

Measurements of sea bottom temperatures between the Faroe Islands and Iceland and between the Faroe Islands and Shetland 1906-1962 using telegraph cables

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Úrtak

Í greininni eru mátningar av el-mótstöðuni í telegrafkaðalum á havbotninum millum Tórshavn og Seyðisfjørð og millum Tórshavn og Burwick. Fyri seinna heimsbardaga vórðu mátningarnar gjórdar eina ferð um mánaðin, seinni eina ferð hvønn ársfjórðing. Saman við upplýsingum um samanbindingar eftir kaðalbrot ber til at brúka mótstöðuna til at finna miðalhitan í sjónum uttan um kaðalarnar. Langtíðarbroytingarnar í hitanum skulu takast við fyrivarni, tí lop eru í, sum m.a. kunnu hava við kaðalbrot at gera. Hitabroytingarnar við árstíðini eru meiri áfítandi og kunnu vera liður í tulkningum av óvanligum viðurskiftum í økinum millum Ísland og Hetland.

Abstract

Resistance measurements are reported from a cable between Tórshavn in the Faroe Islands and Seyðisfjørð on eastern Iceland and a cable between Tórshavn and Burwick in Shetland. The measurements were performed at monthly intervals until the second world war and quarterannually after that. When combined with information on splicings after cable breaks the resistances may be used to determine average bottom temperatures of the water along the cable tracks. The long-term variations of annual mean temperatures may be doubtful due to occasional offsets, possibly associated with cable breaks; but the seasonal variation appears more reliable and exhibits interesting features that may shed light on the behaviour of anomalous periods (Great Salinity Anomalies) in the Iceland-Shetland region.

Introduction

In 1906 the Great Northern Telegraph Company (Det Store Nordiske Telegraf-Selskab A/S, København) hereafter referred to as "SNTS" established two sea-cables, one between Tórshavn in the Faroe Islands and Seyðisfjørð in Iceland (hereafter referred to as the "Iceland-cable") and the other one between Tórshavn and Burwick in Shetland (hereafter referred to as the "Shetland-cable"). Both cables started operation in August 1906 and were in operation until 1962 although with occasional gaps. In this period the cable resistance was measured and archived regularly and as the resistance depends upon the temperature of the surrounding seawater these measurements may yield information on the average bottom temperatures along the cable tracks.

With the large interest in the role of the ocean in the climate system a time series of bottom temperatures between Iceland and Scotland should be of large interest; but to use this information two sets of problems

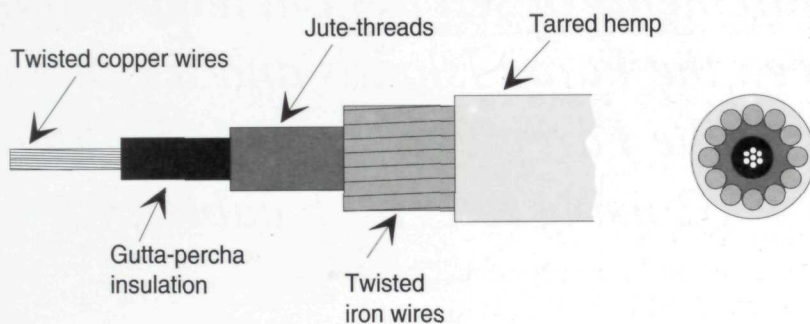


Fig. 1. Construction of the originally deployed cables.

have to be addressed. One involves the measurement procedure itself and problems associated with cable breaks and physical changes of the cables. The second kind of difficulties involves the interpretation of the measurements. Neither of the cables was surrounded by only one water mass. On the contrary, water from widely different origins affected both cables. Thus it is not a straightforward task to interpret a variation in average bottom temperature along one of the cable tracks.

In this publication only the first kind of difficulty is dealt with. This is primarily a data report presenting the results and documenting the methods used in obtaining them. In a separate paper (Hansen *et al.*, 1994) these results are compared to other sources of information and interpreted.

The cables

Both cables were of the same construction with a central copper core and a surrounding screen which was isolated from the core

and from the surrounding seawater (Fig. 1). The cable construction did not change much during the period although some of the later cables had an extra layer of protecting canvas tape surrounded by a brass layer to protect the cable from biological activity.

The cable tracks are shown in Fig. 2 together with the bottom topography. These tracks were not changed appreciably through the period except for the landing in Tórshavn. From the beginning in 1906 until August 8th 1949 the cables were led ashore in a small bay "Sandagerði" close by the town. After this time the cables came ashore at "Hvítanæs", a few miles distant from the original point.

At the original deployment the Iceland-cable had a total length of 318.42 n.m. (nautical miles) while the Shetland-cable had a length of 215.18 n.m. After each cable break the cable was spliced which may involve a change in cable length. An originally taut cable would after splicing be lengthened by an amount which is about

1.5 times the bottom depth. From the beginning the cable was deployed with considerable slack and cable breaks often tended to occur at the same sites so that the slack from previous splicings could be removed; but during the period the cables did change in length several times. This was documented by the "Splicing-list" from the ship which was updated after each splicing. For each section of cable the list showed the length, the weight, detailed cable construction, core resistance at 24°C and capacitance in addition to the time of final splicing and miscellaneous information. During the second World War cable repair was performed by British ships and for this period the splicing lists were not always reported. Thus there are gaps in the measurements during the war period.

Resistance measurement

The resistance measurements were initiated primarily to monitor the state of the cables and in addition to resistance, the capacitance and isolation resistance were also monitored. From the beginning the measurements were made on the first Sunday of every month so that 12 annual measurements were obtained except for periods of cable break. At the end of 1942, however, this was changed to the first Sunday of every third month as the British navy would not accept the 2-hour disruption in communication required for the measurements. After the war the reduced measurement frequency was retained.

