



P.O. Box 1749
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Item No. 9.2 (i)
Halifax Regional Council
May 24, 2016

TO: Mayor Savage and Members of Halifax Regional Council

SUBMITTED BY: Original Signed by Director
Peter Stickings, Acting Director, Operations Support

DATE: May 18, 2016

SUBJECT: **Award – Q16M022 Maintenance Agreement for Facility Emergency Generators**

SUPPLEMENTARY INFORMATION REPORT

ORIGIN

Council Report date April 4, 201, Award – Q16M022 Maintenance Agreement for Facility Emergency Generators.

The May 10,2016 deferral of the matter to the May 24, 2016, meeting of Regional Council pending staff providing additional information regarding possible alternatives for maintenance of facility emergency generators.

LEGISLATIVE AUTHORITY

Under the *HRM Charter*, Section 79, Regional Council may expend money for municipal purposes. Section 111(5) The Municipality may enter into a lease, lease-purchase or other commitment to pay money over a period extending beyond the end of the current fiscal year if, where the total commitment exceeds five hundred thousand dollars, the proposed commitment has been approved by the Minister. Administrative Order #35, the Procurement Policy, requires Council to approve the award of contracts for sole sources exceeding \$50,000 or \$500,000 for Tenders and RFP's. The following report conforms to the above Policy and Charter.

BACKGROUND

Operations Support provides preventative and life cycle maintenance planning to 224 municipal buildings. Included in that number are 52 facilities that have emergency electrical power supply generators, many of which are required to remain operational should there be power failure during emergency situations.

These facilities occupy a total footprint of 1,506,247 square feet of the municipal building portfolio. The approximate replacement value of the all of the emergency generators is approximately \$5,664,000.

Compliance with CSA C282-15 (Emergency Electrical Power Supply for Buildings), HRM is required to operate and maintain the generators and transfer switches in accordance with the manufacturer's recommendations. The current contract for maintenance expired at the end of April, 2016 and is being held over on a month to month basis.

At its May 10, 2016 session Council requested additional information respecting the generators and alternatives to the recommended award, specifically on the option of performing the work in house.

DISCUSSION

The National Building Code requires that all emergency electrical power supply systems be installed and maintained in conformance with the CAN/CAS C282-05, "Emergency Electrical Power Supply for Buildings". The systems shall be maintained as specified in the manufacturer's manual of operating and maintenance instructions. The owner's representative shall ensure that qualified personnel with appropriate training experience and supervision perform the maintenance work. The list of required checks set out in the National Building Code and the CSA Standards for maintaining electrical power are outlined in Attachment B of this report.

Further investigation deemed replacement value for the generators is approximately \$5,664,000 with the average \$107,000 per unit. The recommended annual servicing and inspection cost of \$359,523.06 represents approximately 6 percent of the total asset replacement value.

Within the portfolio of assets there are more recent installations that represent significant public investment and the importance of proper life cycle management cannot be understated. The following is a sample listing of some recent generator installs:

Building	Generator Supply and Install
Transit Bridge Terminal	\$ 185,000
Burnside Transit Centre	\$ 409,000
Dartmouth East Community Centre	\$ 150,000

The majority of the generators are located at key facilities that provide operational, emergency or comfort station support in the event of an emergency. Table 2A is a listing of such facilities. Table 2B lists the balance of the generator locations.

Excluded from the subject service contract award are over 30 locations with smaller generators, that range from \$5,000-\$25,000 in replacement value, that are serviced in house.

Table 2A

Cost Center	Location	Annual	Total Cost	Approx. Generator Replacement Cost
W203	Alderney Gate	\$6,531.00	\$32,655.00	\$300,000
R681	Burnside Transit Depot, 200 Ilsley Avenue	\$6,531.00	\$32,655.00	\$409,000
W213	Captain William Spry Centre	\$6,531.00	\$32,655.00	\$200,000
W213	Cowie Hill Depot	\$6,531.00	\$32,655.00	\$60,000
W213	David P. Mackinnon Building	\$6,531.00	\$32,655.00	\$100,000.00
W213	East Dartmouth Community Centre	\$6,531.00	\$32,655.00	\$150,000.00
W213	Eric Spicer Building - Generator 1	\$6,531.00	\$32,655.00	\$150,000.00
W213	Eric Spicer Building - Generator 2	\$6,531.00	\$32,655.00	\$150,000.00
B034	Halifax Central Library	\$5,426.20	\$27,131.00	\$80,000.00
W213	Halifax City Hall	\$6,531.00	\$32,655.00	\$80,000.00
W213	HRM Fire Station #9 Metropolitan Boul.	\$6,531.00	\$32,655.00	\$40,000.00

