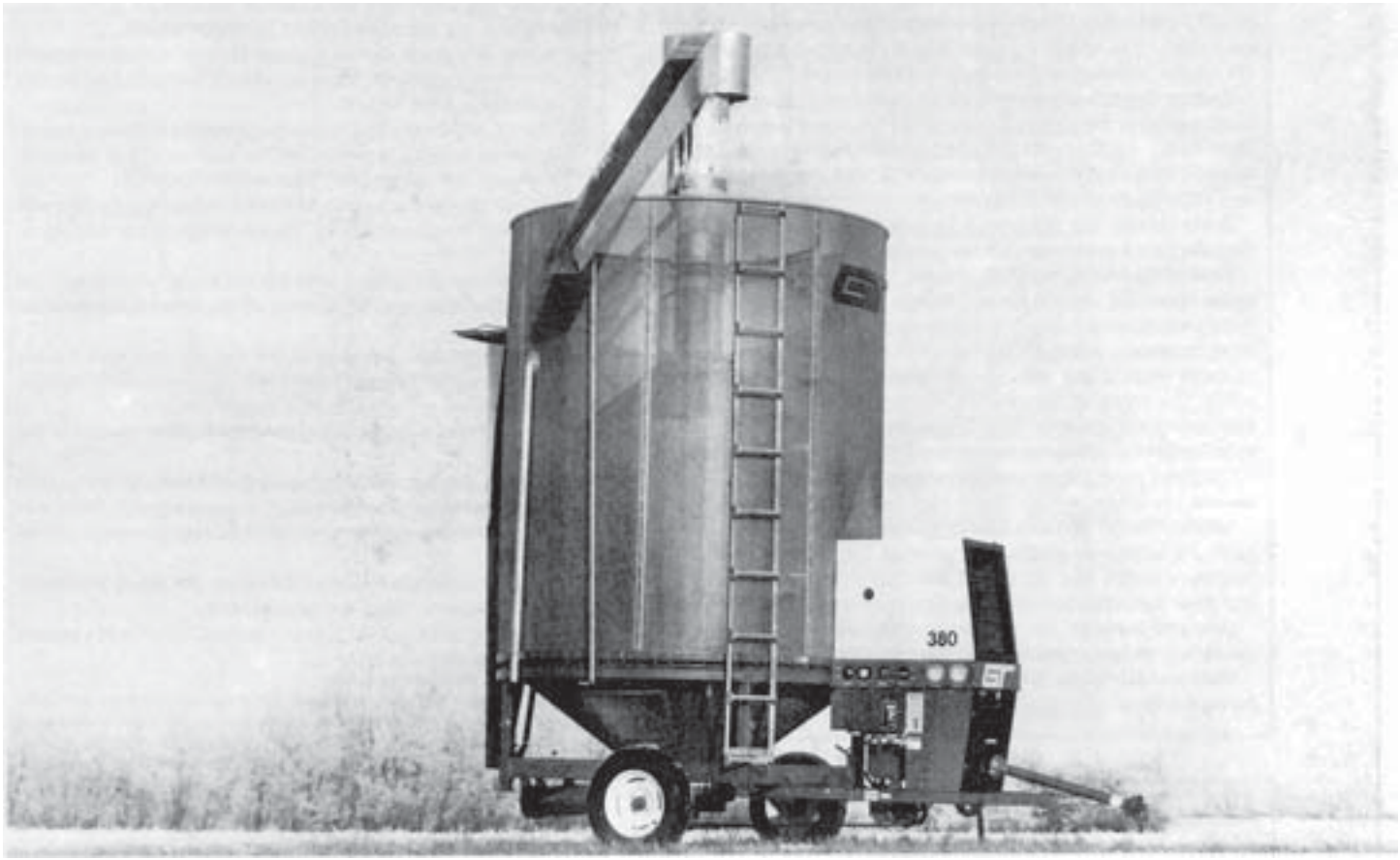
MACHINERY INSTITUTE

Printed: March, 1983
Tested at: Humboldt
ISSN 0383-3445

Evaluation Report 308



GT 380 Grain Dryer

A Co-operative Program Between

ALBERTA FARM MACHINERY RESEARCH CENTRE

PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

GT 380 GRAINDRYER

MANUFACTURER:
Gilmore & Tatge Mfg. Co. Inc.
Box 525
Clay Center, Kansas 67432

DISTRIBUTOR:
Allied Farm Equipment
1920 1st Avenue
Regina, Saskatchewan
S4R 8G6

RETAIL PRICE:
$16,395.00 (March, 1983, f.o.b. Humboldt, complete with power take-off drive, 0.06 in (1.59 mm) rapeseed screens and optional grain cleaner attachment.)