The measurements were performed in Tórshavn while the cables were grounded

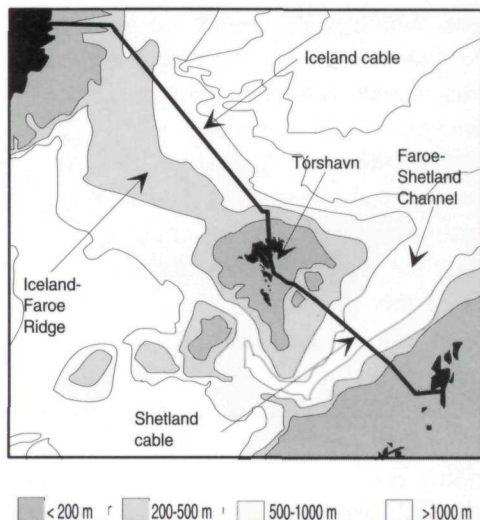


Fig. 2. Cable track and bottom topography for the two cables.

in Iceland and Shetland respectively quite close to the landing points. Resistance of the Iceland-cable was also measured from Iceland, but these values are not presented here. Resistance was measured using a Wheatstone Bridge with a reflecting galvanometer of type "Sullivan". Such a measurement is sensitive to various disturbances including slowly varying and rapidly varying earth current. The measurement procedure was adapted to this and always included two different types of measurement; using "false zero" and the "Rolland Black" method respectively. The details of these methods are described in the manual: "Lærebog i maalings-teknik vedrørende søkabler m.m." published by SNTS (Copenhagen, 1934). The values presented here are from the "false zero" measure-

ments which were considered more accurate; but the consistency with the Rolland Black values decreases the probability of erroneous values considerably.

From 1906 until August 8th 1949 the resistance measurements were made in a test-house just by the landingpoint in Tórshavn. When the landing point was moved at the end of this period, the measuring system was installed at the telegraph station in Tórshavn and for the rest of the period measurements were made there. Four land cables connected the Telegraph station to the landing point, one for each of the sea-cables and two spare cables which were grounded at the landing point. During each cable measurement the resistances of the two spare cables were measured also and the deviations used to correct the resistances of the other two land cables. These were then subtracted from the seacable resistances. Thus the resistance values presented are for only the marine part of the cables also after 1949.

Temperature calculation

In the temperature ranges involved the resistance of a copper conductor increases almost linearly with temperature. If R_t is the measured resistance of such a conductor at a fixed temperature t and R_{24} is the standard resistance at 24°C then the temperature will to sufficient accuracy be given by:

$$t = 24^\circ\text{C} - (R_{24} - R_t)/(a \cdot R_t)$$

where the coefficient a for the cables used was $0.0041 (\text{ }^\circ\text{C})^{-1}$. The linearity further-

more implies that if there are temperature variations along the cable – which was certainly the case here – then the temperature deduced by the above formula should be a fair representation of the average temperature of the whole cable.

In the start of the period the resistances were reported in BA Ohm (British Association, 1864) and the standard resistance was referred to 75° Fahrenheit ($= 23.89^\circ\text{C}$). From Febr. 2.nd 1913 International Ohms were used and 24°C used as standard temperature. In the tables presented here the values before 1913 have all been converted to International Ohms and referred to 24°C .

Results

The measured cable resistances are shown in Table 1 and Table 2 together with information on cable lengths and standard resistances from the splicing lists and calculated cable temperature. The measured resistances and temperatures calculated from them are copied from the SNTS journal (S.N.T.S journal for elektriske målinger) but all temperatures have been recalculated for checking purposes. The temperatures are furthermore plotted in Fig. 3 and Fig. 4 as timeseries for the whole period.

Discussion

The regular seasonal variations in the calculated temperatures, evident in Figs. 3 and 4 for most years, are indications that the values do reflect sea temperature to some extent. This does not guarantee long-term accuracy, however. Hansen *et al.* (1994)

