MACHINERY INSTITUTE

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# Evaluation Report 424

## Super-B AS-600G Grain Dryer

A Co-operative Program Between

ALBERTA FARM MACHINERY RESEARCH CENTRE

PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

## SUPER-B AS-600G GRAIN DRYER

**MANUFACTURER:**
Beard Industries
Frankfort, Indiana 46041
U.S.A.

**DISTRIBUTOR:**
Grant Services Ltd.
Foam Lake, Saskatchewan
S0A 1A0

**RETAIL PRICE:**
$28,860.00 (March, 1985, f.o.b. Humboldt, complete with 0.07 in (1.8 mm) rapeseed screens and optional drying cycle timer).

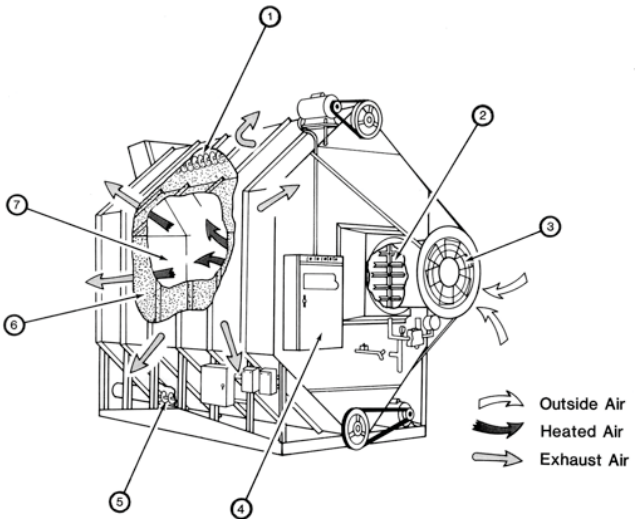


**FIGURE 1.** Super-B AS-600G Grain Dryer: (1) Levelling Auger, (2) Burner, (3) Fan, (4) Control Panel, (5) Discharge Auger, (6) Grain Chamber, (7) Air Plenum.

## SUMMARY AND CONCLUSIONS

**Drying Capacity:** The rated drying capacity of the Super-B AS-600G was 143 bu/h (3.9 t/h) in wheat, 179 bu/h (3.9 t/h) in barley, 140 bu/h (3.2 t/h) in rapeseed, and 126 bu/h (3.2 t/h) in Hybrid 2120 corn.

**Fuel Consumption:** At rated drying capacity, the specific fuel consumption or the amount of propane required to dry a quantity of grain was 6,4 gal/100 bu (10.7 L/t) in wheat, 5.8 gal/100 bu (12.1 L/t) in barley, 4.6 gal/100 bu (9.3 L/t) in rapeseed, and 11.0 gal/100 bu (19.6 L/t) in corn. This corresponds to a fuel consumption of 9.2 gal/h (42 L/h) in wheat, 10.3 gal/h (47 L/h) in barley, 6.6 gal/h (30 L/h) in rapeseed, and 13.6 gal/h (62 L/h) in corn.

**Energy Consumption:** At rated drying capacity, the specific energy consumption or the total energy required to remove a quantity of water from the grain was 1800 Btu/lb (4200 kJ/kg) in wheat, 2000 Btu/lb (4700 kJ/kg) in barley, 1700 Btu/lb (3900 kJ/kg) in rapeseed, and 1500 Btu/lb (3600 kJ/kg) in corn.

**Quality of Work:** No grade loss occurred in the grains tested when operating at the manufacturer's recommended drying air temperature settings. The drying air temperature was very uniform and adequate for all drying conditions encountered and was close to the temperature setting.

**Ease of Operation and Adjustment:** Ease of assembly and installation was excellent. The Super-B AS-600G was not equipped for transporting. The automatic controls made the ease of filling, drying, cooling, and discharge very good. Supervision was only required on the first run each time grain conditions changed to determine the new control settings. The drying air temperature was easy to set. Ease of cleaning the Super-B was very good. However, the screens required daily cleaning in rapeseed. Lubrication points were accessible and semi-monthly servicing took two minutes, making the ease of servicing very good.

**Power Requirements:** The Super-B AS-600G required 15.8 hp (11.8 kW) when operated on 230 V AC electrical power.

**Safety:** The Super-B AS-600G was safe to operate as long as the manufacturer's safety instructions were followed. The sound level at the operator's station was 102 dBA. It is recommended that the operator wear ear protection when working near the Super-B AS-600G.

**Operator's Manual:** The operator's manual was good. It was sufficiently illustrated, clearly written, and contained much useful information. However, it contained a few errors and omissions.

**Mechanical History:** Two minor mechanical problems occurred during the test.

## RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Modifications to the mercury bulb mountings on the full grain paddle switch to permit adequate adjustment for automatic dryer operation.
2. Modifications to improve visibility of the indicator lights in sunlight.
3. Correcting the errors and omissions in the operator's manual.

