

DEPARTMENT OF THE
NAVAL SERVICE.

Specification of Apparatus and Electrical Equip-
ment for Government Radiotelegraph Stations at Port
Burwell and Kingston in the Province
of Ontario.

Transportation.

1. All material is to be transported to the station by the Contractor, and all labour is to be supplied by him.

Ground Connection.

2. (a) Excavation for ground trench is to be carried through earth in a circle 65 feet in diameter around centre of the operating house and is to be 4 feet deep. Where rock is encountered excavation has already been done and will not be required of the contractor.

(b) The ground connection is to consist of a zinc plate 200 feet long by 3 feet wide of No. 9 gauge. If in sections same are to be soldered together at two points on each section. The plate is to be placed on edge in the above mentioned excavation and is to be covered in with good soil.

(c) No. 12 bare copper leads are to be soldered on to the plate every 4 feet in length and are to be of sufficient length to run into the centre of the operating house, with 10 feet spare. The wires are all to be buried below the ground grade level. 1 foot

(d) Capacity ground will be provided for by 1000 feet super copper wire netting, one inch mesh, No. 22 gauge tinned. The same is to be laid one foot below the surface of the ground and excavation is to be filled in to the ground level.

The netting is to be run out radially from the station in four sections. One end of each section is to be connected to the earth wires from the zinc plate by means of 10 No. 14 wires, all joints being properly soldered with a resin flux.

The earth wires are to be soldered together and are to be brought up in the engine room through a porcelain tube in a neat manner, properly connected by means of lugs to the earth arrester plates and the two transmitting equipments.

Aerial.

3. The Contractor is to supply and erect a standard double T aerial with a wave length of 600 metres. The masts, yards, rope, blocks, etc., are already supplied.

The above aerial is to consist of two horizontal wires, No. 42/23 silicon bronze stretched between the yards. Each wire is to be insulated from its gantline by means of one 15 cwt. approved strain insulator.

The down connections are to be of similar wire as above and are to be properly soldered on to the middle of the horizontal wires or attached thereto with an approved clip. These wires are to be brought down vertically to a spreader 12 feet long by 2 inches in diameter and from the spreader to the leading-in insulator, the wires to be so arranged as to place no strain on the latter.

The above mentioned spreader is to be supplied by the Contractor, and is to receive two coats of white paint. It is to be secured to the ground by means of four approved bollards and $3/8$ " diameter S/T. Manilla Rope with one set of four 7" electrose or other approved type strain insulators connected in series on each end of the spreader.

The free ends of the aerial to be soldered to a brass lug which is to be bolted to the brass rod running through the leading-in insulator.

The connections between the ends of all aerial wires and insulators eyes are to be made by means of approved spring snap fasteners or shackles. The connection is to be fitted with a swivel and is to have a breaking strain equal to that of the wire. All eye splices in the wires are to be neatly done with a thimble inserted in the eye.

All gantlines are to be fitted with downhaul of $3/8$ " diameter S/T. Manilla Rope, which will be supplied by the Department.

Engines.

4. Each of the two engines is to be of the Canadian Fairbanks Morse Company's make, 8 H.P. horizontal, Special Electric type - gasoline - with throttling governor to govern within 1% from 0 to full load.

Each of the two concrete beds as installed by the Department is 6 feet long by 4 feet wide by 5 feet deep. The top of each bed is to be roughed up and a block erected thereon to accommodate an 8 H.P. engine of sufficient height to clear the fly wheels of the engine at least 6 inches above the floor level of the engine room.

These top blocks are to be solidly joined to the existing concrete beds and are to be finished off with a smooth finish.

Twelve holding down bolts, $5/8$ " diameter by 3 feet 9 inches long supplied and installed in holes driven for the same, (six in each bed) to secure the engine to that bed.

Each bolt is to have its end split and jagged, and a wedge fitted to open up the split when it is driven home.

The holes to accommodate the bolts are to be drilled down at least 3 feet into the main bed, and the bolts are to be run to the bottom of these holes which are then to be filled up with sulphur.

Each bolt is to be threaded on the projecting end and is to be provided with two hexagonal nuts and one washer.

The piping for gasoline connections and water tanks connections is to be run in the boxings provided for that purpose. The covers of these boxings are to be of 1" pin and finished off flush with the floor.

An overflow pipe connected to the water jacket of each engine is to be provided and arranged so as to carry the water clear of the buildings.

Certain spare parts as per list given in schedule attached hereto are to be provided.

Generators.

The two A.C. generators are to be of $5\frac{1}{2}$ K.W. capacity and of the type supplied to the Coast Stations on the Great Lakes. Ratings of each machine to be as follows:-

5½ K.W. - 240 cycle - 440 volt - single phase - with adjustable field rheostat (mounted on switchboard.)