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W213	HRM Fire Station #12 Windmill Rd.	\$6,531.00	\$32,655.00	\$125,000.00
W213	HRM Fire Station #23 Chezzetcook	\$7,011.00	\$35,055.00	\$100,000.00
W213	HRM Fire Station #34 Tangier	\$7,011.00	\$35,055.00	\$40,000.00
W213	HRM Fire Station #35 Cooks Brook	\$7,011.00	\$35,055.00	\$100,000.00
W213	HRM Fire Station #40 Dutch Settlement	\$7,011.00	\$35,055.00	\$150,000.00
W213	HRM Fire Station #45 Gordon R. Snow Building	\$6,531.00	\$32,655.00	\$375,000.00
W213	HRM Fire Station #49 Beaver Bank Rd.	\$6,531.00	\$32,655.00	\$225,000.00
W213	HRM Fire Station #56 Black Point	\$7,011.00	\$35,055.00	\$125,000.00
W213	HRM Fire Station #60 Herring Cove	\$7,011.00	\$35,055.00	\$100,000.00
W213	HRM Fire Station #65 Upper Tantallon	\$7,011.00	\$35,055.00	\$100,000.00
R683	Lacewood Transit Terminal	\$6,531.00	\$32,655.00	\$60,000.00
W213	MackIntosh Depot	\$6,531.00	\$32,655.00	\$80,000.00
W213	Moser River Community Centre	\$7,011.00	\$35,055.00	\$80,000.00
W213	North Preston Community Centre	\$7,011.00	\$35,055.00	\$80,000.00
W213	Northbrook Community Police Center	\$6,531.00	\$32,655.00	\$80,000.00
W213	Prospect Recreation Centre	\$7,011.00	\$35,055.00	\$100,000.00
R683	Nantucket Bridge Transit Terminal	\$6,531.00	\$32,655.00	\$185,000.00
R680	Ragged Lake Transit Depot	\$6,531.00	\$32,655.00	\$200,000.00
W213	Thornhill Depot	\$6,531.00	\$32,655.00	\$60,000.00
W213	Turner Drive Depot	\$6,531.00	\$32,655.00	\$80,000.00
Sub-total		\$206,156.20	\$1,030,781.00	\$4,164,000.00

Table 2B

Cost Center	Location	Annual	Total Cost	Approximate Replacement Costs
W213	Caledonia Greenhouses	\$6,531.00	\$32,655.00	\$80,000.00
W213	HRM Fire Station #2 University Ave.	\$6,531.00	\$32,655.00	\$80,000.00
W213	HRM Fire Station #3 West St.	\$6,531.00	\$32,655.00	\$80,000.00
W213	HRM Fire Station #4 Lady Hammond Rd.	\$6,531.00	\$32,655.00	\$80,000.00
W213	HRM Fire Station #5 Bayers Rd.	\$6,531.00	\$32,655.00	\$80,000.00
W213	HRM Fire Station #6 Herring Cove Rd.	\$6,531.00	\$32,655.00	\$80,000.00
W213	HRM Fire Station #7 Knightsridge Dr.	\$6,531.00	\$32,655.00	\$50,000.00
W213	HRM Fire Station #8 Convoy Rd.	\$6,531.00	\$32,655.00	\$60,000.00
W213	HRM Fire Station #10 Sackville	\$6,531.00	\$32,655.00	\$80,000.00
W213	HRM Fire Station #13 King St.	\$6,531.00	\$32,655.00	\$80,000.00
W213	HRM Fire Station #16 Eastern Passage	\$6,531.00	\$32,655.00	\$80,000.00
W213	HRM Fire Station #17 Cole Harbour Rd.	\$6,531.00	\$32,655.00	\$80,000.00
W213	HRM Fire Station #18 Main St.	\$6,531.00	\$32,655.00	\$80,000.00
W213	HRM Fire Station #28 Sheet Harbour	\$7,011.00	\$35,055.00	\$80,000.00
W213	HRM Fire Station #29 Moser River	\$7,011.00	\$35,055.00	\$60,000.00
W213	HRM Fire Station #50 Hammonds Plains Rd.	\$6,531.00	\$32,655.00	\$50,000.00
W213	HRM Police Annex	\$6,531.00	\$32,655.00	\$80,000.00
P425	HRM Police Satellite Office (Mellor Ave)	\$6,531.00	\$32,655.00	\$60,000.00
W169	Old Red Cross Building	\$6,531.00	\$32,655.00	\$60,000.00
W213	Public Gardens Greenhouse	\$6,531.00	\$32,655.00	\$60,000.00
W213	Sheet Harbour Community Centre	\$7,011.00	\$35,055.00	\$60,000.00
Sub-total		\$138,591.00	\$692,955.00	\$1,500,000.00

Performing the Work In-House:

Staff has completed an analysis for the alternative of bringing the service work in house. As per Table 1 below the estimated start-up cost for the program is \$635,000 in year one followed by an annual program cost of \$400,000 - \$425,000. This results in a five-year service cost of over \$2.29 million when compared to the recommended external contract award of \$1,782,598. Implementing an in house program including; budget approval; recruitment; and staffing of up to four positions with associated training and program start up would take considerable time to complete.

Cost Item	Description	Year 1	Years 2	Year 3	Year 4	Year 5
Total Compensation	4 Industrial Mechanics - \$32.47 per hour x 2,080 hours = \$67,537.60 + 25% Pension & Benefits = \$84,422 per person	\$ 337,688	\$ 344,442	\$351,330	\$ 358,357	\$365,524
	Supervisor (P-1 Level) (60% of annual salary)	\$ 51,627	\$ 52,660	\$ 53,713	\$ 54,787	\$55,883
Training	Staff Training*	\$ 12,000	0	0	0	0
Fleet	Vehicle cost (\$35,000 - \$40,000 x 4 vehicles)	\$ 160,000	\$2,500	\$2,500	\$3,000	\$3,000
Tools and Equipment	Initial Tools purchase	\$ 8,000	0	\$5,000	0	0
	Load Bank ** (2 required at \$30,000 each)	\$ 60,000	0	0	0	0
	Safety Equipment	\$ 5,000	0	0	\$2,000	0
Total	\$2,289,011	\$634,315	\$399,602	\$412,543	\$418,144	\$424,407

* Staff requires specific manufacturer training. Training on the all the different generator sets (Cummins, Caterpillar and Kolar).