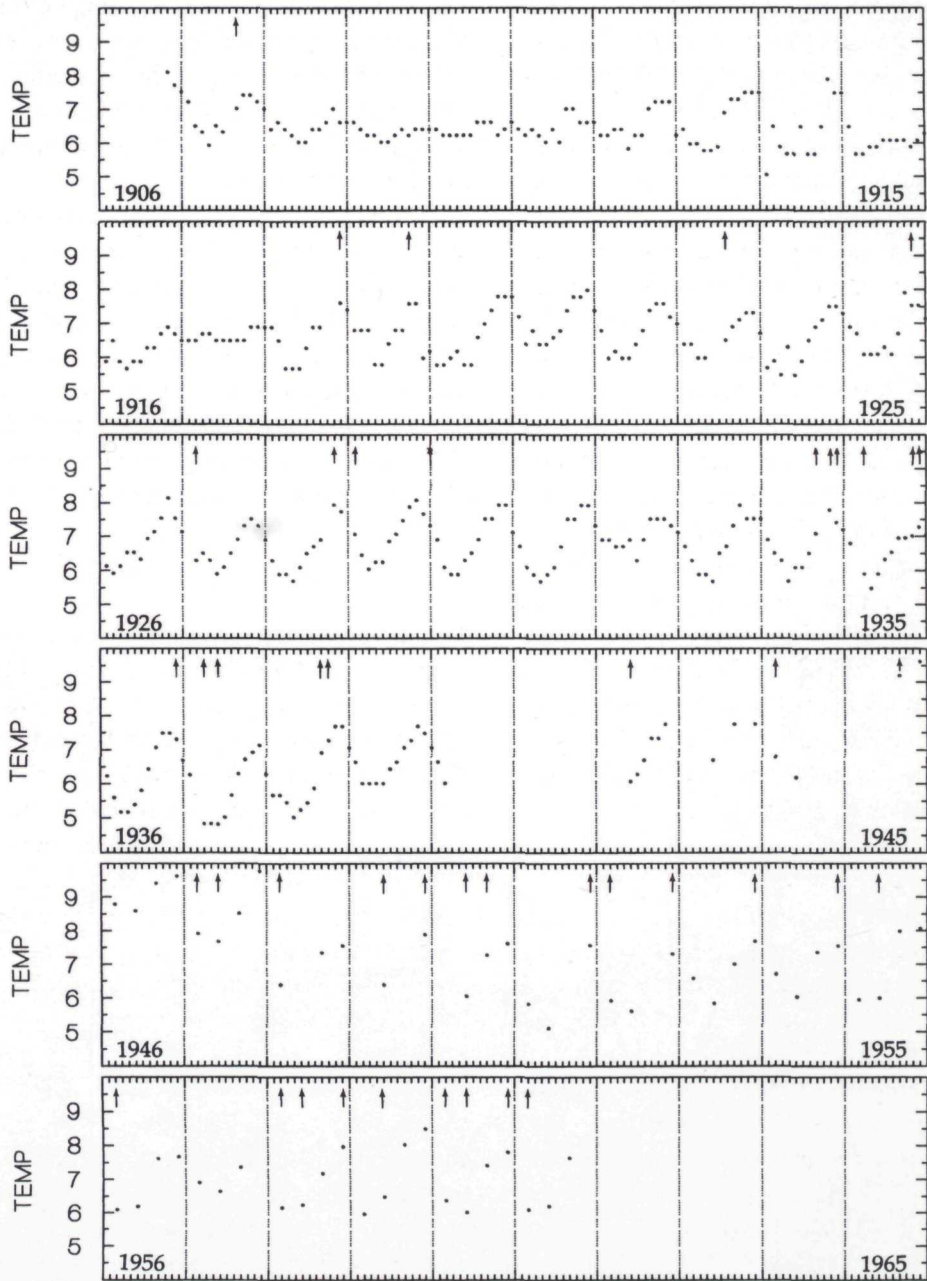


Fig. 3. The calculated temperatures of the Shetland cable plotted against time. Cable breaks are indicated by arrows.

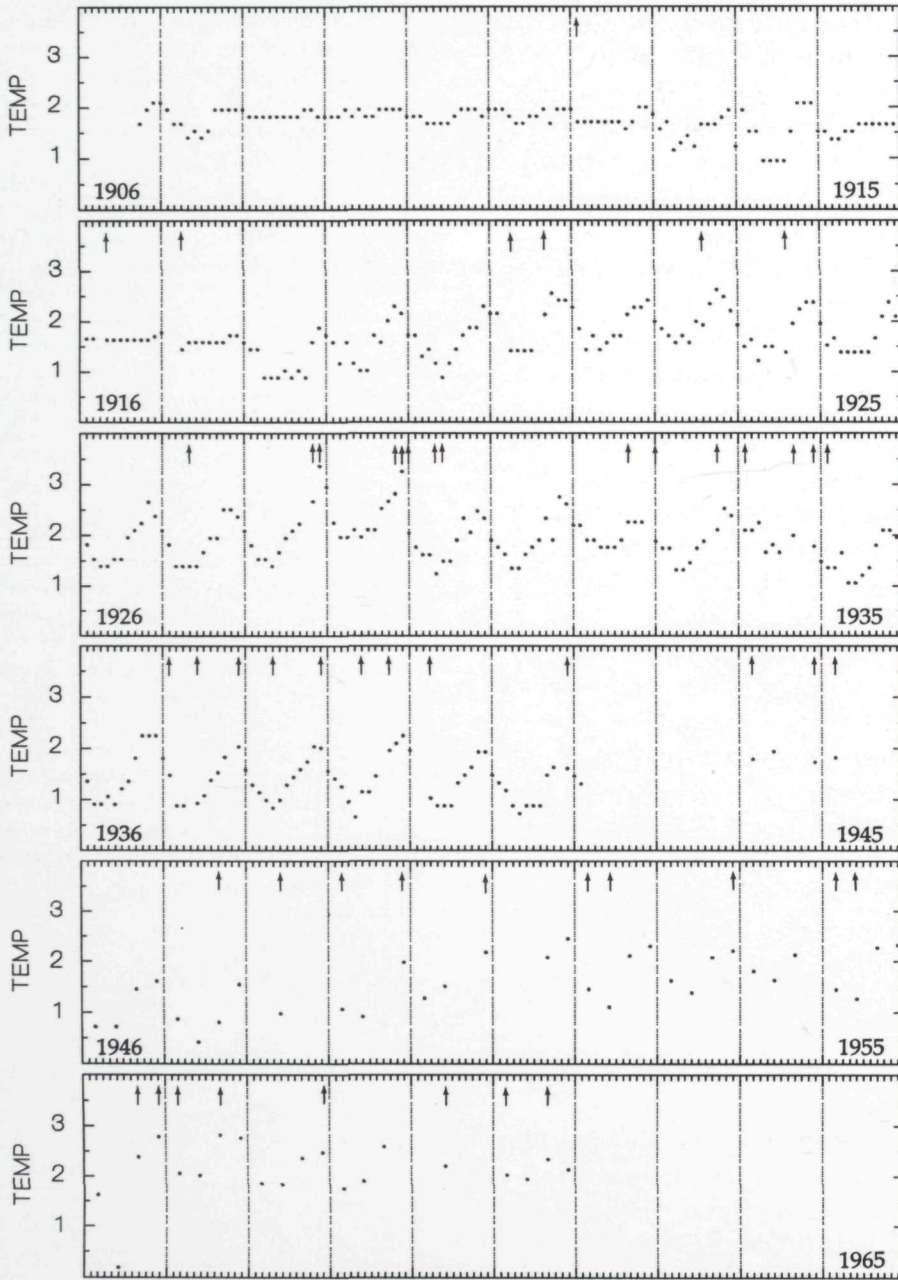


Fig. 4. The calculated temperatures of the Iceland cable plotted against time. Cable breaks are indicated by arrows.

have compared the cable temperatures from the Shetland cable to temperature measurements made from research vessels within one month of the cable measurements. They found a close relationship between the two different methods except that the cable data could be offset considerably for some periods. Thus the high cable temperatures seen in Fig. 3 for the years 1945-47 was considered an artifact. They concluded that the cable temperatures presented here should not be used uncritically to evaluate long-term trends.