*Senior Engineer: G.E. Frehlich*

*Project Technologist: W.F. Stock*

## THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. We had a temporary manufacturing problem with the mercury bulb mountings when the AS-600G test dryer was manufactured in August, 1983. This problem was corrected immediately after it was reported by company test personnel.
2. We will consider adding a sun shield over the indicator light panel to shade the lights and improve visibility in sunlight.
3. The automatic moisture control chart inadvertently included in the test dryer manual was (or a different model. We regret the error. We plan to include recommended drying specifications for rapeseed and barley in future editions of our manuals.

   We will review the section on setting the temperature modulating valve to see if rewording the section can make it easier to understand. Our dealers and customers have not indicated that the setting procedure is difficult or complex. Once the adjustment is understood, it only takes a few minutes to perform.

   All Super-B and Superb manual electrical schematics are shown using well known and respected ladder type diagrams. The component location diagrams used do not always show the exact location of the terminals on the components. This is due to the physical differences in components obtained from different companies. However, the component functions and the wires going to the components are accurately shown.

   The new operator's manuals have been revised to make it easier to find the desired sections.

## GENERAL DESCRIPTION

The Super-B AS-600G is an automatic batch, cross-flow grain dryer with an axial fan, propane burner, and a hexagonal grain chamber enclosing the air plenum. Grain fills at the top rear centre of the dryer and is carried across the length of the dryer by a levelling auger. Outside air is forced by the fan past the burner into the air plenum and through the grain chamber to dry or cool the grain. Dry grain is discharged at the bottom rear centre of the dryer by an auger

The Super-B AS-600G automatically fills, drys, cools, and discharges grain until the wet grain supply is exhausted. As grain shrinkage occurs during drying, the levelling auger automatically engages to top up the dryer. Two mercury paddle switches, one at the top and one at the bottom, control grain flow through the dryer. Drying air temperature is controlled by a modulating valve and monitored on a gauge located underneath the control panel. During drying, the burner is cycled on and off for a preset part of each 15 second interval. The drying time is controlled by the moisture controller settings. The cooling time is controlled by a timer. Automatic operation can be manually overridden. The fan is

driven by a 13 hp (9 7 kW), 230 V AC single phase electric motor. The levelling and discharge augers are each driven by 3 hp (2.2 kW) electric motors. A safety control circuit shuts off fuel to the burner if the pilot flame goes out. If the fan shuts down, or if the drying air temperature exceeds the high limit setting. Detailed specifications are given in APPENDIX I.

## SCOPE OF TEST

The Super-B AS-600G was operated with artificially and naturally wet grain under the conditions shown in TABLE 1 for 78 hours while drying about 11,520 bu (283 t) of grain. It was evaluated[1] for rate of work, fuel and energy consumption, quality of work, ease of operation and adjustment, power requirements, operator safety and suitability of the operator's manual.

**TABLE 1.** Operating Conditions

| Grain | Grade | Dockage | Moisture Content | Hours | Grain Dried | |
|---|---|---|---|---|---|---|
| | | % | % | | bu | t |
| Wheat | 2CW RS | 2 | 16.7 to 23.7 | 25 | 3490 | 95 |
| Barley | 1 Feed | 2 | 17.1 to 25.0 | 15 | 2610 | 57 |
| Rapeseed | 1 Canada | 7 | 11.4 to 19.3 | 18 | 2470 | 56 |
| Corn (Hybrid 2120) | 2CW yellow | 3 | 17.1 to 27.7 | 20 | 2950 | 75 |
| Total | | | | 78 | 11,520 | 283 |

## RESULTS AND DISCUSSION

### RATE OF WORK

**Standard Conditions:** To provide a meaningful comparison of grain dryer performance, the drying capacity, and fuel and the energy consumption of the dryers should be determined for identical drying conditions. Because it is impossible to obtain the same air and grain conditions in the field when testing each machine, the dryer capacities and fuel and energy consumption included in this report have been mathematically adjusted to standard drying conditions[2]. These adjusted results can be compared to the adjusted results of other dryers, even though they were tested under different conditions or in different years.

**Drying Capacity:** The drying capacity[3] of a dryer is the rate at which grain can be dried to the dry moisture content specified by the Canadian Grain Commission, while operating the dryer at standard conditions and the settings recommended by the manufacturer. The drying capacity is based on the time to fill, dry, cool, and discharge the grain from the grain drying chambers. Drying capacity varies with the grain type and the amount of moisture removed. FIGURES 2 to 5 present capacity curves for the Super-B AS-600G while drying wheat, barley, rapeseed, and Hybrid 2120 Corn.