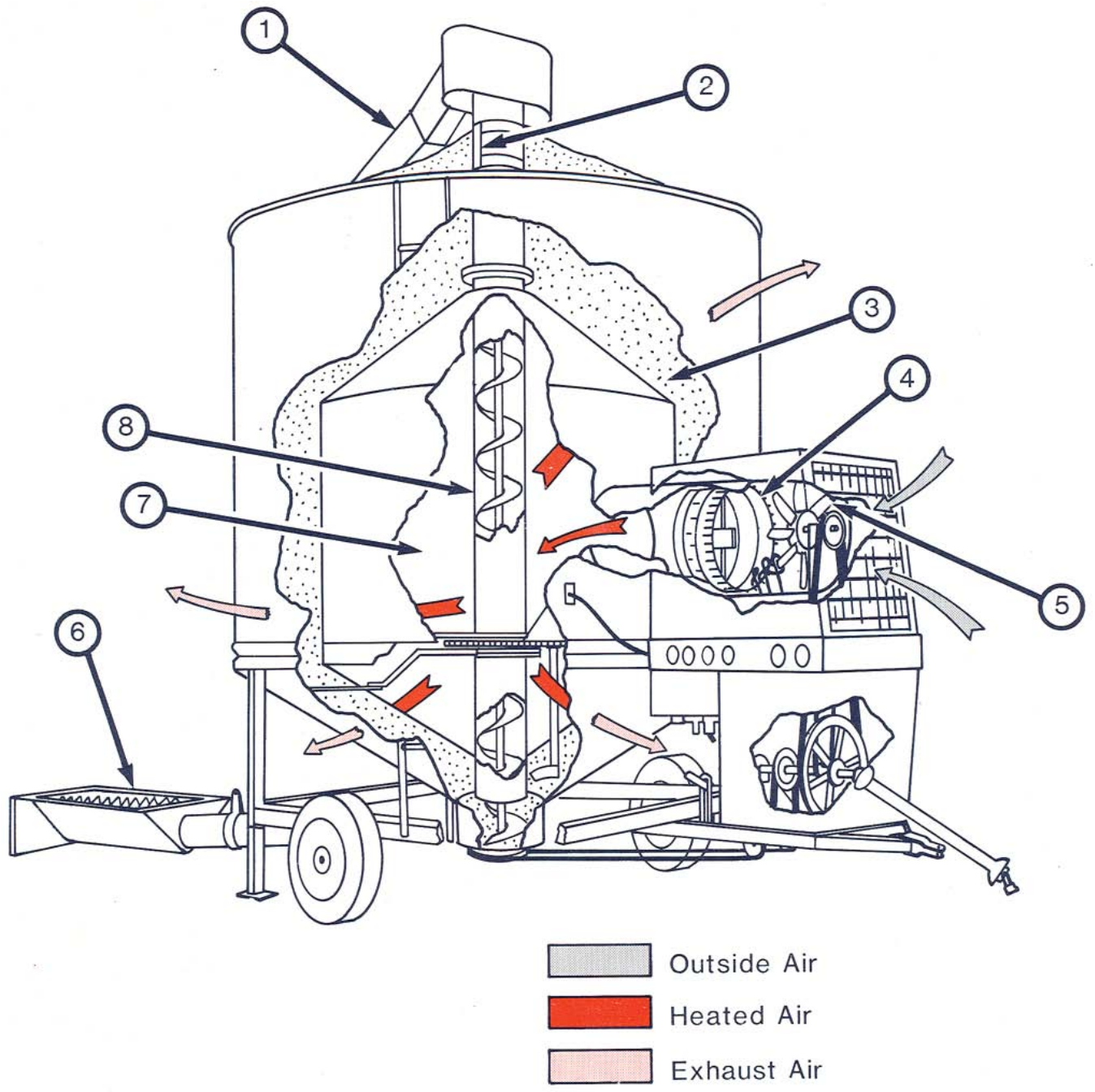


FIGURE 1. GT 380 Grain Dryer: (1) Unloading Chute, (2) Grain Cleaner, (3) Grain Chamber, (4) Burner, (5) Fan, (6) Loading Auger, (7) Air Plenum, (8) Vertical Auger.

SUMMARY AND CONCLUSIONS

Functional Performance: The GT 380 recirculating batch grain dryer was very good in wheat, barley, rapeseed and Hybrid 3996 corn.

Drying Capacity: The rated drying capacity of the GT 380 was 99 bu/h (2.7 t/h) in wheat, 124 bu/h (2.7 t/h) in barley, 110 bu/h (2.5 t/h) in rapeseed and 75 bu/h (1.9 t/h) in 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 (10.6 L/t) in wheat, 4.9 gal/100 bu (10.3 L/t) in barley, 4.7 gal/100 bu (9.5 L/t) in rapeseed and 12.7 gal/100 bu (22.7 L/t) in com. This corresponds to a fuel consumption of 6.4 gal/h (29 L/h) in wheat, 6.2 gal/h (28 L/h) in barley, 5.3 gal/h (24 L/h) in rapeseed and 9.5 gal/h (43 L/h) in corn.

Energy Consumption: At rated capacity, the specific energy consumption or the total energy required to remove a quantity of water from the grain, was 1900 Btu/lb (4300 kJ/kg) in wheat,

1800 Btu/lb (4100 kJ/kg) in barley, 1800 Btu/lb (4100 kJ/kg) in rapeseed and 1800 Btu/lb (4100 kJ/kg) in corn.

Grain Quality: No grade loss occurred when operating at the manufacturer's recommended temperature settings.

Ease of Operation and Adjustment: The GT 380 was difficult to transport, but easy to set up. Burner performance was very good and provided a steady and uniform drying air temperature in most conditions. Adequate drying air temperatures could