The seasonal variation is less sensitive to the errors introduced by cable breaks and other sources and Figs. 3 and 4 indicate long-term changes in the amplitude of the seasonal signal which might be of climatic interest. Especially interesting is the period around 1910 where the cable measurements indicate almost no seasonal variation in temperature. This coincides with what is known to be an anomalous situation (Dickson *et al.*, 1984; Dickson *et al.*, 1988). The interpretation of these changes, however, requires a more detailed analysis of the influence of different water masses on the cable temperature and additional information on the long-term variations of these water masses. These questions are discussed by Hansen *et al.* (1994).

Acknowledgement

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References

- Dickson, R.R., Malmberg, S.A., Jones, S.R. and Lee, A.J. 1984. An investigation of the earlier great salinity anomaly of 1910-14 in waters west of the British Isles. *International Council for the Exploration of the Sea, Contributions to Council Meetings 1984/GEN: 4: 1-30.*
- Dickson, R.R., Meincke, J., Malmberg, S.A. and Lee, A.J. 1988. The "Great Salinity Anomaly" in the Northern North Atlantic 1968-1982. *Prog. Oceanog.* Vol. 20: 103-151.
- Hansen, B., Joensen, H.P. and Michelsen, V.E. 1994. Bottom temperatures between Iceland and Shetland 1906-1962 measured in telegraph cables. *International Council for the Exploration of the Sea, Contributions to Council Meetings 1994/S: 5: 1-14.*

Table 1. Data from the Shetland (Tórshavn – Burwick) cable. The table shows the calculated cable temperature for each date when cable resistance has been successfully measured. When cable breaks have occurred between two measurements this is indicated by updated values for cable length and standard resistance. Resistances are in International Ohm for the whole period.

Table 2. Data from the Iceland (Tórshavn – Seyðisfjörð) cable. The table shows the calculated cable temperature for each date when cable resistance has been successfully measured. When cable breaks have occurred between two measurements this is indicated by updated values for cable length and standard resistance. Resistances are in International Ohm for the whole period.

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Table 1. Sandagerö -Burwick cable