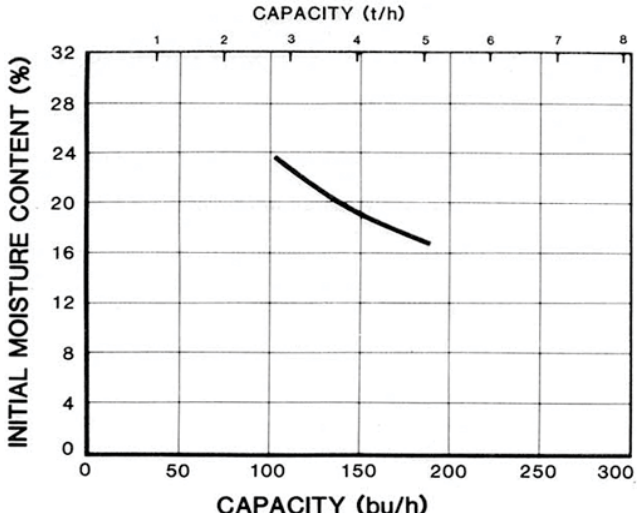


**FIGURE 2.** Drying Capacity in Wheat.

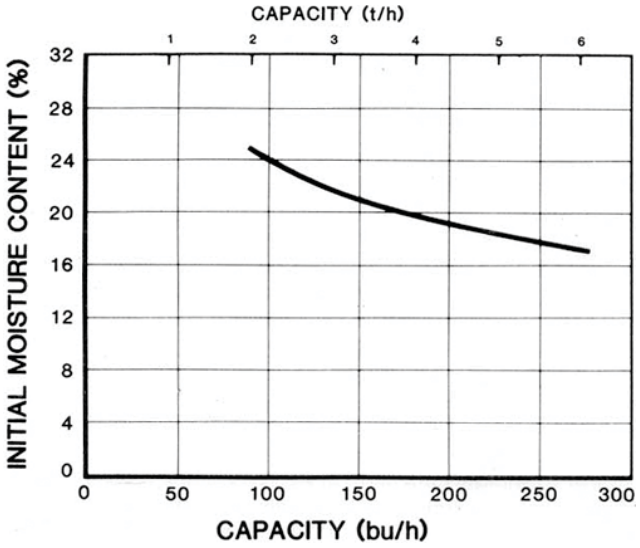


**FIGURE 3.** Drying Capacity in Barley.

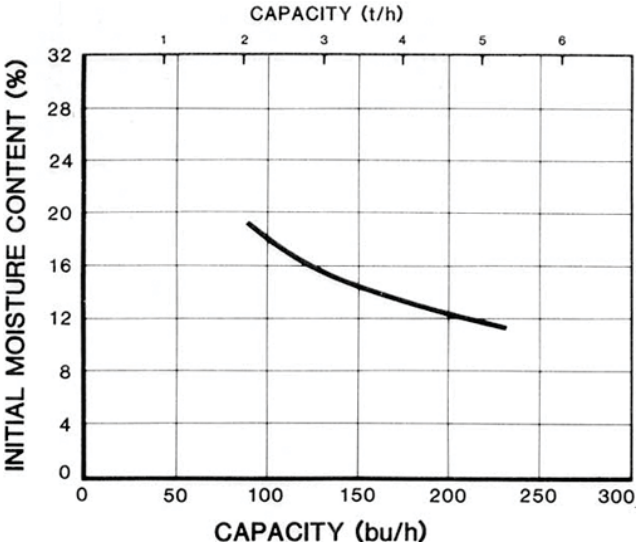


**FIGURE 4.** Drying Capacity in Rapeseed.

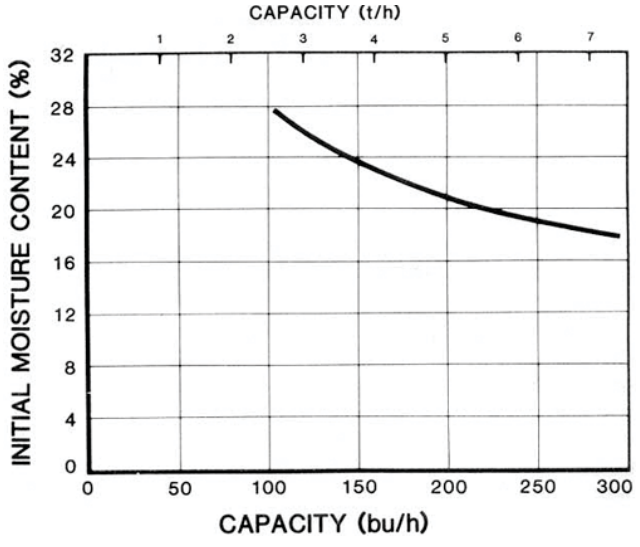


**FIGURE 5.** Drying Capacity in Corn (Hybrid 2120).

**Rated Drying Capacity:** The Machinery Institute has designated the rated drying capacity as the capacity of the dryer while removing 5% moisture in wheat, barley, and rapeseed, and 10% moisture in corn. It is based on the time required to fill, dry, cool, and discharge the grain under these conditions.

The total batch time (TABLE 2) for the Super-B AS-600G varied

[1]Tests were conducted as outlined in the Machinery Institute Detailed Test Procedures for Grain Dryers.

[2]*The standard drying conditions used by the Machinery Institute for the presentation of grain dryer results are given in APPENDIX II.*

[3]*The Machinery Institute determines the drying capacity using the weight of the dried grain discharged from the dryer. Some manufacturers state their drying capacity using the weight of the wet grain entering the dryer. See APPENDIX II for the wet grain to dry grain conversion.*

from 1.35 hours in barley to 1.70 in corn, while the rated drying capacity (TABLE 3) varied from 126 bu/h (3.2 t/h) in corn to 179 bu/h (3.9 t/h) in barley.