Exciters.

6. The two Exciters are to be of 1 K.W. capacity at 110 volts, D.C. with adjustable field rheostat (mounted on switchboard)

Each exciter armature is to be mounted on the same shaft as the generator armature.

Each rotating disc, (as specified in par. 5) is to be mounted on the shaft of its generator, and enclosed in a sound deadening case. A pulley is to be provided and fitted on a shaft of each generator to permit the driving of the machines at their rated speed, from the above mentioned 5 H.P. engines.

The two generator units are to be set up in the engine room, and so arranged that they are driven from the inside flywheels of their respective engines. Each unit is to be secured to the concrete foundation provided for the same by means of four holding down bolts 5/8" diameter by 2 feet long set down 20" into the concrete bed, as specified for the engine in Paragraph 4.

Test for Machine.

7. The A.C. Generators are to give their rated output at 75% load factor, and all windings of all machines are to stand a high potential test of 3000 volts between windings and frame, or between windings and armature core.

The temperature rise when carrying full load continuously shall not exceed 50° C. in the field windings (resistance) and 45° C. in armature windings (Thermometer)

Rotating Spark Gap.

8. Each of the two rotating spark gaps is to be engaged in an approved metal casing fitted with a small glass or mica window to enable the spark to be seen without removing the cover.

The fixed electrodes, (which will presumably be attached to this casing) are to be provided with an arrangement whereby they can be rotated slowly and securely in either direction for not less than 3 inches from the normal position.

Proper ventilation is to be provided for the spark gap casing.

The temperature rise of the rotating and fixed studs when carrying full load continuously shall not come within 20°C. of the temperature at which the insulators used for the insulation of the disc or fixed electrodes begin to soften. Should there be any doubt on this point, the machines and different apparatus will be given an eight hour test when connected up under working conditions with a 600 meter wave aerial. Machines will be run at full load with an automatic sender in the primary circuit. At the end of this run, the temperature rise of the different parts of the machines must not exceed those herein specified and the insulation of the fixed and rotating studs and any other parts of the oscillating circuits must be cool and show no disfigurement or distress.

Belting.

9. Two double ply waterproof belts capable of transmitting 10 H.P. at the rated peripheral speed of the fly wheels

of the engines of the correct length for the driving of the generator units, are to be supplied. All joints in these belts are to be spliced. Metal fasteners will not be approved of.

General Distribution
of Apparatus.

10. The general distribution of the apparatus is to be as follows;-

(a) ENGINE ROOM;-

- 2 - 8 H.P. Gasoline Engines, complete with cooling tanks and fittings.
- 2 - 10 H.P. $5\frac{1}{2}$ K.W. Generator Units.
- 2 - $5\frac{1}{2}$ K.W. sets transmitting apparatus each consisting of;-
 - 1 L.F.I.C. Choker
 - 1 $5\frac{1}{2}$ K.W. Transformer
 - 2 air core chokers
 - 1 high tension condenser 0.06 mf.
 - 1 type No. 1.H.F. primary inductance
 - 1 $5\frac{1}{2}$ K.W. oscillation transformer
 - 1 $5\frac{1}{2}$ K.W. aerial helix
 - 1 type No. 1 Bradfield insulator
 - 1 shunt choker
 - 1 earth arrester plate
 - 2 protecting shunt boards
 - 1 Fibre Base
- 2 Waterproof leather belts,
- 1 Hot wire Ammeter (for both sets)
- 1 stand to carry apparatus

(b) INSTRUMENT ROOM.

- 2 shunt chokers
- 1 DP DT switch for above
- 1 main switchboard
- 1 receiver complete with crystal detectors
- 1 Magnetic detector complete.
- 1 Buzzer and Key
- 2 Transmitting Keys.

Condenser.

11. Each of the two high tension condensers is to be of 0.06 microfarad capacity and is to have sufficient plates in series to withstand the maximum voltage of the transformer without breaking down, it is to be mounted on a hard wood stand as specified in Paragraph 20.

Oscillation Transformer.

12. (a) Each of the two oscillation transformers is to be of the variable coupling type with an adjustable primary from 1 to 4 turns and an adjustable secondary from 1 to 7 turns. The coupling to be capable of variation from 0 to 10%.

H.F. Primary Inductance.

(b) Each of the two primary variable inductances (High Frequency) is to be of the variable solenoid type, No. 2 supplied by the Marconi Company.

H.F. Aerial Inductance.

(c) Each of the two aerial helices is to be of the $5\frac{1}{2}$ K.W.

type fitted with taps on the different turns and with two plugs to make connection to the same. The self induction of each of these two serial helices is to be sufficient to raise the wavelength of the aerial circuit from 600 metres to 1600 metres.