** Load Bank is a device which develops an electrical load, applies the load to an electrical power source and converts or dissipates the resultant power output of the source. The purpose of the load bank is to accurately represent the operational or "real" load that a power sources will see in actual application.

FINANCIAL IMPLICATIONS

See Regular Session Council Recommendation Report dated April 4, 2016.

RISK CONSIDERATIONS

The National Fire code and the CSA have clear standards around maintaining generators and electrical transfer equipment. The risks of not maintaining to the standard specified in the code could mean, in the event of a power failure, the equipment may fail to operate. This could result in no heat and electricity, occupant safety hazards and building damages such as frozen pipes which can lead to leaks and other building damage. Interruptions in service for our 911 and 311 centres would also be a significant concern. Furthermore the current contract pricing as per the procurement process is open for 90 days from receipt of bids.

ENVIRONMENTAL IMPLICATIONS

See Regular Session Council Recommendation Report dated April 4, 2016.

ALTERNATIVES

Council could direct staff to further explore the steps needed to transition the service work be performed in house. This would require the negotiation of at least a one year contract to allow time to implement budget, staffing plan and training program as well as a better understanding of the impacts on collective agreements. This alternative is not recommended for reasons outlined above.

ATTACHMENTS

Attachment A - April 4, 2016 Council Report Award Q16M022 – Maintenance Agreement for Emergency Generators Council Report

Attachment B - C282-05 “Emergency Electrical Power Supply for Buildings” – Operation and Maintenance Program

A copy of this report can be obtained online at <http://www.halifax.ca/council/agendasc/cagenda.php> then choose the appropriate meeting date, or by contacting the Office of the Municipal Clerk at 902.490.4210, or Fax 902.490.4208.

Report Prepared by: Jim Brown, Supervisor, Operations & Technical Services, 902-430-6267

Report Approved by: _____


Diane Moulton, Manager, Municipal Facilities Maintenance & Operations, 902-490-1536

Original Signed


P.O. Box 1749
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Item No. 14.1.1
Halifax Regional Council
May 10, 2016

TO: Mayor Savage and Members of Halifax Regional Council

SUBMITTED BY: Original Signed by 

John Traves, Q.C., Acting Chief Administrative Officer

Original Signed by 

Jane Fraser, Acting Deputy Chief Administrative Officer

DATE: April 4, 2016

SUBJECT: **Award – Q16M022 Maintenance Agreement for Facility Emergency Generators**

ORIGIN

Required generator inspection services for HRM buildings.

LEGISLATIVE AUTHORITY

Under the *HRM Charter*, Section 79, Regional Council may expend money for municipal purposes. Section 111(5) The Municipality may enter into a lease, lease-purchase or other commitment to pay money over a period extending beyond the end of the current fiscal year if, where the total commitment exceeds five hundred thousand dollars, the proposed commitment has been approved by the Minister. Administrative Order #35, the Procurement Policy, requires Council to approve the award of contracts for sole sources exceeding \$50,000 or \$500,000 for Tenders and RFP's. The following report conforms to the above Policy and Charter.

RECOMMENDATION

It is recommended that Regional Council award RFQ number Q16M022 to Eastern Alternative Power Systems for a total tender price of \$1,797,616 (net HST included), with funding from W213, W203, W169, R680, R681, R683, B034, and P425 as outlined in the Financial Implications section of this report for a five-year term from 01 May 2016, to 30 April 2021, pending Ministerial Approval.

BACKGROUND

The Municipality cares for 224 buildings through preventative and life cycle maintenance planning. Included in that number are 52 facilities that have emergency electrical power supply generators, many of which are required to remain operational should there be power failure during emergency situations.

These facilities occupy a total footprint of 1,506,247 square feet of our municipal building portfolio. The approximate replacement value of the all of the emergency generators is \$3,900,000.

In compliance with CSA C282-15 (Emergency Electrical Power Supply for Buildings), HRM is required to operate and maintain the generators and transfer switches in accordance with the manufacturer's recommendations. The current contract for maintenance will expire at the end of April, 2016.

DISCUSSION

The buildings owned and operated by the Municipality enable the provision of a variety of programs and services to the public. Many buildings that contain emergency generators are required to remain operational during emergency situations. These buildings include but are not limited to Eric Spicer which houses both the 311 and 911 Call Centres; various fire stations; transit facilities; and a number of community recreation centres which are designated comfort centres in a state of emergency.

The current maintenance agreement for buildings that have emergency electrical power supply specifies detailed inspections as required by CSA C282-15. This includes, but is not limited to, verifying functionality, checking oil levels and replacement of consumables (oil, filters, etc.), proper automatic transfer under load, fuel replacement and fuel filtration to remove impurities. Failure to perform the maintenance could result in the units not operating in the event of an emergency. In addition, warranties on the units would be void.

