Corrosion of Domestic Hot Water Tanks: Proposed Investigation in Deep River, Ontario

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DIVISION OF BUILDING RESEARCH

CORROSION OF DOMESTIC HOT WATER TANKS

PROPOSED INVESTIGATION IN DEEP RIVER, ONTARIO

by

P. J. Sereda

(Prepared for the

Atomic Energy Project, N.R.C.)

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The problem of corrosion of installations for the domestic supply of hot water was brought to the attention of the Division of Building Research early in its existence. Preliminary study of the problem as it exists in homes across Canada has been started. This information, together with a discussion of possible causes and methods of prevention, were reported to Central Mortgage and Housing Corporation in a D.B.R. interim progress report No. R11, dated May 19, 1949.

It is pointed out in the above Report that many factors contribute to a high rate of corrosion of galvanized tanks and piping, namely, the characteristics of the water, the materials used for fabrication of the equipment, and the conditions of operation. If control is exercised over some of these factors, it is anticipated that the rate of corrosion can be decreased considerably. It was recommended in the earlier Report that the temperature of the water in the storage tanks be controlled below 140°F. This may necessitate a joint recommendation for the use of larger storage tanks than is now common practice. The Report advised against the indiscriminate use of magnesium anodes to provide cathodic protection with certain types of water as well as chemical water treatment where rigid control is not feasible. The Report suggested that the effectiveness of these preventative measures be tested to insure that they are economically justifiable.

As already outlined, a survey of the extent of this problem has been started through the co-operation of the C.M.H.C. The Division has been aware of the problem existing in Deep River, but only recently has it been possible to include it in the survey. On October 27, 1949, the writer visited Deep River to initiate the investigation there and discuss with members of the maintenance staff the various aspects of this problem.

Discussions were held with Messrs. F. Hammond, T. W. Morrison, F. Holland, R. Johnson, and M. Lavigne. From the cases stated and figures quoted there is no doubt that a very serious corrosion problem exists. Some of the houses have had three replacements of the hot water tank in as many years.

The maintenance personnel have made a notable effort to reduce the excessive corrosion failures. One method involved the removal of furnace coils connected to hot water tanks, thus enabling control of temperature. Other methods involved the treatment of the water with a phosphate inhibitor, Alchem No. 918, which was started over a year ago on the recommendation of the Aluminate Chemicals, Limited. Cathodic protection, including the use of magnesium anodes in the galvanized hot water tanks, has also been tried. All new installations and replacements are now made with copper tanks and piping.

The effectiveness of corrosion control by means of temperature control cannot be overemphasized when dealing with corrosion of galvanized tanks by water. Thus the action of the management in removing furnace coils is fully endorsed. The other preventative methods involving the use of an inhibitor and use of cathodic protection are useful for corrosion control. However, the effectiveness of the above measures varies with the type of water encountered. For this reason it is advisable to undertake some experimental work to check if the above measures are economically justifiable.

It is proposed that an experimental program be initiated involving the installation of special hot water storage units so arranged that certain operating variables can be controlled or measured and thus their effect upon the corrosion of the tanks studied. This can be achieved by the installation of a battery of units in the village pump-house. The units would consist of tanks fabricated to the specification of the Hydro Electric Power Commission, and equipped with special heaters and insulating jackets. These would be operated automatically to afford close control of various service conditions. In addition, a number of these units would be installed in the houses at the village to study the effect of certain factors under normal service conditions.

The following aspects of the problem of corrosion can be studied:

1. Corrosion rate of galvanized hot water tanks by untreated water from the Ottawa River at two temperature levels: (135°F. and 165°F);

2. The effect of the inhibitor Alchem 918;

3. The effect of different types of heaters;

4. To rate the performance of commercial tanks against tanks manufactured to the specification of the Hydro Electric Power Commission of Ontario.

Equipment and Instrumentation

A test installation in a house will consist of a galvanized tank, electric heater, insulation, a water meter and a maximum indicating thermometer.

The tanks used as samples will be, for the most part, those manufactured under H.E.P.C. specification and inspection. Several test installations may have commercial tanks for comparison purposes. The Hydro units will be supplied with heaters, thermostats and insulation.