not be obtained when drying corn at outside temperatures below 20°F (-70°C). The drying air temperature was easy to set. Grain cooling was very good. Ease of filling and unloading was good. Grain recirculation was adequate for all conditions. Ease of cleaning the GT 380 was good. Lubrication points were accessible and easy to service.

Safety: The GT 380 was safe to operate as long as the manufacturer's safety instructions were followed. The sound level at the operator's station was 103 dBA. It is recommended that an operator wear ear protection when working near the GT 380.

Operator Manual: The operator manual was well illustrated, clearly written and contained much useful information.

Mechanical History: Six minor mechanical problems occurred during the tests.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Supplying a hitch jack.
2. Modifications to prevent over centering when hitching.
3. Increasing the hitch clevis gap to accommodate large tractor drawbars.
4. Lengthening the control circuit power supply cord.
5. Providing a warning of caution when greasing the top vertical auger bearing.
6. Equipping the dryer with tires that comply with the Tire and Rim Association load rating.
7. Providing a slow moving vehicle sign as standard equipment.
8. Modifications to the airflow sensor to prevent it from freezing shut in cold weather.
9. Providing a warning system on the dryer to indicate a safety shutdown.
10. Including information on transporting in the operator manual.
11. *Senior Engineer-- G.E. Frehlich*