The quotation for the maintenance agreement for emergency generators was advertised on the provincial website beginning on February 22, 2016, and closing on March 7, 2016.

The recommended five-year term contract is renewable on a year-to-year basis, based on acceptable performance. The contract is transferrable; we can add and remove facilities as required based on acquisition or disposal time lines. All facilities with generators require testing and maintenance regardless of age, the warranty only covers the equipment as long as we do the maintenance based on code and manufacturers recommendations. Failure on the part of the contractor to fulfill the contractual obligations shall be considered just cause for termination of the contract.

The new maintenance agreement for emergency generators will realize a \$35,700 annual savings, with an overall 5-year term savings of \$178,500.

The following is the price breakdown from the bidding process:

Company	Total Annual Cost (net HST included)	Total Cost (net HST included)
Eastern Alternative Power Systems Ltd.	\$359,523.06	\$1,797,615.32
David Veinottes Truck & Auto	\$370,448.90	\$1,852,244.50
Madsen Power Systems	\$395,631.88	\$1,978,159.42
Sansom Equipment Limited	\$569,338.98	\$2,846,694.94
Cummins Eastern Canada	\$583,003.58	\$2,915,017.91
Smith's Diesel and Power Generation Systems Ltd.	\$788,420.30	\$3,942,101.53
Wajax Power Systems	\$878,515.27	\$4,392,576.38
Canadian Maritime Engineering	\$969,960.74	\$4,849,803.74

FINANCIAL IMPLICATIONS

In compliance with CSA C282, based on the lowest 5-year cost of \$1,782,598.14 (net HST included) equalling \$356,519.62 per year (net HST included), funding is available for 2016/17 and will be included in the proposed Operating Budgets for the subsequent years, ending March 31, 2021.

The budget availability has been confirmed by Finance.

Cost Center	Location	Total Cost	Total Cost (net HST Incl.)
W203	Alderney Gate	\$32,655.00	\$34,054.59
R681	Burnside Transit Depot	\$32,655.00	\$34,054.59
W213	Caledonia Greenhouses	\$32,655.00	\$34,054.59
W213	Captain William Spry Centre	\$32,655.00	\$34,054.59
W213	Cowie Hill Depot	\$32,655.00	\$34,054.59
W213	David P. Mckinnon Building	\$32,655.00	\$34,054.59
W213	East Dartmouth Community Centre	\$32,655.00	\$34,054.59
W213	Eric Spicer Building - Generator 1	\$32,655.00	\$34,054.59
W213	Eric Spicer Building - Generator 2	\$32,655.00	\$34,054.59
B034	Halifax Central Library	\$27,131.00	\$28,293.83
W213	Halifax City Hall	\$32,655.00	\$34,054.59
W213	HRM Fire Station #2 University Ave.	\$32,655.00	\$34,054.59
W213	HRM Fire Station #3 West St.	\$32,655.00	\$34,054.59
W213	HRM Fire Station #4 Lady Hammond Rd.	\$32,655.00	\$34,054.59
W213	HRM Fire Station #5 Bayers Rd.	\$32,655.00	\$34,054.59
W213	HRM Fire Station #6 Herring Cove Rd.	\$32,655.00	\$34,054.59
W213	HRM Fire Station #7 Knightsridge Dr.	\$32,655.00	\$34,054.59
W213	HRM Fire Station #8 Convoy Rd.	\$32,655.00	\$34,054.59
W213	HRM Fire Station #9 Metropolitan Boul.	\$32,655.00	\$34,054.59
W213	HRM Fire Station #10 Sackville	\$32,655.00	\$34,054.59
W213	HRM Fire Station #12 Windmill Rd.	\$32,655.00	\$34,054.59
W213	HRM Fire Station #13 King St.	\$32,655.00	\$34,054.59
W213	HRM Fire Station #16 Eastern Passage	\$32,655.00	\$34,054.59
W213	HRM Fire Station #17 Cole Harbour Rd.	\$32,655.00	\$34,054.59
W213	HRM Fire Station #18 Main St.	\$32,655.00	\$34,054.59
W213	HRM Fire Station #23 Chezzetcook	\$35,055.00	\$36,557.46
W213	HRM Fire Station #28 Sheet Harbour	\$35,055.00	\$36,557.46
W213	HRM Fire Station #29 Moser River	\$35,055.00	\$36,557.46
W213	HRM Fire Station #34 Tangier	\$35,055.00	\$36,557.46
W213	HRM Fire Station #35 Cooks Brook	\$35,055.00	\$36,557.46
W213	HRM Fire Station #40 Dutch Settlement	\$35,055.00	\$36,557.46
W213	HRM Fire Station #45 Gordon R. Snow Building	\$32,655.00	\$34,054.59
W213	HRM Fire Station #49 Beaver Bank Rd.	\$32,655.00	\$34,054.59
W213	HRM Fire Station #50 Hammonds Plains Rd.	\$32,655.00	\$34,054.59
W213	HRM Fire Station #56 Black Point	\$35,055.00	\$36,557.46
W213	HRM Fire Station #60 Herring Cove	\$35,055.00	\$36,557.46
W213	HRM Fire Station #65 Upper Tantallon	\$35,055.00	\$36,557.46
W213	HRM Police Annex	\$32,655.00	\$34,054.59
P425	HRM Police Satellite Office (Mellor Ave)	\$32,655.00	\$34,054.59
R683	Lacewood Transit Terminal	\$32,655.00	\$34,054.59
W213	MackIntosh Depot	\$32,655.00	\$34,054.59
W213	Moser River Community Centre	\$35,055.00	\$36,557.46
R683	Nantucket Bridge Transit Terminal	\$32,655.00	\$34,054.59
W213	North Preston Community Centre	\$35,055.00	\$36,557.46
W213	Northbrook Community Police Center	\$32,655.00	\$34,054.59
W169	Old Red Cross Building	\$32,655.00	\$34,054.59
W213	Prospect Recreation Centre	\$35,055.00	\$36,557.46
W213	Public Gardens Greenhouse	\$32,655.00	\$34,054.59
R680	Ragged Lake Transit Depot	\$32,655.00	\$34,054.59
W213	Sheet Harbour Community Centre	\$35,055.00	\$36,557.46
W213	Thornhill Depot	\$32,655.00	\$34,054.59
W213	Turner Drive Depot	\$32,655.00	\$34,054.59
Total		\$1,723,736.00	\$1,797,615.32