For the test installation in the pump-house an automatic draw-off system has to be provided in addition to the test system as installed in houses. It will consist of an Asco solenoid valve operated from a time switch (Dwg. No. MTL-21). This system will provide for six draw-off periods consisting of 9 gallons of hot water drawn every 2 hours. A total of 54 gallons of hot water being drawn every 24 hours.

Detailed Proposals

It is proposed to have a battery of five experimental units installed at the Deep River pump-house where very close control of all variables can be achieved. These would be operated automatically including the draw-off of hot water. The arrangement of units and instrumentation is represented on Dwg. MTL-16.

In addition to the above, it is proposed to install 6 special Hydro units in the houses at Deep River where normal operating conditions exist. These installations will be arranged as represented on Dwg. MTL-18. Three of the units will be operated at a temperature of 135°F, and the other 3 will be operated at a temperature of 165°F. This can be achieved by the setting on the thermostats.

After experimental units are installed, and before they are placed in service, it will be necessary for a representative of this Division to inspect the installation and check the temperature setting on the thermostat.

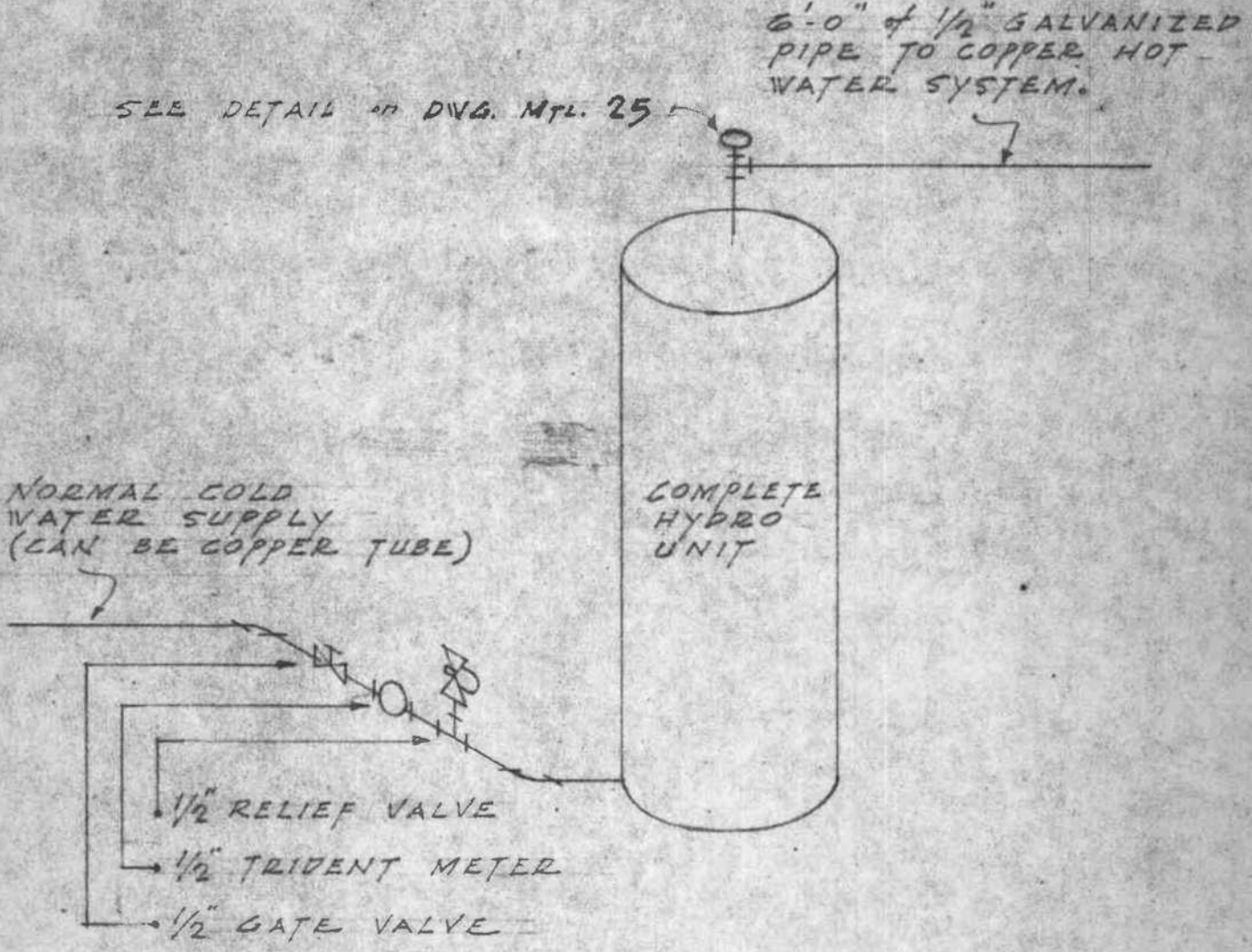
It is planned that a routine inspection every 6 months will be made of these experimental units. It is possible that special examination of the tanks, involving x-ray photography, may be done during these inspection tours. Some of these units may