**TABLE 2.** Batch Times

| Grain | Filling | Drying | Cooling | Discharge | Total |
|---|---|---|---|---|---|
| | Hours | Hours | Hours | Hours | Hours |
| Wheat | 0.15 | 0.85 | 0.40 | 0.15 | 1.55 |
| Barley | 0.10 | 0.90 | 0.20 | 0.15 | 1.35 |
| Rapeseed | 0.15 | 0.95 | 0.35 | 0.15 | 1.60 |
| Corn (Hybrid 2120) | 0.15 | 1.00 | 0.40 | 0.15 | 1.70 |

**TABLE 3.** Rated Drying Capacities

| Grain | Initial Moisture Content | Moisture Removed | Drying Air Temperature Setting | | Rated Drying Capacity | | Fig. No. |
|---|---|---|---|---|---|---|---|
| | % | % | °F | °C | bu/h | t/h | |
| Wheat | 19.5 | 5 | 180 | 82 | 143 | 3.9 | 2 |
| Barley | 19.8 | 5 | 160 | 71 | 179 | 3.9 | 3 |
| Rapeseed | 15.0 | 5 | 150 | 66 | 140 | 3.2 | 4 |
| Corn (Hybrid 2120) | 25.5 | 10 | 220 | 104 | 126 | 3.2 | 5 |

## FUEL AND ENERGY CONSUMPTION

**Specific Fuel Consumption:** Fuel consumption of a grain dryer varies considerably with the temperature and moisture content of the grain and ambient air, the drying air temperature, airflow, and burner efficiency. To permit comparison of fuel used in different dryers, fuel consumption must be adjusted to standard conditions and must be related to the quantity of grain dried. Specific fuel consumption is a measure of the fuel used to dry a quantity of grain. It is expressed in gallons (gal) of propane per 100 bushels (bu) of grain dried [litres (L) of propane per tonne (t) of grain dried]. A low specific fuel consumption indicates efficient fuel use. The specific fuel consumption for the Super-B AS-600G at rated drying capacity (TABLE 4) varied from 4.6 gal/100 bu (9.3 L/t) in rapeseed to 11 gal/100 bu (19.6 L/t) in corn. Fuel consumption[4] ranged from 6.6 gal/h (30 L/h) in rapeseed to 13.6 gal/h (62 L/h) in corn

**TABLE 4.** Fuel and Energy Consumption

| Grain | Moisture Removed | Fuel Consumption | | Specific Fuel Consumption | | Specific Energy Consumption | |
|---|---|---|---|---|---|---|---|
| | % | gal/h | L/h | gal/100 bu | L/t | Btu/lb | kJ/kg |
| Wheat[4] | 5 | 9.2 | 42 | 6.4 | 10.7 | 1800 | 4200 |
| Barley | 5 | 10.3 | 47 | 5.8 | 12.1 | 2000 | 4700 |
| Rapeseed | 5 | 6.6 | 30 | 4.6 | 9.3 | 1700 | 3900 |
| Corn (Hybrid 2120) | 10 | 13.6 | 62 | 11.0 | 19.6 | 1500 | 3600 |

**Specific Energy Consumption:** Energy consumption of a dryer also varies with drying conditions and grain dryer design. To permit comparison of the energy used in different dryers, energy consumption must be adjusted to standard conditions and related to the quantity of water removed from the grain. Specific energy consumption is a measure of overall dryer efficiency. It is the total energy, including electrical, mechanical, and fuel, required to remove a quantity of water, it is expressed in British thermal units (Btu) of energy per pound (lb) of water removed [kilojoules (kJ) of energy per kilogram (kg) of water removed]. A low specific energy consumption indicates efficient grain drying.

The specific energy consumption for the Super-B AS-600G (TABLE 4) at rated drying capacity varied from 1500 Btu/lb (3600 kJ/kg) in corn to 2000 Btu/lb (4700 kJ/kg) in barley.

## QUALITY OF WORK

**Grain Quality:** Grain can be damaged in the dryer, if it is dried too long at excessively high temperatures. The grain damage that can occur before there is a loss in the grade and corresponding reduction in the grain price depends on whether the grain is seed, commercial or feed. Feed grain is permitted the greatest damage and seed the lease damage before a grade loss occurs. It is very important for the operator to occasionally have the grain tested for damage especially when drying unfamiliar grains or operating at new dryer settings.

No grade loss occurred when drying commercial wheat and rapeseed or feed barley and corn with the Super-B AS-600G grain dryer.

**Drying Air Temperature:** A uniform drying air temperature minimizes grain damage and provides uniform and efficient grain drying. The drying air temperature for the Super-B AS-600G was uniform. The average drying air temperature was close to the gauge reading. See Appendix IV for further details.

## EASE OF OPERATION AND ADJUSTMENT

**Transporting:** The test machine was not equipped for transporting. A transport kit is available as an option.

**Installation:** The Super-B AS-600G was installed by two men in about 1-1/2 hours, making dryer preparation excellent. The dryer was easily located and connected to electrical and propane supplies. The manufacturer's recommended installation height provided adequate clearance for an auxiliary unloading auger.