ENVIRONMENTAL IMPLICATIONS

There are no Environmental Implications.

ALTERNATIVES

Each of the 52 Buildings could be outsourced separately which would be more costly and difficult to coordinate.

RISK CONSIDERATIONS

Failure to perform maintenance as per CSA C282 could result in units not functioning in the event of an emergency. Warranties on units would be void and there would also be potential for insurance implications in the event that there was an incident during a power switch over.

ATTACHMENTS

None.

A copy of this report can be obtained online at <http://www.halifax.ca/council/agendasc/cagenda.php> then choose the appropriate meeting date, or by contacting the Office of the Municipal Clerk at 902.490.4210, or Fax 902.490.4208.

Report Prepared by: Jim Brown, Supervisor, Operations & Technical Services, 902-430-6267

Report Approved by: _____
Diane Moulton, Manager, Municipal Facilities Maintenance & Operations, 902-490-1536

Procurement Review: _____
Jane Pryor, Manager, Procurement, 902.490.4200

Report Approved by: _____
Dave Reage, Acting Director, Halifax Transit, 902.490.5138

Report Approved by: _____
Peter Stickings, Acting Director, Operations Support, 902.490.1729

Original Signed

C282-05 “Emergency Electrical Power Supply for Buildings”

11 Operation and maintenance program

11.1 General

11.1.1 Operation and maintenance

The emergency electrical power supply equipment shall be operated and maintained in accordance with the manufacturer’s recommendations and instruction manuals and the requirements of Clauses 11.1.2. to 11.5.

Note: See Clause B.19 for commentary on this Clause.

11.1.2 Inspection, testing, and maintenance log

A permanent log of the inspection, testing, and maintenance of the emergency electrical power supply system shall be maintained in accordance with the manufacturer’s manual of operating and maintenance instructions and cover at least the items specified in Tables 2 to 6.

This log shall be kept on site and shall include

- (a) the date on which an inspection, testing, and maintenance exercise was carried out;
- (b) the name(s) of the person(s) who performed the inspection, testing, and maintenance;
- (c) notes on any unsatisfactory conditions observed or discovered and the steps taken to correct such conditions; and
- (d) copies of the design and installation performance test certificates.

11.2 Instruction, tools and spare parts

11.2.1 Manual of operating and maintenance instructions

11.2.1.1

At least two copies of a manual containing mechanical and electrical drawings and instructions for the operation and maintenance of the emergency generator equipment shall be provided. It shall cover all of the elements affecting the reliable operation of the emergency electrical power supply, including the engine generator set and associated accessories, the generator control panel, the protective devices, and the transfer switch(es).

11.2.1.2

The manual should be available in both English and French.

11.2.1.3

One copy of the manual shall be kept in the safe custody of the person responsible for overall control of the operation and maintenance program.

11.2.1.4

Copies of the manual to be used by the operating and maintenance staff shall be kept in a location convenient for staff use.

11.2.2 Tools

Any special tools and gauges needed for routine maintenance shall be kept in a secure location accessible to the operating and maintenance staff when necessary.

Note: A possible suitable location is the area where the engine generator set is installed.

11.3 Annual test

The emergency generator set shall be subjected annually to a 2 h full-load test (See Table 5) in accordance with Clauses 10.3.2 to 10.3.4. In parallel generator set installations, each generator may be load tested individually in synchronization and load sharing is demonstrated. All inspection covers shall be opened or removed, as necessary, to provide access to all electrical connections during this test.

Note: See Clause B.18 for commentary on this Clause.

11.4 Periodic operational tests

The emergency electrical power supply system shall be completely tested as specified in Table 3 at least once a month in all facilities.

11.5 Maintenance

11.5.1 General

The emergency electrical power supply shall be maintained as specified in the manufacturer's manual of operating and maintenance instructions, provided that the manual covers at least the items specified in Tables 2 to 6. The owner's representative shall ensure that qualified personnel with appropriate training, experience, and supervision perform the maintenance work.