be removed before they fail. All units on having failed, will be removed and sent to the Division of Building Research in Ottawa.

The thermometer used in each installation will be a long stem Weston dial thermometer with a plastic window, equipped with a maximum indicator. The thermometer bulb will normally be inside the top portion of the tank and thus will be used as a means of checking the thermostat calibration.

Conclusion:

This Report has been prepared as a basis for discussion amongst those interested in the problem and with the responsible authorities at Deep River. It is subject to amendment in the light of the discussions which it is designed to assist.



= SYSTEM 1 =

DETAIL REFERANCE REVISED 1-3-50 T.N.B.

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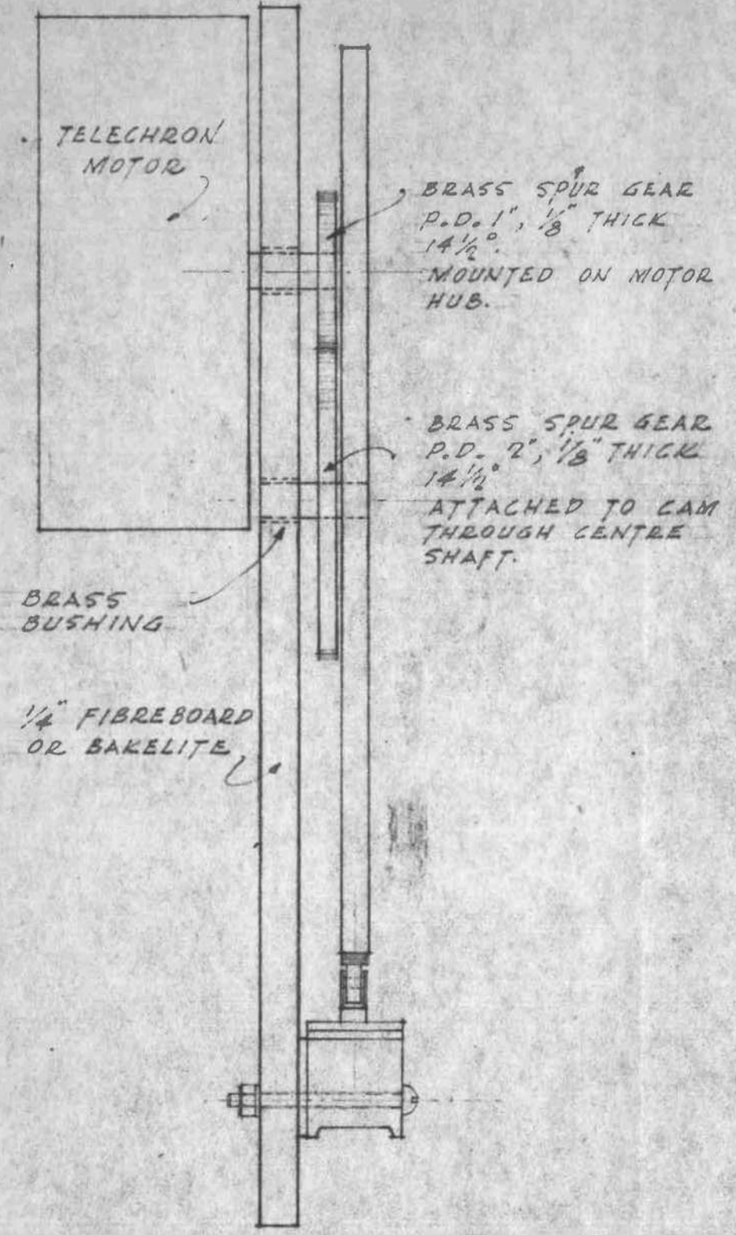
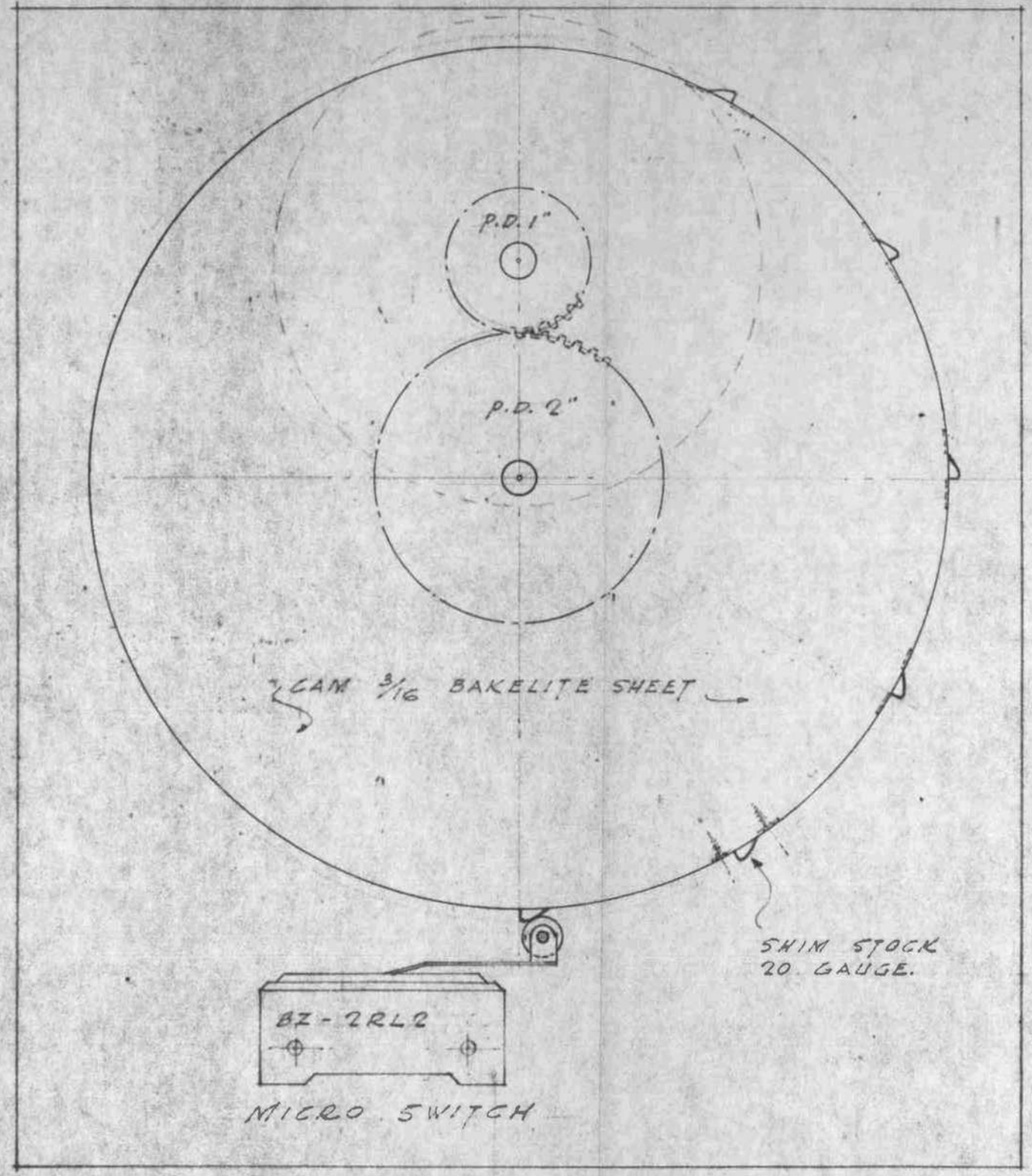


