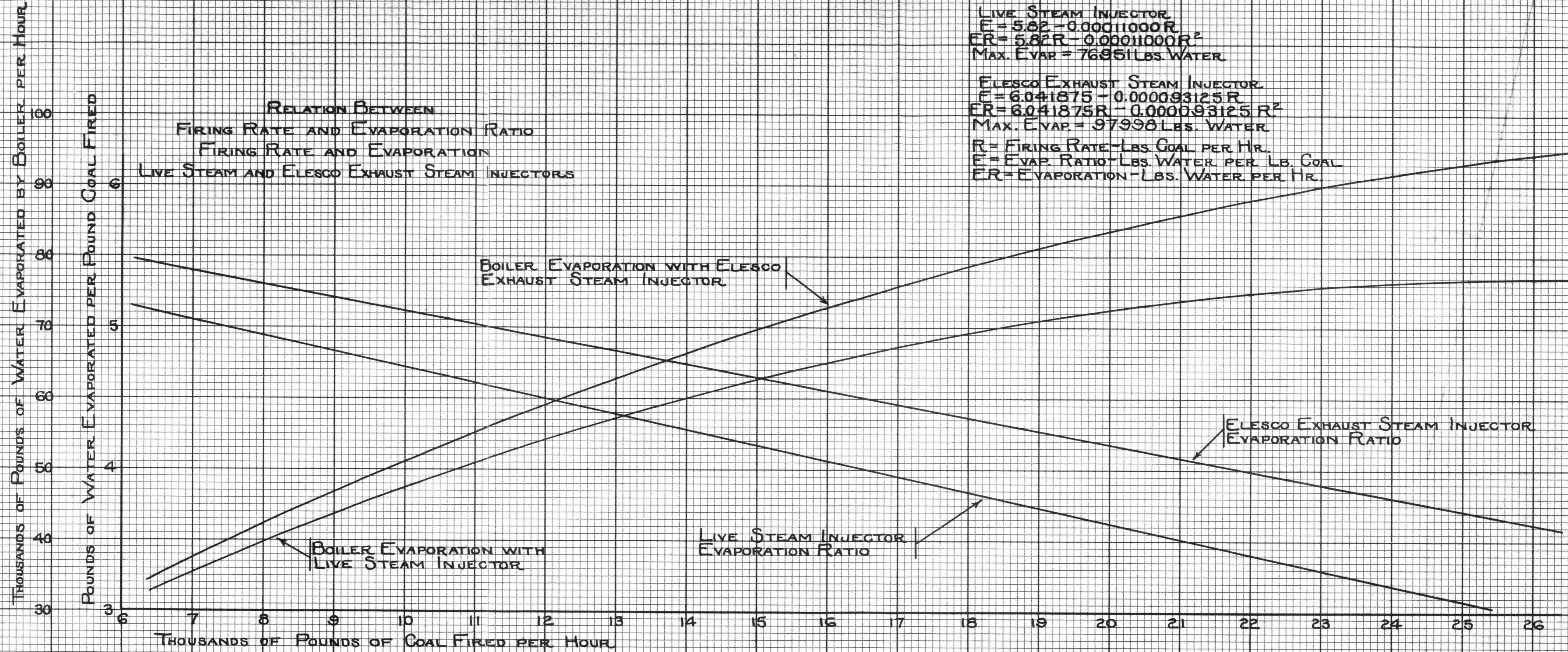
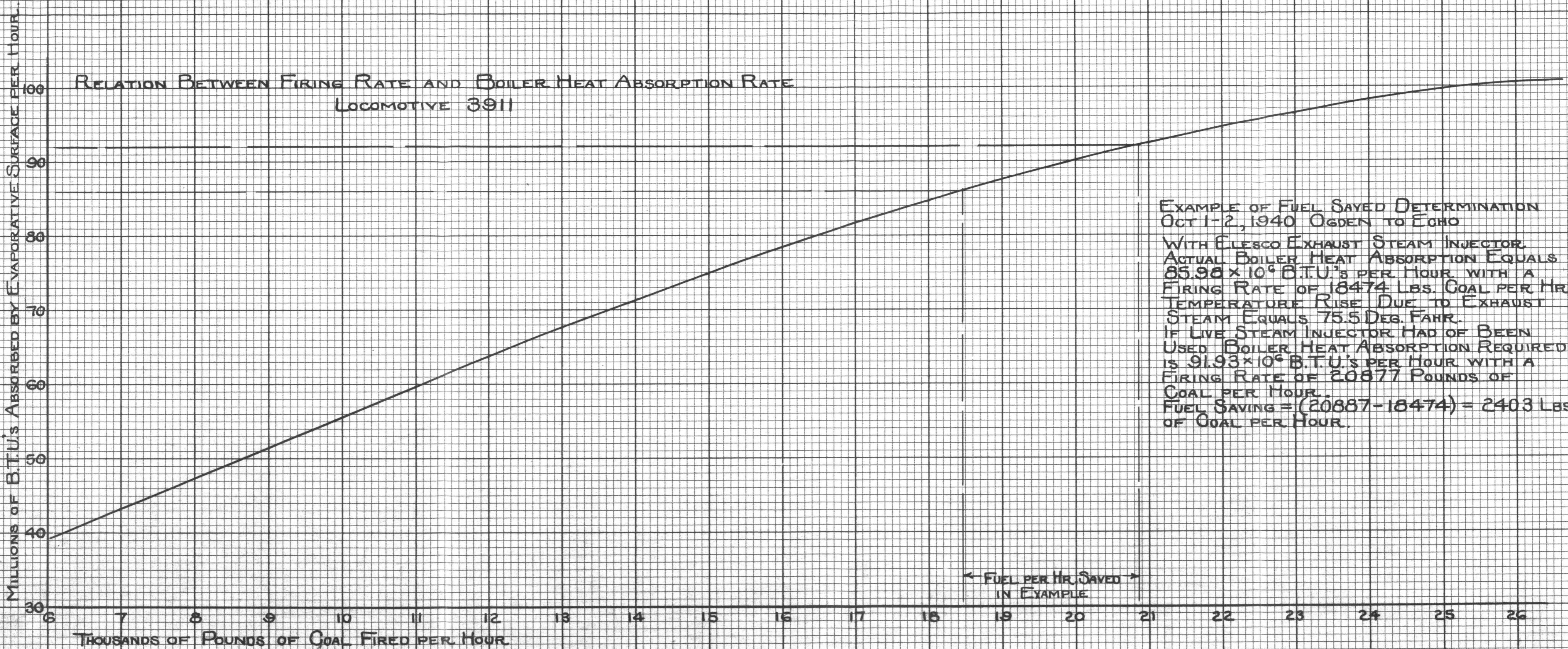