11.5.2 Frequency of procedures

The minimum frequency of inspection, testing, and maintenance procedures shall be as specified in Tables 2 to 6. Additional requirements may be specified by manufacturers, operators, or authorities having jurisdiction and shall be permanently recorded in the manual of operating and maintenance instructions and the log.

11.5.3 Records

A permanent log of the maintenance work (including inspections and tests) shall be maintained in accordance with the manufacturer's manual of operating and maintenance instructions (see Clause 11.5.1). The permanent log shall be kept on site and shall include at least the following:

- (a) the date on which the work was done;
- (b) a note of parts replaced;

- (c) a note of any unsatisfactory condition discovered and the steps taken to correct it;
- (d) the name of the person who performed the work; and
- (e) A note verifying that any switches or controls that were deactivated for safety purposes during maintenance have been restored to their intended operating condition.

Note: A permanent logbook meeting all the requirements of this standard is available from CSA (C282 Logbook)

11.5.4 Safety

11.5.4.1

If the maintenance procedure involves a risk of injury because of moving parts or energized electrical parts, step shall be taken before the work is begun to deactivate all automatic and manual control devices for the parts with which contact will be named.

11.5.4.2

Signs shall be installed on the equipment at the entrance to the enclosure and on the door to the room housing the equipment stating that the equipment is automatically controlled and could start at any time.

11.5.5 Visual inspection of fuel (clear and bright test)

11.5.5.1 General

All fuel supplied to the emergency generator set shall be clean and clear and bright as specified in Clause 11.5.5.4. Immediately upon completion of the annual fuel oil inventory maintenance specified in Table 5, the fuel oil shall be tested to verify that it is clear and bright. If the fuel fails the test, tank shall be flushed to remove built-up sludge and impurities.

Note: The purpose of this test is to detect possible water or solid contaminants in diesel fuel by visual inspection. The test method is based on ASTM D 4176.

11.5.5.2 Description

The fuel shall be placed in a transparent bottle or container (Clause 11.5.5.3) and examined to determine whether it is clear and bright. Samples for the clear and bright test shall be obtained from the bottom of the storage and day tanks.

11.5.5.3 Equipment

A dry, capped, clear glass bottle or container capable of holding 250 to 1000 mL of liquid shall be used. The bottle or container shall have a clear, undistorted bottom and be thoroughly washed before the test.

11.5.5.4 Procedure

The following procedure shall be followed:

- (a) Wash the fuel sample bottle or container before gathering each sample.

- (b) Let the sample settle for 1 min to remove air bubbles.
- (c) Observe the sample against a light background for a clear and bright condition. Swirl the bottle or container to create a vortex (free water and solids tend to collect beneath the vortex).

11.5.5.5 Interpretation of test results

The samples shall be clear and bright. Record the visual clarity as clear and bright or not clear and bright. Record whether particulate matter or water was seen at the bottom of the vortex.

Note: *The term “clear and bright” has no relation to the natural fuel oil colour. Fuel oil colour varies from water white, to straw colour, to amber, depending on the processing and/or crude source. Clear and bright fuel has no floating or suspended matter. Brightness is a quality independent of the sample colour and refers to the lack of suspended or free water in the sample. Bright fuel tends to sparkle.*

Table 1
Safety indicators and shutdowns
(See Clauses 7.4.1, 7.4.2, and 10.5)

Indicator/function (at battery voltage)	CV (see Clause 7.4.1(d))	RA (see Clause 7.4.1 (e))	S	Notes
1. Overcrank	X	X	X	----
2. Low engine temperature (i.e., too low for reliable start)	X	X	----	----
3. High engine temperature pre-alarm	X	X	----	----
4. High engine temperature	X	X	X	1
5. Low lube oil pressure pre-alarm	O	O	----	----
6. Low lube oil pressure	X	X	X	1
7. Overspeed	X	X	X	1
8. Low fuels (signal less than 2 h of fuel remaining)	X	X	----	----
9. Emergency electrical power supply system supplying load	O	----	----	2
10. Control switch not in automatic position	X	----	----	----
11. Low voltage in battery	X	X	----	----
12. Lamp test	X	----	----	----
13. Contacts for local and remote common alarm	X	X	----	----
14. Audible alarm silencing switch	----	X	----	----
15. Low starting air pressure (if applicable)	X	X	----	----
16. Low starting hydraulic pressure (if applicable)	X	X	----	----
17. Air shutdown damper (if applicable)	X	X	----	----
18. Remote emergency stop (if applicable)	----	O	O	----
19. Low coolant level (if applicable)	X	X	----	----
20. Ventilation dampers not open	O	O	----	----
21. Day tank containment leak sensing	X	X	----	----
22. Automatic transfer switch in bypass mode (if applicable)	X	X	----	3
23. Underfrequency/underspeed	O	----	----	----
24. Overcurrent	O	----	----	----
25. Undervoltage	O	----	----	----
26. Overvoltage	O	----	----	----
27. Main disconnect open	X	X	----	4

Legend:

CV – *Control-panel-mounted visual indicator*

RA – *Remote audible indicator*

S – *Shutdown of emergency power system*

X – *Required*

O – *Optional*

Notes:

(1) To ensure that the emergency power system is operational for as long as possible, shutdown should be delayed until failure is imminent. The setting of Item 4 shall be not less than 110% of normal temperature, the setting of Item 6 shall be not more than 40% of normal pressure, and the setting of Item 7 shall be not less than 115% of normal speed.

