Canadian Standards Association
Mississauga, Ontario
To the Part I Committee

Subject No. 3214 Chair: R. Leduc Date: March 31, 2005

Title: Wiring for Instantaneous Water Heaters, Rules 26-744 and 26-751

Submitted by: Dr. Thomas L. Harman of University of Houston/Clear Lake, 2700 Bay Area Boulevard, Houston, TX 77058, e-mail, harman@cl.uh.edu, Phone: (281) 283-3774, Fax:(281) 283-3870 on November 11, 2004.

Proposal 1: Modify Existing Rule 26-744: (Change shown in bold letters)

26-744 Supply Connections for Appliances
Electric heating appliances **other than boilers and instantaneous water heaters** and cooking appliances shall have only one point of connection for supply.

Reasons for Request: Due to the technological advances in tankless (instantaneous) water heater design, I believe that Rule 26-744 should not apply as presently written to water heaters that are protected within their rating. If an instantaneous water heater is a listed product that has been field tested with a variety of supply circuits, there is no technical or safety reason to limit the supply to one branch circuit.

Proposal 2: Add a new Rule 26-751 to read as follows

26-751 Installation of Instantaneous Water Heaters
The supply to listed instantaneous water heaters shall be permitted to be subdivided into several branch circuits not exceeding 120 amperes and protected at not more that 150 amperes.

Where more than one branch circuit is used to supply a water heater, the disconnection means for the circuits shall be clearly marked to indicate the circuits controlled.

Reasons for Request: Due to the technological advances in tankless (instantaneous) water heater design, I believe that Rule 26-744 should not apply as presently written to water heaters that are protected within their rating. If an instantaneous water heater is a listed product that has been field tested with a variety of supply circuits, there is no technical or safety reason to limit the supply to one branch circuit.

The restrictions on supply circuits of water heaters in the present Code are unnecessarily restrictive for the new types of instantaneous water heaters. Field experience and testing has

indicated that the design and control of today's instantaneous water heaters allows for their safe installation as described in the proposal.

For example, an instantaneous water heater with four elements drawing a maximum of 25 amperes each could require four 30-ampere branch circuits or the elements could be connected using two elements each on a 60-ampere circuit as allowed by the proposal. Then, only two circuit breakers need be turned off to disconnect the unit. Since the heater must be a listed appliance, the internal wiring would be sufficient for either the 30-ampere or the 60-ampere circuits.

Note: The wording of the Proposal is consistent with the present wording of the *National Electrical Code* rule 422-11(F)(3) that recognizes instantaneous water heaters as distinct from storage-type water heaters.

Chair's Comments:
As explained by the submitter, the proposal is basically to address newer technology and to harmonize with the NEC. For the member's information, following is the excerpt from the NEC pertaining to the equipment described in the proposal.

(F) Electric Heating Appliances Employing Resistance-Type Heating Elements Rated More Than 48 Amperes.
(1) Electric Heating Appliances. Electric heating appliances employing resistance-type heating elements rated more than 48 amperes, other than household appliances with surface heating elements covered by 422.11(B), and commercial-type heating appliances covered by 422.11(D), shall have the heating elements subdivided. Each subdivided load shall not exceed 48 amperes and shall be protected at not more than 60 amperes.

These supplementary overcurrent protective devices shall be (1) factory-installed within or on the heater enclosure or provided as a separate assembly by the heater manufacturer; (2) accessible; and (3) suitable for branch-circuit protection.
The main conductors supplying these overcurrent protective devices shall be considered branch-circuit conductors.
(2) Commercial Kitchen and Cooking Appliances. Commercial kitchen and cooking appliances using sheathed-type heating elements not covered in 422.11(D) shall be permitted to be subdivided into circuits not exceeding 120 amperes and protected at not more than 150 amperes where one of the following is met:
(1) Elements are integral with and enclosed within a cooking surface.
(2) Elements are completely contained within an enclosure identified as suitable for this use.
(3) Elements are contained within an ASME-rated and stamped vessel.
(3) Water Heaters and Steam Boilers. Water heaters and steam boilers employing resistance-type immersion electric heating elements contained in an ASME-rated and stamped vessel or listed instantaneous water heaters shall be permitted to be subdivided into circuits not exceeding 120 amperes and protected at not more than 150 amperes.