Year	Date	Length n.mile	R_24 Ohm	Temp Celsius	Year	Date	Length n.mile	R_24 Ohm	Temp Celsius	Year	Date	Length n.mile	R_24 Ohm	Temp Celsius											
1906	22/9	215,18	1385,09	8,10					6,41					6,08											
	7/10			7,72					6,23					5/9	6,08										
	4/11			7,52					6,03					3/10	5,88										
	2/12			7,22					6,41					7/11	6,08										
1907	6/1	215,38	1385,62	7,02					6,03					6,28											
	3/2			6,51					7,02					5/12	5,88										
	3/3			6,33					7,02					2/1	6,49										
	7/4			5,93					7,02					6/2	6,49										
	5/5			6,51					6,62					5/3	5,88										
	2/6			6,33					6,62					2/4	5,67										
	4/8			7,02					6,62					7/5	5,88										
	1/9			7,42					6,62					4/6	5,88										
	6/10			7,42					6,23					2/7	6,28										
	3/11			7,22					6,41					6/8	6,28										
	1/12			7,02					6,41					3/9	6,69										
	1908			5/1											6,41					6,23					6,89
2/2		6,62	6,23	5/11	6,69																				
1/3		6,41	7,02	3/12	6,49																				
5/4		6,23	7,02	7/1	6,49																				
3/5		6,03	7,02	4/2	6,49																				
31/5		6,03	7,02	3/3	6,69																				
5/7		6,41	7,02	31/4	6,69																				
2/8		6,41	6,23	5/5	6,69																				
6/9		6,62	6,23	2/6	6,49																				
4/10		7,02	6,23	7/7	6,49																				
1/11		6,62	7,02	4/8	6,49																				
6/12		6,62	7,02	1/9	6,49																				
1909		3/1			6,62						6,41														6,89
		7/2			6,41						6,41														6/10
	7/3	6,23			6,89				3/11		6,89														
	4/4	6,23			6,89				1/12		6,89														
	2/5	6,03			6,89				5/1		6,89														
	6/6	6,03			6,89				2/2		6,49														
	4/7	6,23			6,89				2/3		6,49														
	1/8	6,41			6,89				6/4		6,49														
	5/9	6,23			6,89				4/5		6,49														
	3/10	6,41			6,89				1/6		6,49														
	7/11	6,41			6,89				6/7		6,49														
	5/12	6,41			6,89				3/8		6,49														
	1910	2/1									6,41								6,41						6,89
		6/2									6,23								6,41						7/9
6/3		6,23	6,49	5/10		6,49																			
3/4		6,23	6,49	2/11		6,49																			
1/5		6,23	6,49	7/12		6,49																			
5/6		6,23	6,49	4/1		6,49																			
3/7		6,62	6,49	1/2		6,49																			
7/8		6,62	6,49	1/3		6,49																			
4/9		6,62	6,49	5/4		6,49																			
2/10		6,23	6,49	3/5		6,49																			
6/11		6,41	6,49	7/6		6,49																			
4/12		6,62	6,49	5/7		6,49																			
1911		8/1				6,41						6,49													6,80
		5/2				6,23						6,49													2/8
					6,49	6/9			6,80																
1912	7/1			6,23					6,49					6,80											
	4/2			6,23					6,49					4/5	6,80										
	3/3			6,41					6,49					1/11	6,40										
	31/4			6,41					6,49					3/7	6,80										
	5/5			5,83					6,49					7/9	6,80										
	2/6			6,23					6,49					4/8	6,80										
	7/7			6,23					6,49					3/11	6,80										
	4/8			7,02					6,49					1/12	6,80										
	1/9			7,22					6,49					5/10	6,80										
	6/10			7,22					6,49					2/11	6,80										
	3/11			7,22					6,49					7/12	6,80										
	1/12			6,23					6,49					4/1	6,80										
1913	5/1			6,41					6,49					6,80											
	2/2			5,97					6,49					2/2	6,80										
	2/3			5,97					6,49					3/3	6,80										
	6/4			5,77					6,49					7/4	6,80										
	4/5			5,77					6,49					5/5	6,80										
	1/6			5,88					6,49					2/6	6,80										
	6/7			6,89					6,49					7/7	6,80										
	3/8			7,29					6,49					4/8	6,80										
	7/9			7,29					6,49					3/11	6,80										
	5/10			7,49					6,49					1/12	6,80										
	2/11			7,49					6,49					5/1	6,80										
	7/12			7,49					6,49					2/2	6,80										
1914	4/1			5,06					6,49					6,80											
	1/2			6,49					6,49					2/3	6,80										
	1/3			5,88					6,49					6/4	6,80										
	5/4			5,67					6,49					7/4	6,80										
	3/5			5,67					6,49					5/5	6,80										
	7/6			6,49					6,49					2/6	6,80										
	5/7			5,67					6,49					7/7	6,80										
	2/8			5,67					6,49					4/8	6,80										
	6/9			6,49					6,49					3/11	6,80										
	4/10			7,89					6,49					1/12	6,80										
	1/11			7,49					6,49					5/1	6,80										
	6/12			7,49					6,49					2/2	6,80										
1915	3/1			6,49					6,49					6,80											
	7/2			5,67					6,49					2/3	6,80										
	7/3			5,67					6,49					6/4	6,80										
	11/4			5,88					6,49					4/5	6,80										
	2/5			5,88					6,49					1/6	6,80										
1916	6/8			7,02					6,49					6,80											
	3/9			7,02					6,49					2/7	6,80										
	1/10			6,62					6,49					3/8	6,80										
1917	5/11			6,62					6,49					6,80											
	3/12			6,62					6,49					4/9	6,80										
	7/1			6,23					6,49					5/10	6,80										
	4/2			6,23					6,49					2/11	6,80										
	3/3			6,41					6,49					7/12	6,80										
	31/4			6,41					6,49					4/1	6,80										
	5/5			5,83					6,49					5/2	6,80										
	2/6			6,23					6,49					6/3	6,80										
	7/7			6,23					6,49					7/4	6,80										
	4/8			7,02					6,49					5/5	6,80										
	1/9			7,22					6,49					2/6	6,80										
	6/10			7,22					6,49					7/7	6,80										
3/11	7,22	6,49	4/8	6,80																					
1/12	6,23	6,49	3/11	6,80																					
1918	5/1			6,41					6,49					6,80											
	2/2			5,97					6,49					2/2	6,80										
	2/3			5,97					6,49					2/3	6,80										
	6/4			5,77					6,49					6/4	6,80										
	4/5			5,77					6,49					4/5	6,80										
	1/6			5,88					6,49					1/6	6,80										
	6/7			6,89					6,49					1/6	6,80										
	3/8			7,29					6,49					6/7	6,80										
	7/9			7,29					6,49					3/8	6,80										
	5/10			7,49					6,49					7/9	6,80										
	2/11			7,49					6,49					5/10	6,80										
	7/12			7,49					6,49					2/11	6,80										
1919	4/1			5,06					6,49					6,80											
	1/2			6,49					6,49					7/12	6,80										
	1/3			5,88					6,49					4/1	6,80										
	5/4			5,67					6,49					1/2	6,80										
	3/5			5,67					6,49					5/2	6,80										
1920	7/6			6,49					6,49					6,80											
	5/7			5,67					6,49					4/1	6,80										
	2/8			5,67					6,49					1/2	6,80										