(2) An ac ammeter is acceptable for this function.

(3) An automatic transfer switch requires a remote audible safety indicator for both the automatic and bypass modes.

(4) The main disconnect open indicator should be included with the common “generator trouble” alarm indication on the fire alarm panel.

Table 2
Weekly inspection, test, and maintenance requirements
(See Clauses 6.11.2, 10.7, 11.1.2, 11.5.1, and 11.5.2 and Tables 3 to 5.)

<p>1. Consumables:</p> <p>(a) Inspect day tank fuel level (gas pressure) and main tank level (gas pressure) (if applicable). Minimum 2 h supply required (see Clause 7.3.1).</p> <p>(b) Inspect lubricating oil level.</p> <p>(c) Inspect engine coolant level.</p> <p>(d) Inspect engine, generator, fuel tank(s), and cooling systems for leakage.</p> <p>(e) Inspect for proper operation of fuel transfer pump (if applicable).</p> <p>(f) Inspect fuel filter for contamination if filter is equipped with a transparent bowl.</p>
<p>2. Starter system:</p> <p>(a) Inspect electric starter for cleanliness, mounting, and terminal security.</p> <p>(b) Air starter:</p> <p>(i) Inspect air tanks for pressure.</p> <p>(ii) Inspect valves for leakage.</p> <p>(iii) Test auxiliary engine and compressor for proper operation.</p> <p>(iv) Bleed off any condensation.</p>
<p>3. Batteries and charging equipment:</p> <p>(a) Inspect all battery cells for correct electrolyte fill level.</p> <p>(b) Test all battery cells for correct electrolyte specific gravity.</p> <p>(c) Inspect electrical connections for tightness and evidence of corrosion.</p> <p>(d) Inspect battery for cleanliness and dryness between terminals.</p> <p>(e) Inspect charger electrical connections for cleanliness and tightness.</p> <p>(f) Test charger for proper operation of float and equalize modes.</p>
<p>4. Engine:</p> <p>(a) Test lubricant and/or coolant heaters for proper operation.</p> <p>(b) Inspect governor control linkages and oil level (if applicable).</p> <p>(c) Inspect fuel pump oil sump (if applicable).</p> <p>(d) Inspect fan belts for correct tension and wear.</p>
<p>5. Control panel:</p> <p>(a) Inspect control panel covers for security.</p> <p>(b) Test annunciator lamps to confirm that they are operational.</p> <p>(c) Inspect control panel settings (ensure that the unit is ready for automatic start-up).</p> <p>(d) Test remote visual and audible trouble signals at the building fire alarm panel.</p>
<p>6. Inspect air control louvre settings to ensure proper operation.</p>
<p>7. Test emergency lighting unit(s).</p>
<p>8. Verify whether room temperature is above 10 °C.</p>
<p>9. Inspect generator and transfer switch room(s) for cleanliness and accessibility to all components of the emergency system.</p>
<p>10. Correct all defects found during inspections and tests.</p>
<p>11. Record all inspections, tests, and corrective actions in the log (see Clause 11.5.3).</p>

Note: *The person performing the work described in this Table shall have received appropriate training and be qualified to perform the specified tasks.*

Table 3
Monthly inspection, test, and maintenance requirements
 (See Clauses 10.7, 11.1.2, 11.4, 11.5.1, and 11.5.2 and Tables 4 and 5.)

1. All items specified in Table 2.
2. Test and verify the entire system as follows: (a) Simulate a failure of the normal electrical supply to the building. (b) Operate the system under at least 30% of the rated load for 60 min. (c) Operate all automatic transfer switches under load. (d) Inspect brush operation for sparking. (e) Inspect for bearing seal leakage. (f) Inspect for correct operation of all auxiliary equipment, e.g., radiator shutter control, coolant pumps, fuel transfer pumps, oil coolers, and engine room ventilation system(s). (g) Record the readings for all instruments in the log (see Clause 11.5.3) and verify that they are normal. (h) Drain the exhaust system condensate trap.
3. Inspect block heater hoses and wires.
4. Correct all defects found during inspections and tests.
5. Record all inspections, tests, and corrective actions in the log (see Clause 11.5.3).

Note: The person performing the work described in this Table shall have received appropriate training and be qualified to perform the specified tasks.

Table 4
Semi-annual inspection, test, and maintenance requirements
 (See Clauses 10.7, 11.1.2, 11.5.1, and 11.5.2 and Table 5.)

1. All items specified in Tables 2 and 3.
2. Inspect and clean engine crankcase breathers.
3. Inspect and clean all engine linkages
4. Lubricate the engine governor and ventilation system.
5. Test protective devices for proper operation.
6. Before start-up, perform two full cranking cycles (as specified in Clauses 10.4.1 and 10.4.2). Near the end of each cycle (and while still cranking), measure and record the lowest indicated battery voltage. If the measured voltage is less than 80% of the battery's rated voltage, replace the battery. Alternatively, perform a battery load test using a suitable load tester.
7. Inspect ventilation system belt(s).
8. Correct all defects found during inspections and tests.
9. Record all inspections, test, and corrective actions in the log (see Clause 11.5.3).