422.11(B) reads as follows:

(B) Household-Type Appliances with Surface Heating Elements. Household-type appliances with surface heating elements having a maximum demand of more than 60 amperes calculated in accordance with Table 220.55 shall have its power supply subdivided into two or more circuits, each of which shall be provided with overcurrent protection rated at not over 50 amperes.

422.11(D) reads as follows:

> **(D) Open-Coil or Exposed Sheathed-Coil Types of Surface Heating Elements in Commercial-Type Heating Appliances.** Open-coil or exposed sheathed-coil types of surface heating elements in commercial-type heating appliances shall be protected by overcurrent protective devices rated at not over 50 amperes.

Also, I believe that CAN/CSA-C22.2 No. 64-M91 (Reaffirmed 2003) *Household Cooking and Liquid-Heating Appliances* is the applicable Part II Standard for the equipment in question. I did a quick review of the standard and did not find any clauses that might prevent the type of installation proposed by the submitter.

Without going into proper CEC formatting, and before developing a proper SC recommendation, the Chair requests SC members to please review the proposal and provide any comments you may have.

Subcommittee Deliberations (1st Round)
10 SC members commented on the proposal, all expressing concern with having multiple circuits feeding a device. Following is a flavour of the comments received.

- If the standard does not prohibit multiple circuit feeds, we should have a stand-alone rule for Tankless Instantaneous Water Heaters (TIWHs).
- Part I should not have product requirements… that is the role of Part II standards
- Concern with the potential for increased risk of shock with multiple circuits to a single device
- If we go this route, we need to ensure adequate safety provisions are introduced (marking requirements, disconnect requirements, barriers, etc.)
- Should be dealt with as a general rule rather than getting into the numerous possibilities when addressing specific equipment.
- C22.2 No. 64 has no specific requirement for restricting multiple feeds.
- There is a potential hazard to service personnel working on a heater where only part of the unit is disconnected.
- Such multiple circuit arrangements are found in radiant floor heating installations and perhaps this proposal should fall under Section 62.
- More information on the construction of the product is required.

Chair's Comments (for a 2nd Round)
The Chair has reviewed C22.2 No. 64 and agrees with the comment that it does not specifically restrict multiple circuit feeds except for the reference in the Scope to the CE Code Part I.

> This Standard applies to cord-connected and permanently connected cooking and liquid-heating appliances* rated for use on nominal single-phase system voltages of 240 V and less, designed to be used in nonhazardous locations in household and similar applications in accordance with the Rules of the Canadian Electrical Code, Part I.

If we consider a Tankless Instantaneous Water Heater to fall under the category of appliances referred to in Rule 26-744, then Subrule (1) of that Rule would pose an obstacle for multiple circuits to a TIWH. I'm not sure that when Rule 26-744 was written, TIWHs were part of the considerations.

As noted in the comments, there are many situations where multiple circuits are required to feed a device such as radiant floor heating and industrial heat-tracing controllers. The Chief Inspector

for New Brunswick advises me that he has come across a hot tub installation that has 3 separate cord feeds, 1 for the pump, 1 for the blower and 1 for the heater. So there seems to be a precedent for allowing multiple circuits to a device or appliance. The NB Chief also advises that there is a hospital installation where IWHs are specified throughout, most requiring multiple circuit feeds.

The Chair has gone back to the submitter for more information. He has provided a number of documents, which will be posted on the SDOW. Information on the NB hospital IWHs will also be posted. The wiring diagrams clearly identify some units requiring multiple circuit feeds. The NB model appears to be a European model and the Seisco appears to be North American. Neither type indicate a Canadian Certification, but the Seisco is obviously being used in the States presumably manufacture to UL 499.

In light of a product that is becoming globally available, hopefully the SC can find a way to accommodate the technology in our Canadian Code in an effort to reduce 'trade barriers' especially considering the precedent that multiple circuits feeding is recognized in other applications.

Chair's proposal to begin discussions on a path forward

1. Delete Rule 26-744(1)

Rationale: This is really a product requirement. The Part II standard should be responsible for determining whether the product design should permit one of more circuits to feed it. Rule 14-414 "Connection to Different Circuits" would deal with those situations where the device or appliance requires multiple circuits. This would address the submitter's Proposal 1.