Table 1. Sandagerø -Burwick cable

Year	Date	Length n.mile	R_24 Ohm	Temp Celsius	Year	Date	Length n.mile	R_24 Ohm	Temp Celsius	Year	Date	Length n.mile	R_24 Ohm	Temp Celsius
	7/3			5,98		5/10			7,51		2/6			6,86
	11/4			6,18		2/11			7,51		7/7			7,07
	2/5			5,78		7/12			7,31		4/8			7,47
	6/6			5,78		1925	4/1		6,90		1/9			7,88
	4/7			6,59		1/2			6,70		6/10			8,08
	1/8			6,99		1/3			6,09		3/11			7,67
	5/9			7,39		5/4			6,09		1/12	214,62	1375,02	7,32 *
	3/10			7,79		3/5			6,09		1930	5/1		6,91
	7/11			7,79		7/6			6,30		2/2			6,10
	5/12			7,79		5/7			6,09		2/3			5,89
1921	2/1			7,19		2/8			6,70		6/4			5,89
	6/2			6,39		6/9			7,91		4/5			6,30
	6/3			6,79		4/10	214,64	1382,38	7,54 *		1/6			6,51
	3/4			6,39		1/11			7,54		6/7			6,91
	1/5			6,39		6/12			7,14		3/8			7,52
	5/6			6,59		1926	3/1		6,13		7/9			7,52
	3/7			6,79		7/2			5,92		5/10			7,93
	7/8			7,39		7/3			6,13		2/11			7,93
	4/9			7,79		11/4			6,53		7/12			7,12
	2/10			7,79		2/5			6,53		1931	4/1		6,71
	6/11			7,99		6/6			6,33		1/2			6,10
	4/12			7,39		4/7			6,94		1/3			5,89
1922	8/1			6,79		1/8			7,14		12/4			5,69
	5/2			5,98		5/9			7,54		3/5			5,89
	5/3			6,18		3/10			8,14		7/6			6,10
	2/4			5,98		7/11			7,54		5/7			6,71
	7/5			5,98		5/12			7,14		2/8			7,52
	11/6			6,39		1927	6/2	214,79	1383,59	6,30 *	6/9			7,52
	2/7			6,79		6/3			6,51		4/10			7,93
	6/8			7,39		3/4			6,30		1/11			7,93
	3/9			7,59		1/5			5,90		6/12			7,32
	1/10			7,59		29/6			6,10		1932	3/1		6,91
	5/11			7,19		3/7			6,51		7/2			6,91
	3/12			6,99		7/8			6,91		6/3			6,71
1923	7/1			6,39		4/9			7,31		3/4			6,71
	4/2			6,39		2/10			7,52		1/5			6,91
	4/3			5,98		6/11			7,31		5/6			6,30
	8/4			5,98		4/12			6,91		3/7			6,91
	1/7	214,67	1382,56	6,50 *		1928	8/1		6,30		7/8			7,52
	5/8			6,90		5/2			5,90		4/9			7,52
	2/9			7,11		4/3			5,90		2/10			7,52
	7/10			7,31		1/4			5,70		6/11			7,32
	4/11			7,31		6/5			6,10		4/12			7,12
	2/12			6,70		3/6			6,51		1933	8/1		6,71
1924	6/1			5,69		1/7			6,71		5/2			6,30
	3/2			5,89		5/8			6,91		5/3			5,89
	2/3			5,48		7/10	214,40	1381,33	7,94 *		2/4			5,89
	6/4			6,30		4/11			7,74		7/5			5,69
	4/5			5,48		1929	6/1	214,52	1375,28	7,07 *	11/6			6,51
	1/6			5,89		3/2			6,46		2/7			6,71
	6/7			6,50		3/3			6,05		6/8			7,32
	3/8			6,90		7/4			6,25		3/9			7,93
	7/9			7,11		5/5			6,25		1/10			7,52

Table 1. Sandagerö -Burwick cable

Year	Date	Length n.mile	R_24 Ohm	Temp Celsius	Year	Date	Length n.mile	R_24 Ohm	Temp Celsius	Year	Date	Length n.mile	R_24 Ohm	Temp Celsius
	5/11			7,52		3/7			5,88		4/5			5,61
	3/12			7,52		7/8	215,13	1337,51	6,92 *		2/11	219,28	1339,01	7,31 *
1934	7/1			6,91		4/9	215,15	1333,57	7,28 *	1953	1/2			6,58
	4/2			6,51		2/10			7,69		3/5			5,83
	4/3			6,30		6/11			7,69		2/8			7,00
	8/4			5,69		4/12			7,07		1/11	219,03	1334,93	7,68 *
	6/5			6,10	1939	8/1			6,65	1954	7/2			6,70
	3/6			6,10		5/2			6,02		2/5			6,03
	1/7			6,51		5/3			6,02		1/8			7,36
	5/8	214,67	1371,96	7,09 *		2/4			6,02		7/11	220,07	1336,73	7,55 *
	7/10	214,61	1357,60	7,79 *		7/5			6,02	1955	6/2			5,94
	4/11	214,32	1347,79	7,42 *		4/6			6,44		8/5	220,12	1334,99	5,99 *
	2/12			7,21		2/7			6,65		7/8			7,59
1935	6/1			6,80		6/8			7,07		6/11			8,07
	3/3	214,46	1337,33	5,91 *		3/9			7,28	1956	5/2	220,27	1334,88	6,09 *
	7/4			5,49		1/10			7,69		6/5			6,19
	5/5			5,91		5/11			7,49		12/8			7,62
	2/6			6,33		3/12			7,07		4/11			7,68
	7/7			6,54	1940	7/1			6,65	1957	3/2			6,64
	4/8			6,96		4/2			6,02		5/5			7,36
	1/9			6,96		1942	3/5	215,15	1324,68	6,08 *	11/8			6,64
	6/10	214,38	1337,00	7,02 *		7/6			6,29	1958	2/2	220,36	1335,27	6,15 *
	3/11	214,25	1336,76	7,28 *		5/7			6,71		4/5	220,75	1336,85	6,24 *
	1/12			7,07		2/8			7,34		3/8			7,18
1936	5/1			6,23		6/9			7,34		2/11	220,92	1336,39	7,97 *
	2/2			5,60		4/10			7,76	1959	1/2			5,96
	1/3			5,18	1943	2/5			6,71		3/5	221,27	1335,80	6,48 *
	5/4			5,18		1/8			7,76		2/8			8,04
	3/5			5,39		7/11			7,76		1/11			8,50
	7/6			5,81	1944	9/2	215,29	1325,29	6,80 *	1960	7/2	221,91	1322,32	6,37 *
	5/7			6,44		7/5	215,29	1325,14	6,20		1/5	221,98	1322,90	6,01 *
	2/8			7,07	1945	5/8	214,91	1332,19	9,20 *		7/8			7,42
	6/9			7,49		4/11			9,62		6/11	222,08	1322,65	7,81 *
	4/10			7,49	1946	3/2			8,79	1961	5/2	222,28	1323,98	6,10 *
	1/11	214,28	1337,65	7,31 *		5/5			8,59		7/5			6,20
	6/12			6,69		18/8			9,41		6/8			7,64
1937	3/1			6,27		3/11			9,62					
	7/3	214,35	1333,12	4,84 *	1947	2/2	214,94	1334,54	7,92 *					
	4/4			4,84		4/5	214,88	1317,62	7,68 *					
	2/5	214,74	1336,42	4,82 *		3/8			8,52					
	6/6			5,03		2/11			9,77					
	4/7			5,67	1948	8/2	216,22	1324,19	6,39 *					
	1/8			6,30		1/8	216,48	1318,24	7,35 *					
	5/9			6,72		7/11			7,56					
	3/10			6,93	1949	1/5	215,59	1317,71	6,39 *					
	7/11			7,14		6/11	219,18	1327,01	7,89 *					
	5/12			6,30	1950	8/5	219,27	1331,90	6,05 *					
1938	2/1			5,67		6/8	219,31	1331,21	7,28 *					
	6/2			5,67		5/11			7,62					
	6/3			5,46	1951	4/2			5,82					
	3/4			5,03		6/5			5,11					
	1/5			5,25		4/11	219,16	1323,96	7,57 *					
	12/6			5,46	1952	3/2	219,26	1330,64	5,92 *					