**Grain Filling:** The automatic grain filling was very good as a paddle switch controlled the levelling auger. During drying, as grain shrinkage occurred, the paddle switch engaged the levelling auger to top up the dryer. The amount of shrinkage depended on the initial grain moisture content. For example, while drying wheat, the dryer topped up once at 2% moisture removal, adding approximately 3 bu (0.1 m³). It topped up 13 times at 10% moisture removal, adding approximately 36 bu (1.3 m³). Because of automatic top up, the Super-B AS-600G had to be filled (FIGURE 6) with either a gravity feed system from wet grain storage or an electric grain conveyor with a discharge height of 13 ft (4 m). The dryer had an electrical panel to power auxiliary filling and discharge conveyors.


**FIGURE 6.** Grain Filling and Unloading.

The mercury paddle switch was sensitive to set to ensure a full dryer without overfilling. The dryer automatically shut down if the wet grain supply was exhausted.

The holding capacity[5] of the Super-B AS-600G was about 225 bu (8.2 m³). Batches smaller than the holding capacity could not be dried.

**Grain Drying:** Grain drying was very good. The fan (FIGURE 7) and burner were started automatically when the paddle switch sensed the dryer was full of grain. However, the factory adjustment

*[4]Fuel consumption for batch dryers is the fuel consumed during the drying cycle averaged over the total batch time.*

*[5]The holding capacity is determined with wheat at 19.5% moisture content.*

was not adequate to trigger the start-up. The mounting screw for the mercury bulb on the paddle switch had to be modified for the paddle switch to operate properly. It is recommended that the manufacturer consider modifications to the mercury bulb mounting to permit adequate adjustment for proper switch operation.

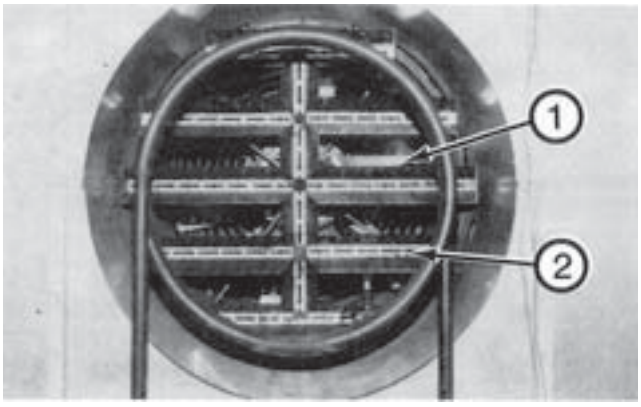


**FIGURE 7.** Fan Housing: (1) Fan, (2) Burner.

The drying air temperature was set by adjusting a dial on the modulating valve. Drying air temperature and fuel pressure were monitored on nearby gauges. Adequate drying air temperatures were easily achieved under all conditions. The maximum drying air temperature was set on the high limit thermostat inside the control panel. If the setting was exceeded, the dryer would shut down. On initial start-up after changing the grain drying temperature or when the ambient air temperature fluctuated 30 to 40°F (17 to 22°C), the maximum flow screw setting on the pressure regulator had to be changed. The procedure given in the operator's manual for setting the maximum flow screw was not easily performed. Therefore, another method was used. The maximum flow screw was adjusted to allow the temperature to rise approximately 20°F (11°C) higher than the desired drying temperature upon initial start-up of the burner. Then the modulating valve was set to obtain the desired drying temperature.

The dryer was equipped with a moisture controller (FIGURE 8) that measured grain temperature and automatically shut off the burner when the set temperature was reached. The initial drying cycles required supervision to determine the moisture control setting corresponding to dry grain. This could be determined using the settings given in the operator's manual and then sampling the discharge moisture content to fine tune the setting. There were no provisions for sampling grain during drying. The moisture control setting had to be readjusted when the grain type, moisture content or temperature changed. The moisture controller performed well in wheat, barley and corn. However, when drying rapeseed, the moisture controller did not always properly control the drying cycle as the dried grain temperature did not always correspond closely to the dried grain moisture content. This problem could be overcome by using an optional timer to control the length of the drying cycle.

The Super-B AS-600G required supervision on the first run after changing grain conditions, but operated automatically once the control settings for the new conditions were determined.

It was difficult to detect whether the indicator lights were on when the sun was shining on them. It is recommended that the manufacturer consider modifications to improve visibility of indicator lights when drying in sunlight.

**Grain Cooling:** Grain cooling was very good. It occurred after the moisture controller automatically shut off the burner. The operator's manual listed the cooling timer settings for a wide range of ambient air temperatures. Supervision was required on the first run to manually check discharge grain temperature to ensure correct cooling time.

**Grain Discharge:** Grain discharge was very good. After cooling, an auger automatically discharged grain at the rear of the dryer (FIGURE 6). A mercury paddle switch disengaged the auger when empty. A shield on the top of the discharge auger could be adjusted to maximize the output of the auger. However, caution was required to prevent motor overload.