Note: Items 2 to 9 require special skills and shall be carried out by a qualified contractor, the system manufacturer, or individuals trained and certified by the system manufacture.

Table 5
Annual inspection, test, and maintenance requirements
(See Clauses 11.1.2, 11.3, 11.5.1, 11.5.2, 11.5.5.1, and B.20.)

<p>1. All items specified in Tables 2 to 4.</p>
<p>2. Control panel:</p> <ul style="list-style-type: none"> (a) Open all inspection covers and inspect all electrical connections. (b) Test breakers for proper operation. (c) Clean insulators and bushings. (d) Test voltage regulator for proper operation. (e) Operate all moving parts to ensure that they move freely. (f) Clean and dress contacts as necessary. (g) Remove all dust. (h) Check gauge calibration. (i) With the generator set operating at full load (see Clause 11.3), conduct an infrared survey of all electrical connections to identify any high-resistance connections.
<p>3. Engine:</p> <ul style="list-style-type: none"> (a) Change engine lubrication oil and filters. (b) Test strength of coolant and chemical protection level of coolant inhibitors. (c) Change fuel filters, clean strainer(s), and verify that the fuel supply is open. (d) Inspect the exhaust system. Check and record the back pressure of the exhaust system to ensure that it complies with the engine manufacturer's requirements, and compare with previous readings. (e) Clean and lubricate linkages. (f) Inspect air filters. (g) Inspect all mechanical connections. (h) Inspect all electrical connections. (i) For spark ignition engines, inspect all components of ignition system(s) and service or replace as appropriate. (j) Inspect all external surfaces of heat exchanger(s) and clean as necessary. (k) Inspect all belts and hoses and replace if necessary. (l) Test and inspect ignition system(s). Replace any defective components. (m) Inspect coolant pump(s) for leaks and external wear (if belt driven, remove the belt(s) first).
<p>4. Diesel fuel storage tank(s):</p> <p>The fuel oil in any storage tank (and day tank, if used) shall be tested in accordance with Clause 11.5.5, and if the fuel oil fails the test, it shall be</p> <ul style="list-style-type: none"> (a) drained and refilled with fresh fuel in accordance with Article 6.7.1.5 of the <i>National Fire Code of Canada</i>; or (b) full filtered to remove water, scale, bacteria, and oxidized gums/ resins in order to minimize filter clogging and ensure diesel start-up (see Clause B.20 for commentary). <p>When the fuel is filtered, it shall be treated with suitable conditioner and stabilizer to minimize degradation while in storage.</p> <p>Note: <i>The bottom(s) of the tank(s) shall be also tested chemically for water.</i></p>

(Continued)

Table 5 (Concluded)

<p>5. Generator:</p> <ul style="list-style-type: none">(a) Test surge suppressor and rotating rectifier on brushless machines.(b) Grease bearings (replace old grease with new) (if applicable).(c) Clean commutator and slip rings (if applicable).(d) Clean rotor and stator windings using clean compressed air.(e) Inspect coupling bolts and alignment.(f) Inspect conduits for tightness.(g) Inspect windings at rotor and stator slots.(h) Inspect all electrical connections.(i) With the generator set operating at full load (see Clause 11.3), conduct an infrared survey of all electrical connections to identify and high-resistance connections.
<p>6. Transfer switches:</p> <ul style="list-style-type: none">(a) Isolate transfer switch, open all inspection covers, and inspect all electrical connections.(b) Operate all moving parts to ensure that they move freely.(c) Clean and dress contacts as required.(d) Remove all dust.(e) Clean and lubricate linkages.(f) Conduct an infrared survey of all electrical connections, contacts, and energized components while under load on both the normal and the emergency side.
<p>7. Lubricate door locks and hinges (if necessary), especially those of outdoor enclosures.</p>
<p>8. Conduct a 2 h full-load test (see Clause 11.3).</p>
<p>9. As needed, review and provide instruction on the technical requirements specified in Tables 2 to 4 with the person(s) responsible for carrying out the work.</p>
<p>10. Correct all the defects found during inspections and tests.</p>
<p>11. Record all inspections, tests, and corrective actions in the log (see Clause 11.5.3).</p>

Note: *Item 2 to 11 require special skill and shall be carried out by a qualified contractor, the system manufacturer, or individuals trained and certified by the system manufacturer.*

Table 6
**Quinquennial (every five years) inspection,
test, and maintenance requirements**
(see Clauses 11.1.2, 11.5.1, and 11.5.2)

<p>1. Generator: Inspect insulation of generator windings. Use an insulation tester (megger). The resistance in megohms should be not less than</p> <p style="text-align: center;"><u>Rated voltage + 1000</u> 1000</p> <p>If the resistance is less, dry out the insulations using the auxiliary heat process.</p>
<p>2. Engine:</p> <ul style="list-style-type: none"> (a) Drain and flush the cooling system. Refill the system with new coolant. (b) Clean radiator tubes and cooling fins. (c) Replace thermostats. (d) Inspect valve clearances and adjust as appropriate.
<p>3. Correct all defects found during inspections and tests.</p>
<p>4. Record all inspections, tests and corrective actions in the log (see Clause 11.5.3).</p>

Note: *Items 1 to 4 require special skill and shall be carried out by a qualified contractor, the system manufacturer, or individuals trained and certified by the system manufacturer.*