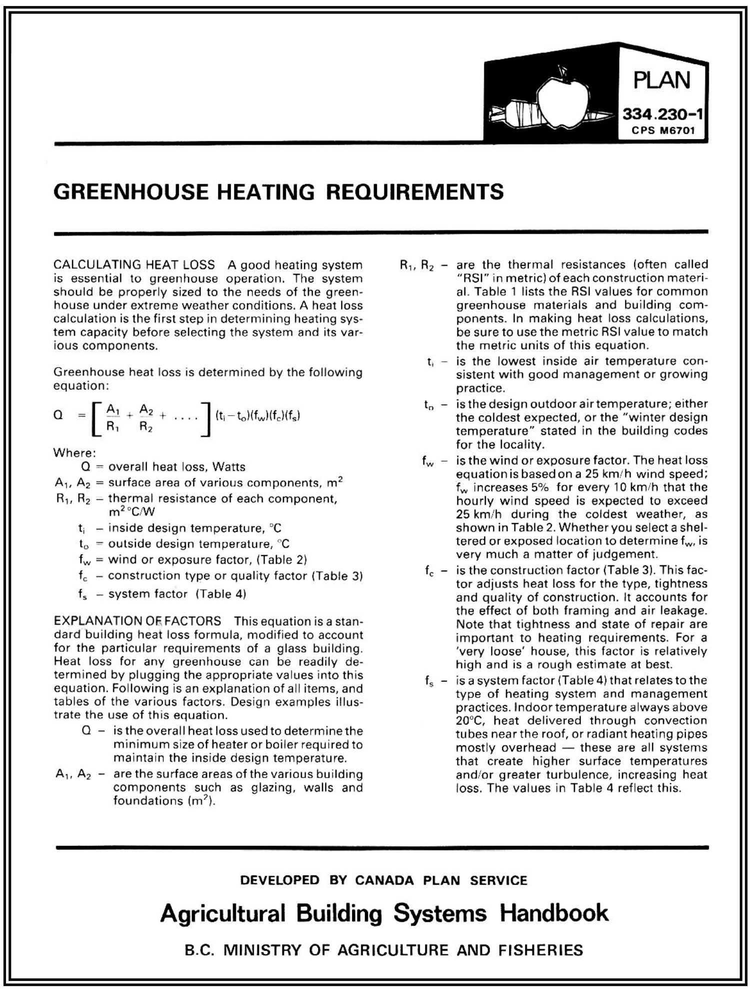
Farm Structures
FACTSHEET

BRITISH COLUMBIA
Ministry of Agriculture, Food and Fisheries

Order No. 334.230-1
CPS: 6701
September 1983

GREENHOUSE HEATING REQUIREMENTS



PLAN
334.230-1
CPS M6701

GREENHOUSE HEATING REQUIREMENTS

CALCULATING HEAT LOSS A good heating system is essential to greenhouse operation. The system should be properly sized to the needs of the greenhouse under extreme weather conditions. A heat loss calculation is the first step in determining heating system capacity before selecting the system and its various components.

Greenhouse heat loss is determined by the following equation:

$$Q = \left[\frac{A_1}{R_1} + \frac{A_2}{R_2} + \ldots \right] (t_i - t_o)(f_w)(f_c)(f_s)$$

Where:

- Q = overall heat loss, Watts
- A_1, A_2 = surface area of various components, m^2
- R_1, R_2 – thermal resistance of each component, $m^2\,°C/W$
- t_i – inside design temperature, °C
- t_o = outside design temperature, °C
- f_w = wind or exposure factor, (Table 2)
- f_c – construction type or quality factor (Table 3)
- f_s – system factor (Table 4)

EXPLANATION OF FACTORS This equation is a standard building heat loss formula, modified to account for the particular requirements of a glass building. Heat loss for any greenhouse can be readily determined by plugging the appropriate values into this equation. Following is an explanation of all items, and tables of the various factors. Design examples illustrate the use of this equation.

- Q – is the overall heat loss used to determine the minimum size of heater or boiler required to maintain the inside design temperature.
- A_1, A_2 – are the surface areas of the various building components such as glazing, walls and foundations (m^2).
- R_1, R_2 – are the thermal resistances (often called "RSI" in metric) of each construction material. Table 1 lists the RSI values for common greenhouse materials and building components. In making heat loss calculations, be sure to use the metric RSI value to match the metric units of this equation.
- t_i – is the lowest inside air temperature consistent with good management or growing practice.
- t_o – is the design outdoor air temperature; either the coldest expected, or the "winter design temperature" stated in the building codes for the locality.
- f_w – is the wind or exposure factor. The heat loss equation is based on a 25 km/h wind speed; f_w increases 5% for every 10 km/h that the hourly wind speed is expected to exceed 25 km/h during the coldest weather, as shown in Table 2. Whether you select a sheltered or exposed location to determine f_w, is very much a matter of judgement.
- f_c – is the construction factor (Table 3). This factor adjusts heat loss for the type, tightness and quality of construction. It accounts for the effect of both framing and air leakage. Note that tightness and state of repair are important to heating requirements. For a 'very loose' house, this factor is relatively high and is a rough estimate at best.
- f_s – is a system factor (Table 4) that relates to the type of heating system and management practices. Indoor temperature always above 20°C, heat delivered through convection tubes near the roof, or radiant heating pipes mostly overhead — these are all systems that create higher surface temperatures and/or greater turbulence, increasing heat loss. The values in Table 4 reflect this.

DEVELOPED BY CANADA PLAN SERVICE

Agricultural Building Systems Handbook

B.C. MINISTRY OF AGRICULTURE AND FISHERIES

A good heating system is essential to greenhouse operation. The system should be properly sized to the needs of the greenhouse under extreme weather conditions. A heat loss calculation is the first step in determining heating system capacity before selecting the system and its various components. This leaflet outlines the procedure for such a calculation. To obtain a copy, please contact:

CANADA PLAN SERVICE
Website: http://www.cps.gov.on.ca