SIDE VIEW



FRONT

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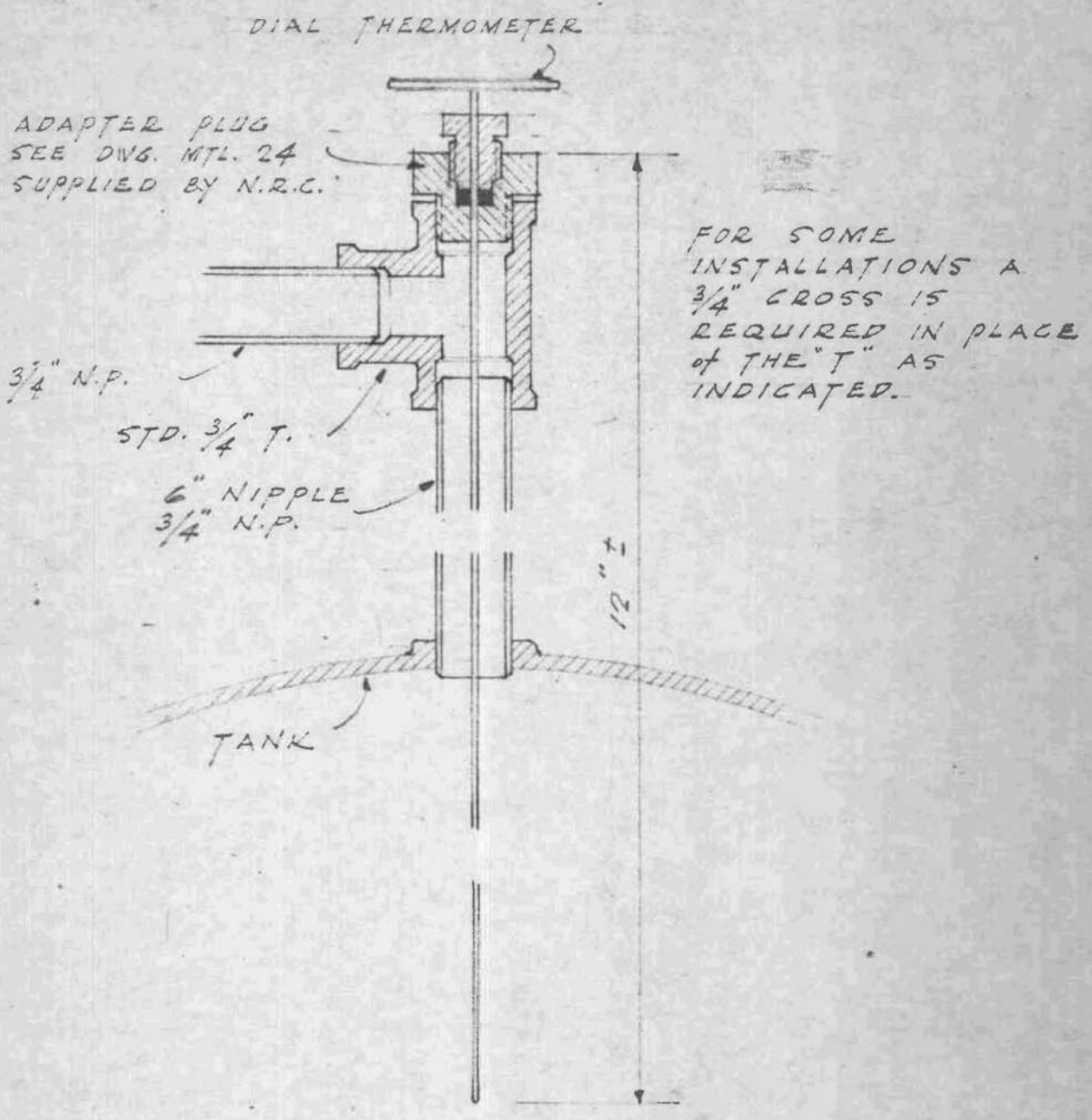
TRACED:	APPROVED:		DATE: 19/12/49		



NOTE:

ALL PIPE & FITTINGS GALVANIZED.

TITLE	CORROSION STUDY THERMOMETER WELL				DRAWING No.
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