Table 2. Sandagerð-Seyðisfjörður

Year	Date	Length n.mile	R_24 Ohm	Temp Celsius	Year	Date	Length n.mile	R_24 Ohm	Temp Celsius	Year	Date	Length n.mile	R_24 Ohm	Temp Celsius											
1906	22/9	318,42	2054,76	1,68					1,96					1,66											
	7/10			1,96					1,82					1,66											
	4/11			2,10					1,68					1,66											
	2/12			2,10					1,68					1,66											
1907	6/1			1,96					1,82					1,66											
	3/2			1,68					1,82					1,66											
	3/3			1,68					1,96					1,66											
	7/4			1,41					1,68					1,64											
	5/5			1,54					1,96					1,64											
	2/6			1,41					1,96					1,64											
	7/7			1,54					1,96					1,64											
	4/8			1,96					1,71					1,64											
	1/9			1,96					1,71					1,64											
	6/10			1,96					1,71					1,64											
	3/11			1,96					1,71					1,64											
	1/12			1,96					1,71					1,78											
1908	5/1			1,82					1,71					1,45											
	2/2			1,82					1,71					1,59											
	1/3			1,82					1,71					1,59											
	5/4			1,82					1,71					1,59											
	3/5			1,82					2,00					1,59											
	31/5			1,82					2,00					1,59											
	5/7			1,82					1,86					1,59											
	2/8			1,82					1,57					1,59											
	6/9			1,96					1,71					1,73											
	4/10			1,96					1,16					1,73											
	1/11			1,82					1,30					1,59											
	6/12			1,82					1,44					1,73											
	1909			3/1											1,82					1,94					1,45
				7/2											1,82					1,52					0,89
7/3		1,96	1,52	0,89																					
4/4		1,82	1,66	0,89																					
2/5		1,96	1,66	1,03																					
6/6		1,82	1,66	0,89																					
4/7		1,82	1,66	1,03																					
1/8		1,96	1,66	0,89																					
5/9		1,96	1,66	0,89																					
3/10		1,96	1,66	1,59																					
7/11		1,96	1,66	1,88																					
5/12		1,82	1,23	1,73																					
1910		2/1			1,82						1,94														1,59
		6/2			1,82						1,52														1,17
	6/3	1,68			1,52				1,59																
	3/4	1,68			1,52				1,17																
	1/5	1,68			2,08				1,03																
	5/6	1,68			2,08				1,03																
	3/7	1,82			2,08				1,73																
	7/8	1,96			1,52				1,59																
	4/9	1,96			1,52				2,02																
	2/10	1,96			1,37				2,30																
	6/11	1,82			1,37				2,16																
	4/12	1,96			1,52				1,73																
1911	8/1			1,96										1,73											
1912	7/1	318,56	2055,49	1,71					1,71					1,31											
	4/2			1,71					1,52					1,66											
	3/3			1,71					1,52					1,66											
	31/3			1,71					1,52					1,66											
	5/5			1,71					1,52					1,66											
	2/6			1,71					1,52					1,66											
	7/7			1,71					1,52					1,66											
	4/8			1,57					1,52					1,66											
	1/9			1,71					1,52					1,66											
	6/10			2,00					1,52					1,66											
	3/11			2,00					1,52					1,66											
	1/12			1,86					1,52					1,66											
1913	5/1			1,57					1,94					1,59											
	2/2			1,71					1,52					1,17											
	2/3			1,16					1,52					1,59											
	6/4			1,30					1,52					1,17											
	4/5			1,44					1,52					1,03											
	1/6			1,23					1,52					1,73											
	6/7			1,66					1,52					1,59											
	3/8			1,66					1,52					1,66											
	7/9			1,66					1,52					1,66											
	5/10			1,80					1,52					1,66											
	2/11			1,94					1,52					1,66											
	7/12			1,23					1,52					1,66											
1914	4/1			1,94					1,94					1,59											
	1/2			1,52					1,52					1,17											
	1/3			1,52					1,52					1,59											
	5/4			0,95					1,52					1,17											
	3/5			0,95					1,52					1,03											
	7/6			0,95					1,52					1,03											
	5/7			0,95					1,52					1,73											
	2/8			1,52					1,52					1,59											
	6/9			2,08					1,52					2,02											
	4/10			2,08					1,52					2,30											
	1/11			2,08					1,52					2,16											
	6/12			1,52					1,52					1,73											
1915	3/1			1,52					1,52					1,73											
	7/2			1,37					1,52					1,66											
	7/3			1,37					1,52					1,66											
	11/4			1,52					1,52					1,66											
	2/5			1,52					1,52					1,66											
	6/6			1,66					1,52					1,66											
1916	2/1	318,73	2056,72	1,66					1,66					1,66											
	6/2			1,66					1,66					1,64											
1917	2/4	318,94	2058,17	1,64					1,64					1,45											
	7/5			1,64					1,64					1,59											
	4/6			1,64					1,64					1,59											
	2/7			1,64					1,64					1,59											
	6/8			1,64					1,64					1,59											
	3/9			1,64					1,64					1,59											
	1/10			1,64					1,64					1,59											
	5/11			1,71					1,64					1,59											
	3/12			1,78					1,64					1,59											
	1918			4/3											1,45					1,45					1,45
1/4		1,59	1,45	0,89																					
6/5		1,59	1,45	0,89																					
3/6		1,59	1,45	0,89																					
1/7		1,59	1,45	0,89																					
5/8		1,59	1,45	0,89																					
2/9		1,59	1,45	0,89																					
7/10		1,73	1,45	0,89																					
4/11		1,73	1,45	0,89																					
2/12		1,59	1,45	0,89																					
1919		6/1			1,45						1,45														1,45
		3/2			1,45						1,45														0,89
	3/3	0,89			1,45				0,89																
	7/4	0,89			1,45				0,89																
	5/5	0,89			1,45				0,89																
	2/6	1,03			1,45				0,89																
	7/7	0,89			1,45				0,89																
	4/8	1,03			1,45				0,89																
	1/9	0,89			1,45				0,89																
	6/10	1,59			1,45				0,89																
	3/11	1,88			1,45				0,89																
	1/12	1,73			1,45				0,89																
1920	5/1			1,59					1,59					1,59											
	2/2			1,17					1,59					1,17											
	2/3			1,59					1,59					1,17											
	6/4			1,17					1,59					1,03											
	4/5			1,03					1,59					1,03											
	1/6			1,03					1,59					1,03											
	6/7			1,73					1,59					1,03											
3/8	1,59	1,59	1,03																						
7/9	2,02	1,59	1,03																						
5/10	2,30	1,59	1,03																						
2/11	2,16	1,59	1,03																						
7/12	1,73	1,59	1,03																						
1920	4/1			1,73					1,73					1,73											
	1/2			1,31					1,73					1,31											