Range of Wavelength of Transmitting Apparatus.

13. The primary oscillation circuit consisting of 0.06 microfarad condenser, variable helix and primary of oscillation transformer is to be capable of adjustment to any wavelength between 600 and 1600 metres. The wavelength of the aerial circuit consisting of ground connection, secondary of oscillation transformer, aerial inductance and the aerial proper, is to have a wavelength of 600 metres when the inductance is cut out and with all the turns of the secondary of oscillation transformer included in the circuit.

The aerial inductance is to be of ample size to increase the above mentioned wavelength to 1600 metres when the said inductance is placed in the above aerial circuit.

Hot Wire Ammeter.

14. The Hot Wire Ammeter is to be of sufficient range to indicate the maximum current in the aerial circuit directly in amperes. It is to be mounted on an insulating stand and is to be permanently connected in the earth wire so as to be common to both sets. If a switch for short circuiting the hot wire ammeter is not an integral part of that instrument the same is to be supplied and fitted as an accessory.

Transformer.

15. Each of the two $5\frac{1}{2}$ K.W. transformers is to be contained in a cast iron case and with oil insulation and is to be designed for 240 cycles and a capacity of 0.06 microfarad and for use with the above mentioned generators and apparatus.

Each transformer shall operate with a power factor of not less than 90% when supplied with alternating current from the above generator.

The insulation of the secondary windings shall be capable of standing without breakdown an alternating potential applied to its terminals for one minute equal in value to double the normal maximum spark gap voltage.

The insulation between the primary and the secondary windings shall be capable of standing without breakdown the same applied voltage for one minute.

The primary winding shall be capable of standing without breakdown, an alternating effective potential of 1000 volts applied to its terminals for one minute.

The temperature rise of the primary and secondary windings must not be greater than 50°C. above a room temperature of 25°C. after a run of sufficient duration for the transformer to reach a practically constant temperature. This test to be made with key locked.

The temperature of the secondary to be determined by resistance measurements.

L. F. H. T. Chokers.

16. The two sets of air core chokes, each consisting of two units are to have 500 turns of No. 16 wire wound on a tube in one layer, insulation between the tube and the base of its support is to be capable of withstanding twice the maximum voltage of th

voltage of the secondary of the transformer.

L. F. I. C. Chokers.

17. The L.F.I.C. adjustable chokers are to be of the standard 5 K.W. type supplied by the Marconi Company, with a total self induction of 0.0106 henries.

Earth Arrestor Plates.

18. The two earth arrestor plates are to be of the standard type supplied by the Marconi Company. The same are to be fitted with all necessary lugs and mica insulation and are to be mounted on approved fibre bases.

Leading-in Insulators.

19. The two leading-in insulators are to be of the Bradfield type, No. 1 fitted with discs.

Erection of Trans-
mitting Apparatus.

20. Each of the two sets of transmitting apparatus as detailed in clause (a) of paragraph 10, is to be mounted on a specially insulated stand built for the same on the floor of the engine room immediately adjoining the bed plates of the generator units, and if possible the stands are to be arranged so as to allow a passage between wall of engine room and apparatus. One complete transmitting set is to be installed in connection with each generator unit.

The connections between the different parts of the primary circuit are to be kept as short as possible and are to be made of thin sheet copper with a perimeter of not less than 2 inches.

The leads to the disc spark gap terminals are to be so arranged as to permit of slight adjustment of the fixed electrodes.

The connections between the leading-in insulator and aerial helix, aerial helix and secondary of oscillation transformer, secondary of oscillation transformer and earth plate and the hot wire ammeter are to be made of best silk covered dynamo flex of ample capacity to carry the current.

Keys.

21. Each of the two transmitting keys is to be of the standard type supplied by the Marconi Company, each to be complete with telephone break attachment, and one pair of platinum iridium contacts. They are to be mounted on the desk in an approved position.

Key Chokers.

22. Each of the two keys chokers is to be of the standard 2 K.W. variable type supplied by the Marconi Company. They are to be mounted on the wall directly underneath the desk or in other approved position, and connected across the respective keys.

A DP. DT. Switch is to be provided and mounted so that either key may be used with either choker.

Change over Switch.

23. The change over switch is to be of an approved design. It must be in one movement carry out the following operations:-

Break circuit between aerial and tuner.
Break circuit between tuner and ground.
Break circuits between crystal and rest of instrument.
Break both sides telephone connection.
Make primary L.F. circuit of main generator.

Receiver.

24. One tuner complete with crystal detector of the Marconi Company's type No. 843 is to be supplied complete with a switch to change over to the magnetic detector, one telephone transformer to permit the use of low resistance telephones with the crystal detector, one commutator change over switch as specified in paragraph 23, six selected carborundum crystals in cups and to be arranged for two detectors.