FIGURE NO. 1



EXAMPLE OF FUEL SAVED DETERMINATION  
Oct 1-2, 1940 OGDEN TO ECHO

With Elesco Exhaust Steam Injector  
Actual Boiler Heat Absorption Equals  
 $85.98 \times 10^6$  B.T.U.'s per hour with a  
Firing Rate of 18474 Lbs. Coal per hr.  
Temperature Rise Due to Exhaust  
Steam Equals 75.5 Deg. Fahr.  
If Live Steam Injector Had of Been  
Used Boiler Heat Absorption Required  
is  $91.93 \times 10^6$  B.T.U.'s per hour with a  
Firing Rate of 20877 Pounds of  
Coal per hour.  
Fuel Saving =  $(20887 - 18474) = 2403$  Lbs.  
of Coal per hour.

FIGURE NO. 2

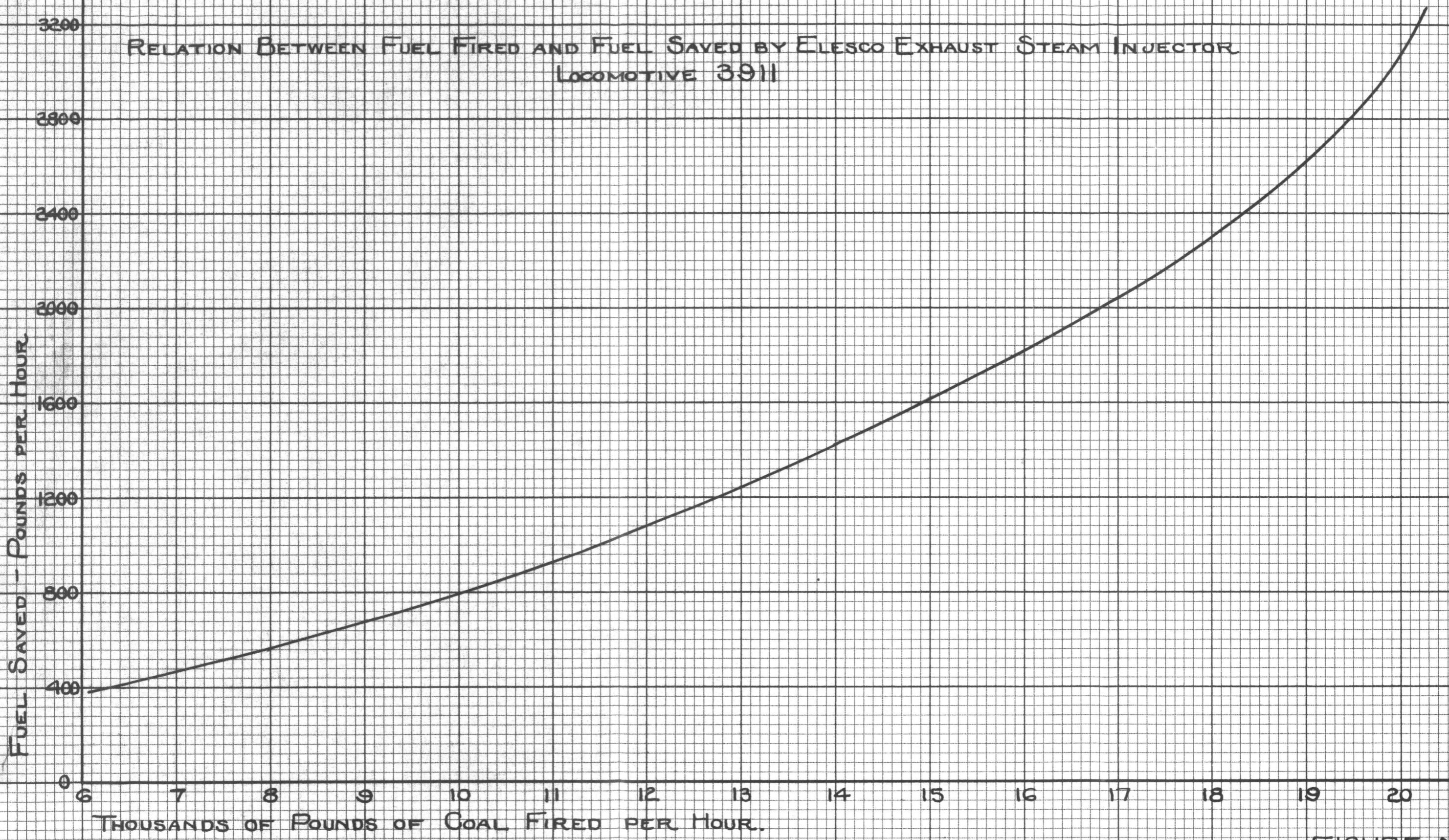


FIGURE NO. 3.