**Cleaning:** Ease of cleaning the Super-B AS-600G was very good. The discharge auger was equipped with a swing-out bottom. Most of the fines that entered the air plenum dropped into the discharge auger. The remainder could be easily swept into the auger.

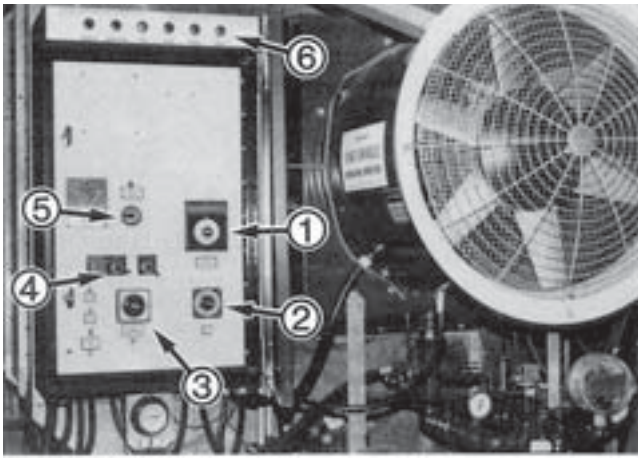


**FIGURE 8.** Control Panel: (1) Automatic Moisture Controller, (2) Burner Cycle Timer,(3) Cooling Timer, (4) Operating Switches, (5) Hour Meter, (6) Indicator Lights, (7) High Limit Thermostat (not shown, behind panel).

Rapeseed partially plugged the screens during operation and had to be cleaned daily with a wire brush. Grain buildup occurred behind the flood gate, on the intake to the top levelling auger. This buildup had to be cleaned out after a rain or when changing grains. During loading and unloading, rapeseed sifted out through the screens onto the ground, (FIGURE 9) and had to be cleaned up occasionally.

Thorough cleaning, including wire brushing the screen, took one man about 1/2 hour. Daily cleaning took only one minute.

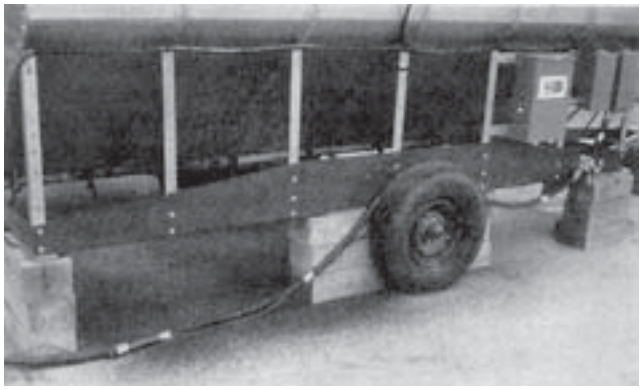

**FIGURE 9.** Rapeseed on Ground After One Drying Cycle.

**Servicing:** Servicing was very good. The only daily maintenance required was general cleaning. Four pressure grease fittings, one on either end of the two augers, required greasing semi-monthly. The propane drip sump required draining semimonthly. To lubricate the pressure grease fitting on the drive end of the discharge auger, the safety shield had to be unbolted.

## POWER REQUIREMENTS

The Super-B AS-600G was equipped with a 125 A main breaker. It drew a maximum current of 75 A when operating on 230 V AC single phase power. The dryer was equipped with an additional 125 A breaker for powering auxiliary filling and discharge conveyors. Power requirements with the fan and levelling auger on was 15.8 hp (11.8 kW). Optional 208, 230, 460 or 575 V AC three phase electrical systems were available.

## OPERATOR SAFETY

The Super-B AS-600G operator's manual emphasized safety, and warning decals adequately indicated dangerous areas. Drives were well shielded and machine adjustments were easily made.

Sound level at the control panel was 102 dBA. The dryer fan was noisy, and it was recommended that an operator wear ear protection when working near the Super-B AS-600G grain dryer.

The Super-B AS-600G is CGA (Canadian Gas Association) certified as meeting the requirements of Gas Fired Equipment for Drying Farm Crops. The safety controls were effective in automatically shutting off fuel to the burner if the pilot flame went out, the fan shut down, or the drying air temperature exceeded the high limit setting.

Although the operator's manual was very detailed, the complex control circuit was difficult to understand without a good electrical knowledge. Qualified electricians should be consulted if electrical servicing is required to ensure proper operation.

A ULC approved multi-purpose fire extinguisher with a 2A 10BC rating should be kept with the dryer at all times.

## OPERATOR'S MANUAL

The operator's manual was good. It was clearly written and sufficiently illustrated. It contained useful information on safe operation, adjustments, service, and maintenance. However, it contained a few errors and omissions. The electrical schematic contained an error on a relay connection. The automatic moisture controller on the test machine had a different adjustment scale than listed in the operator's manual. The operator's manual did not include recommended rapeseed drying temperature or the rapeseed and barley moisture controller settings. The Table of Contents in the operator's manual did not list page numbers to aid in literature search. It is recommended that the manufacturer consider correcting the errors and omissions in the operator's manual.