2. Reject the Submitter's Proposal 2.

Rationale: Without any Rule to restrict the practice of a device being fed from multiple circuits, there would be no need to introduce a permissive Rule. TIWHs would automatically be permitted provided of course that they meet the applicable Part II standard and certified as such, as well as meeting other Rules of the Code such as Rule 14-414.

Subcommittee Deliberations (2nd Round)

Only 8 out of 13 members responded, 4 agreeing with the Chair's proposal and 4 disagreeing. Clearly we do not have consensus. Without going into details of the deliberations, I sense from the disagreeing members that they are not opposed to the submitter's proposal but rather differ on how the SC should approach a resolution to the issue. The idea of creating a separate Rule for tankless instantaneous water heaters seemed to emerge in the discussions.

Discussions on which Rules actually posed obstacles to the tankless instantaneous water heater technology determined that Rule 26-744 Supply Connections for Appliances is actually addressing cord-connected appliances and was not the Rule we should be concerned with. Rule 26-746(1) however, may be where the obstacle lies where it states that appliances exceeding 1500W "shall be supplied from a branch circuit used solely for one appliance…"

There was also a suggestion that we let the Technical subcommittee on C22.2 No 64 deal with the issue and then have Part I align with what Part II proposes.

Chair's Comments (3rd Round)

Allowing Part II to deal with the issue only foster the "chicken and egg" scenario. The Chair would prefer to have something in Part I to give Part II some direction. The Chair agrees that

rather than deleting existing Rules that may not even have an impact on the issue, a new Rule may be a more acceptable.

To address the comments from the members and in an attempt to resolve this in the SC before the cut-off for Part I subjects to be in, the Chair will make one more proposal with a very short response time. If the SC does not reach consensus here, unfortunately the subject will be carried over to the next Code cycle. The Chair proposes a new Rule as follows:

> **26-760 Tankless Instantaneous Water Heaters**
> Notwithstanding Rule 26-746(1), tankless instantaneous water heaters shall be permitted to be supplied by more than one branch circuit provided:
> (a) The branch circuits supplying the tankless instantaneous water heater shall not exceed 120 amperes, and
> (b) The tankless instantaneous water heater shall be clearly and permanently labelled at the point of connection with a warning to the effect that it is supplied from more than one branch circuit.
>
> *Rationale:*
> 1. *The technology for tankless instantaneous water heaters (TIWH) is such that some product designs require that more than 1 circuit to supply them.*
> 2. *Rule 26-746(1) would appear to be the Rule that prevents TIWHs from being supplied by more than one circuit.*
> 3. *As the Submitter requested, branch circuits supplying the TIWH are limited to 120A. (note: the maximum allowable OC protection of 150A is addressed by Rule 8-104).*
> 4. *A warning label on the appliance will provide necessary safety information to service personnel.*
> 5. *A new Rule specifically for TIWHs allows the Rule to evolve as the technology around this product evolves.*

Subcommittee Deliberations (3rd Round)
8 members responded, 3 agreeing with the Chair's latest proposal and 5 disagreeing. Comments from the disagreeing members include:

- Supplementary protectors and splitting a single branch circuit feeder should be an integral part of the TIWH design
- Part I should not be used as the trigger for having Part II begin work on revisions to a standard
- Concern regarding maintenance and servicing
- Should not place limitations on the rating of circuits
- Wording in paragraph (a) should refer to circuit ampacity rather than device ampere rating
- Labelling as proposed in paragraph (b) should be at the disconnecting means as in 14-414(3), not on the TIWH
- I'd prefer to see spec 64 change first

Chair's Comments (final)
The Chair senses reluctance from the SC members to move in a direction that will allow multiple circuits to a device despite this practice being acceptable in the US and in Europe. The Chair also

senses reluctance to proceed with any new Rule in Part I until the TSC for Standard No. 64 has made the necessary changes to the standard. The Chair is disappointed that Part I could not expedite the process of removing barriers to allow this product in Canada. Waiting for Part II will significantly extend the timeframe for this to happen. The chair proposes the following:

Subcommittee Recommendation
Close the Subject pending revisions to CSA standard C22.2 No. 64 where it is expected that the TSC for Spec No. 64 will request any required changes to Part I.