Table 2. Sandagerð-Seyðisfjörður

Year	Date	Length n.mile	R_24 Ohm	Temp Celsius		Year	Date	Length n.mile	R_24 Ohm	Temp Celsius		Year	Date	Length n.mile	R_24 Ohm	Temp Celsius														
1934	7/1	318,70	2008,45	2,10	*		6/11	318,40	1940,50	2,01	*		7/5				1,51	*												
	4/2			2,10			4/12			1,56			5/11				316,53	1927,69	2,18	*										
	4/3			2,25		1939	8/1				1,41	*	1951	feb.	316,59	316,61	1928,39	1928,96	2,08	2,45	*									
	8/4			1,67			5/2				1,26			maj																
	6/5	1,82		5/3	0,96						4/8												4/8							
	3/6	1,67		2/4	0,66						4/11												4/11							
	5/8	318,89	2000,48	2,00	*		7/5				318,40	1939,07		1,15							*	1952	3/2	316,66	1928,98	1,46	*			
	4/11	319,41	1970,47	1,79	*	4/6			1,15	*	4/5	316,90	1928,79	1,11	*															
	2/12			1,49	*	2/7			1,46	*	3/8			2,11																
1935	6/1	319,17	1945,24	1,36	*	1940	3/3	319,05	1943,27	1,03	*	1953	1/2					1,62												
	3/2			1,36			7/4			0,88			3/5						1,39											
	3/3			1,66			5/5			0,88			2/8						2,08											
	7/4			1,06			2/6			0,88		1/11	317,15	1928,29	2,21	*														
	5/5			1,06			7/7			1,33		7/2		1,81																
	2/6			1,21		4/8	1,81		2/5		1,63																			
	7/7			1,36		1/9	2,10		1/8		2,13																			
	6/10			2,10		6/10	1,93		6/2	317,39	1928,10	1,45	*																	
	3/11			1,96		1/9	1,63		8/5	317,24	1926,79	1,27	*																	
	1/12			1,96		6/10	1,93		7/8		2,27																			
	1936			5/1			1,36		1941	5/1			1,33		1956	5/2					1,63									
				2/2			0,91			6/5			0,19			12/8					317,22	1922,69	2,39	*						
				1/3			0,91			4/11			317,96	1926,60		2,79					*									
				5/4			1,06			2/2			1,18		1957	3/2	317,95	1922,47	2,06	*										
				3/5			0,91			2/3			0,88			5/5		2,02												
7/6		1,21		4/5			0,88			11/8			317,85	1917,13		2,82	*													
5/7		1,36		8/6			0,88			3/12				2,77																
2/8		1,81		6/7			0,88			1958			2/2		1,86															
6/9		2,25		3/8			1,48						4/5		1,84															
4/10		2,25		7/9			1,63						3/8		2,37															
1/11		2,25		2/11			319,03	1952,16		1,61			*	2/11	317,77	1916,76	2,48	*												
6/12		1,81		7/12			1,46			1959			1/2		1,76															
1937	3/1	318,87	1944,37	1,81	*	3/5		1,91																						
	7/2			0,88		2/8		2,60																						
	7/3			0,88		1960	1/5	317,74	1921,67	2,21	*																			
	2/5			318,77	1944,01		0,93	*	7/5	324,29	1982,30	2,03	*																	
	6/6	1,08		5/11	319,77		1962,19	1,73	*																					
	4/7	1,38		4/2	319,81		1962,60	1,82	*																					
	1/8	1,53		1946	3/2	319,65	1968,54	0,72																						
	5/9	1,83			5/5			0,72																						
7/11	318,84	1947,96	2,03	*	18/8		1,46																							
5/12			1,58	*	3/11		1,61																							
1938	2/1	318,66	1946,80	1,29		1947	2/2			0,87		1948	2/5	319,53	1962,23	0,98	*													
	6/2			1,14			4/5			0,42			1949	6/2	319,47	1955,01	1,07	*												
	6/3			0,99			3/8			319,77	1971,14			0,81	*															
	3/4			0,84		2/11	1,55		1/5		0,92																			
	1/5			0,99		1950	5/2			1,28																				
	12/6			1,29			6/11	316,52	1927,65	1,98	*																			
	3/7			1,44																										
	7/8			1,59																										
	4/9			1,74																										
	2/10			2,04																										