## DURABILITY RESULTS

TABLE 5 outlines the mechanical history of the Super-B AS-600G during 78 hours of operation while drying 11,520 bu (283 t) of grain. The intent of the test was to evaluate the functional performance of the machine. An extended durability test was not conducted.

**TABLE 5.** Mechanical History

| Item | Operating Hours | Grain bu | Dried (t) |
|---|---|---|---|
| -the diaphragm in the propane regulator tore and was replaced at | 58 | 8570 | (208) |
| -one regulator flange mount leaked propane and was tightened at | 60 | 9050 | (227) |

### APPENDIX I
### SPECIFICATIONS

| | |
|---|---|
| **MAKE:** | Super-B |
| **MODEL:** | AS-600G |
| **SERIAL NUMBER:** | AS12G121088312 |
| **MANUFACTURER:** | Beard Industries<br>Frankfort, Indiana 46041<br>U.S.A. |
| **GRAIN FILLING:** | |
| -- position | top rear centre of dryer |
| -- height | 13 ft (4.0 m) |
| -- levelling auger | |
| -diameter | 7 in (18 mm) |
| -speed | 410 rpm |
| -drive | belt from electric motor |
| **GRAIN DRYING CHAMBER:** | |
| -- type | hexagonal |
| -- length | 12.2 ft (3.7 m) |
| -- width (outer) | 7 ft (2.1 m) |
| -- height (outer) | 10 ft (3.1 m) |
| -- effective grain depth | 12 in (305 mm) |
| **GRAIN DISCHARGE:** | |
| -- type | auger |
| -- diameter | 9 in (229 mm) |
| -- length | 15.2 ft (4.6 m) |
| -- drive | belt driven from electric motor |
| -- speed | 347 rpm |
| -- discharge rate adjustment | varying height of shield over auger |
| -- discharge height | 1 in (25 mm) above machine base |
| -- discharge position | bottom rear centre of dryer |
| **AIR PLENUM:** | |
| -- shape | hexagonal |
| -- air transfer to grain | screen |
| -- screen porosity | 79 holes/in² (122 holes/cm²) |
| -- screen hole shape | circular |
| -- screen hole size | 0.07 in (1.8 mm) diameter |
| -- screen area | |
| -plenum | 211 ft² (196 m²) |
| -outer | 283ft² (263 m²) |
| **FAN:** | |
| -- type | vane axial |
| -- outer diameter | 28 in (71 cm) |
| -- number of blades | 6 |
| -- speed | 3450 rpm |
| -- drive | direct from motor |
| -- control | automatic switch |
| **BURNER:** | |
| -- maximum rating | 45 MBtu/h (48 G J/h) |
| -- type | 1.5 x 2.6 x 26 in (38 x 66 x 660 mm) main tube with five 1.25 x 1.25 in (32 x 32 mm) lateral tubes varying in length from 145 to 28.25 in (368 to 718 mm) |
| -- fuel | propane |
| -- ignition | spark ignited pilot |
| -- temperature adjustment | modulating valve |
| -- cycle control | 15 sec timer |
| **ELECTRICAL SYSTEM:** | |
| -- train circuit | 125 A, 230 V AC, single base |
| -- electric motors | |
| -number | 3 |
| -size | |
| -fan | 13 hp (9.7 kW), 230 V AC, single phase |
| -levelling and discharge auger | 3 hp (2.2 kW), 230 V AC, single phase |
| **NUMBER OF CHAIN DRIVES:** | 0 |
| **NUMBER OF BELT DRIVES:** | 2 |
| **NUMBER OF PRELUBRICATED BEARINGS:** | 2 |
| **LUBRICATION POINTS:** | |
| -- semi-monthly | 4 |
| **OVERALL DIMENSIONS:** | |
| -- field length | 19.3 ft (5.9 m) |
| -- field width | 7.3 ft (2.2 m) |
| -- field height | 12.7 ft (3.9 m) |
| -- body metal thickness | 18 gauge (1.3 mm) |
| **WEIGHT (Dryer Empty):** | 4730 lb (2145 kg) |
| **SOUND LEVEL:** (At Operator's Station) | 102 dBA |
| **HOLDING CAPACITY:** | 225 bu (8.2 m³) |
| **INSTRUMENTS:** | batch counter; hour meter; liquid and vapour fuel pressure gauges: drying air temperature gauge: power on, no wet grain, drying, cooling, loading and unloading indicator lights |
| **OPTIONS:** | centre loading, drying cycle timer, trans port axle/hitch kit, heat cycle timer, quiet low speed vane axial fans, rotary phase converters |

### APPENDIX II
### MACHINERY INSTITUTE STANDARD DRYING CONDITIONS

The Machinery Institute has chosen to state the performance of grain dryers at the following air and grain conditions:

| | | |
|---|---|---|
| Ambient temperature | 50°F (10°C) | |
| Initial grain temperature | 50°F (10°C) | |
| Initial grain temperature | 50°F (10°C) | |
| Barometric pressure | 13.8 psia (95 kPa) | |
| Final grain moisture content (Canadian Grain Commission) | -wheat | 14.5% |
| | -barley | 14.8% |
| | -rapeseed | 10.0% |
| | -corn | 15.5% |

$$\text{Dry Grain Weight} = \text{Wet Grain Weight} \times \frac{(100 - \text{wet moisture content (\%)})}{(100 - \text{dry moisture content (\%)})}$$