The receiving apparatus is to permit of the reception of all wavelengths between 250 and 2000 metres. A calibration chart of the instrument is to be supplied from which the adjustment of the instrument for any length of wave can be determined.

Magnetic Detector.

25. One standard double magnetic detector complete with telephone condenser is to be supplied and connected up.

Telephones.

26. Three pairs of standard low resistance double head telephones with adjustable head band are to be supplied for use with the crystal receiver and the magnetic detector.

Buzzer.

27. One Standard high note Buzzer with battery and key for same to be supplied and installed.

Switchboard.

28. One main switch board is to be supplied and installed in the instrument room. The Panel to be of Blue Vermont Marble, mounted on angle iron frame, as per blue print submitted by the Company, and approved of by the Department.

In general the switch board is to have mounted on it;-

1 - D.C. Voltmeter.

1 - A.C. Voltmeter.

1 - A.C. Ammeter of Weston ^{make} ~~type~~, Eclipse type.

Generator and exciter rheostats.

Pilot Lamp

Necessary double pole, double throw switches to control all changes.

Single pole switches to control instruments.

The switch board is to be designed to enable either transmitting set to be thrown in circuit and placed in operation from the instrument room. All the necessary instruments, etc. essential for this purpose are to be connected in their respective circuits on the switchboard.

Wires and Wiring.

29. All wiring is to be installed in a neat, workmanlike manner and is to be of the best rubber covered lead sheathed copper wire of the following sizes;-

Main A. C. leads in generator circuits, No. 10.
 Main exciter Armature leads, and all leads to rheostat
 and auxiliary apparatus, No. 14.
 30 ampere dynamo flex to be used for all plug circuits carry-
 ing H.F. current.

All wiring is to be concealed and run along the ceiling
 of the basement of the building. All wires are to be
 carried on approved cleats and to be kept absolutely clear
 of adjoining woodwork. Where wires are run through wooden
 partitions, etc. the wires are to be run through porcelain
 tubes, or covered with asbestos, so that the lead sheathing
 does not touch the wood at any point. All lead sheathings
 are to be grounded by means of a No. 14 wire soldered to the
 sheathing at either end of the lead. (These connections will
 be made in the basement where the leads run up through the
 floor)

Where the lead sheathing is broken to permit of a T
 Joint the break is to be short circuited by means of one
 No. 14 copper wire soldered on the ends of the sheathing.

Protecting Board.

30. The protecting appliances are to consist of 2 - 5000
 ohm carbon rod, or graphite, resistances mounted on an
 approved porcelain stand and connected in series. The
 middle connection to be grounded and the two outer terminals
 connected to the apparatus to be protected. All carbon or
 graphite rods are to be fitted with a copper cap to facilitate
 connection with the clip of the stand, and to prevent
 sparking. These devices are to be installed across the
 following apparatus.

- The terminals of the primaries of the transformers.
- The terminals of the armatures of the alternators.
- The terminals of the fields of the exciters.
- The terminals of the armatures of the exciters.

General Test be-
 fore Acceptance.

31. The contractor shall set up the apparatus at the station
 mentioned in the beginning of this specification, in
 accordance with the terms of the spec.
- (a) The set will be tested in actual operation, connected
 to the standard aerial in compliance with the terms of
 this specification.
 - (b) All covers to be in place to give full effects of heat, etc.
 - (c) The transmitter and accessories to be operated at 600
 metres and 1600 metres wavelength at full power, in the dark
 to indicate location of brush discharges, etc.
 - (d) The test for the machines to be as hereinbefore specified.
 - (e) As an indication of the existence of loss, the readings
 of hot wire ammeter placed in the ground wire circuit are
 not to fall off more than 7.5% from the maximum reading with
 the set working at the full rated power, after the key has
 been kept closed for 5 minutes.

Tests.

32. No more than two tests will be made. The second test
 within ten working days after receipt by the Contractor of
 notice of the defects found.

Interchangeability.

33. All work is to be done to templates, jigs, and gauges in
 order that interchangeability may be ensured for all parts,
 both fixed and moving.

Standardization
of installation.

34. The installation at every station equipped with apparatus to this specification is to be identical in every way. The apparatus is to be set up in exactly the same location and connections made to exactly the same terminals so that each station will be a duplicate of the others.

Time Limit.

35. The apparatus is to be installed and ready for operation within six weeks from the time the buildings and masts are placed at the disposal of the contractors for installation purposes.

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General Superintendent Government
Wireless Service.

.....
Manager Marconi Wireless Telegraph
Co. of Canada Limited.

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