### APPENDIX III
### REGRESSION EQUATIONS FOR DRYING CAPACITY RESULTS

Regression equations for the drying capacity results shown in FIGURES 2 to 5 are presented in TABLE 6. In the regressions, B = drying capacity in bu/h, C = drying capacity in t/h. and M = initial grain moisture content in percent of total weight, while $\ell n$ is the natural logarithm. Sample size refers to the number of tests conducted. Limits of the regression may be obtained from FIGURES 2 to 5 while the grain conditions are presented in TABLE 1.

**TABLE 6.** Regression Equations

| Grain | Fig. No. | Regression Equation | Simple Correlation Coefficient | Variance Ratio | Sample Size |
|---|---|---|---|---|---|
| Wheat | 2 | $\ell n B = 10.194\text{-}1.76\ \ell n M$<br>$\ell n C = 6.59\text{-}1.76\ \ell n M$ | 0.99 | 325[1] | 9 |
| Barley | 3 | $\ell n B = 14.20\text{-}3.02\ \ell n M$<br>$\ell n C = 10.37\text{-}3.02\ \ell n M$ | 0.97 | 77[1] | 8 |
| Rapeseed | 4 | $\ell n B = 9.85\text{-}1.81\ \ell n M$<br>$\ell n C = 6.07\text{-}1.81\ \ell n M$ | 0.99 | 229[1] | 8 |
| Corn | 5 | $\ell n B = 12.42\text{-}2.34\ \ell n M$<br>$\ell n C = 8.74\text{-}2.34\ \ell n M$ | 0.99 | 592[1] | 10 |

[1] *Significant at $P \leq .01$*

**APPENDIX IV**
**DRYING AIR TEMPERATURE VARIATION**

The coefficient of variation[7] (CV) is used to describe the variation in the temperature within the air plenum during drying. The lower the CV, the more uniform is the drying air temperature.

TABLE 7 presents the coefficients of variation for the Super-B AS-600G when drying wheat, barley, rapeseed, and corn.

**TABLE 7.** Drying Air Temperatures

| Grain | Gauge Setting | | Average Drying Air Temperature | | CV |
|---|---|---|---|---|---|
| | °F | °C | °F | °C | % |
| Wheat | 180 | 82 | 181 | 83 | 6 |
| Barley | 160 | 71 | 153 | 67 | 5 |
| Rapeseed | 150 | 66 | 147 | 64 | 4 |
| Corn | 220 | 104 | 228 | 109 | 6 |

*[7]The coefficient of variation is the standard deviation of the measured drying air temperatures expressed as percent of the average drying air temperature.*

**APPENDIX V**
**MACHINE RATINGS**

The following rating scale is used in Machinery Institute Evaluation Reports:

| | |
|---|---|
| excellent | fair |
| very good | poor |
| good | unsatisfactory |

**SUMMARY CHART**

# SUPER-B AS-600G GRAIN DRYER

| | | |
|---|---|---|
| **RETAIL PRICE** | $28,860.00 (March, 1985, f.o.b. Humboldt, Sask.) | |
| **RATED DRYING CAPACITY** | bu/h | (t/h) |
| Wheat | 143 | (3.9) |
| Barley | 179 | (3.9) |
| Rapeseed | 140 | (3.2) |
| Hybrid 2120 Corn | 126 | (3.2) |
| **SPECIFIC FUEL CONSUMPTION** | gal/100 bu | (L/t) |
| Wheat | 6.4 | (10.7) |
| Barley | 5.8 | (12.1) |
| Rapeseed | 4.6 | (9.3) |
| Hybrid 2120 Corn | 11.0 | (19.6) |
| **QUALITY OF WORK** | | |
| Grain Quality | No grade loss in grains tested | |
| Drying Air Temperature | Uniform and adequate for all drying conditions; within 8°F (5°C) of gauge reading | |
| **EASE OF OPERATION AND ADJUSTMENT** | | |
| Dryer Preparation | **Excellent;** negligible assembly and easily hooked up | |
| Filling and Discharge | **Very Good;** automatic operation was convenient | |
| Drying | **Very Good;** automatic operation was convenient, supervision required to determine settings; drying air temperature was easy to set | |
| Cooling | **Very Good;** automatic operation was convenient | |
| Cleaning | **Very Good;** swing-out bottom under discharge auger; rapeseed partially plugged screens | |
| Servicing | **Very Good;** no daily servicing | |
| **POWER REQUIREMENTS** | 15.8 hp (11.8 kW); 230 V AC electric drive | |
| **OPERATOR SAFETY** | CGA certified, well shielded, noisy fan | |
| **OPERATOR'S MANUAL** | **Good;** very clear and complete, but contained a few errors and omissions | |


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