Project Technologist-- R.M. Barrel

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. There has been no great customer demand for a hitch jack, however, we will consider your recommendation.
2. A rear jack stand can be lowered before hitching to prevent over centering. We will move the wheels back on future models to increase hitch weight.
3. The 1-1/4 in (32 mm) hitch clevis gap prevents excessive bouncing when coupled to narrow hitches such as pickup bumpers. However, we will consider your recommendation,
4. We were not aware that the 15 ft (4.6 m) power supply cord was too short for some tractors. We will lengthen the cord as required,
5. A recommendation to grease the top auger bearing with the dryer shut down and full of grain will be added to the operator manual.
6. Current tires and rims used on the thousands of dryers in the field have caused no problems. We see no need for change, however, we will consider your recommendation.
7. We will install a slow moving vehicle decal on the rear of the dryer.
8. Current CSA specifications requiring differential air pressure to detect airflow has us locked into the present design. Work is in progress to change the regulations so improvements can be made.
9. Indicator lights which display the cause of a safety shutdown, are available on 1982 and later models.
10. .In the next printing of the operator manual, we will add a section on transporting the dryer.

Manufacturer's Additional Comments

1. Our published drying capacities are much higher than indicated in this report since our ratings are based on wet bushels entering the dryer and do not include loading and unloading time.
2. The following improvements have been made to the current model dryers:
   a) function indicator lights added to visually display the dryer operation sequence
   b) improved ring burner performance and ease of maintenance
   c) non skid ladder, with increased toe spacing for greater safety
   d) idler sheaves have pre-lubricated bearings eliminating two 4 hour grease points

GENERAL DESCRIPTION

The GT 380 is a recirculating batch, cross-flow grain dryer with an axial fan, propane burner and cylindrical grain chamber enclosing the air plenum. Grain is loaded into a loading auger at ground level or into the top of the dryer. The grain is fed into the bottom of a vertical auger by the grain agitator and continuously recirculated from the bottom to the top of the dryer. An optional grain cleaner attachment removes fines and small weed seeds as the grain is recirculated. 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 top of the dryer.

Drying air temperature is controlled by a modulating valve and monitored at the control panel. The length of the drying cycle is set on a grain temperature control, which automatically shuts off the burner to start the cooling cycle.

The test machine was power take-off driven. The control circuit required a 12 V DC supply. An optional electric drive and 110 V AC control circuit were available.

A safety control circuit shuts off fuel to the burner if the burner flame is extinguished, 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 GT 380 was operated with artificially and naturally wet grains under the conditions shown in TABLE 1 for 106 hours while drying about 9300 bu (226 t) of grain. It was evaluated[1] for ease of operation and adjustment, rate of work, power requirements, fuel and energy consumption, quality of work, operator safety and suitability of the operator manual.

TABLE 1. Operating Conditions

Grain	Grade	Dockage	Moisture Content	Hours	Grain Dried	
		%	%		bu	t
Wheat	2CW RS	4	17.0 to 24.0	30	2300	63
Barley	1 Feed	1	17.0 to 24.5	25	2350	51
Rapeseed	2CW	5	11.5 to 16.5	20	2400	55
Corn (Hybrid 3996)	4CW	2	17.8 to 31.7	31	2250	57
Total				106	9300	226

RESULTS AND DISCUSSION

EASE OF OPERATION AND ADJUSTMENT

Assembly: The GT 380 required some assembly. The top vertical auger section was installed by two men in about 2-1/2 hours. The grain cleaner attachment was installed by one man in about 1 hour. Assembly instructions were clear and made installation easy.

Transporting: No hitch jack was provided and the GT 380 easily over centered, making hitching difficult for one man. It is recommended that the manufacturer supply a hitch jack and prevent over centering to make hitching easier. The hitch clevis was not adjustable to suit varying tow bar heights. The clevis gap was too narrow for most tractor drawbars and it is recommended that the clevis gap be increased to accommodate these drawbars.

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

Transport width of the test machine was 8.3 ft (2.5 m) while transport height was 18.2 ft (5.5 m). Extreme care was needed when transporting on public roads, through gates, over bridges, and beneath power and telephone lines. The transport height could be decreased to 13.5 ft (4.1 m), by removing the vertical auger top section and grain cleaner attachment.

The GT 380 towed well at normal transport speeds. Care had to be taken to use a towing vehicle with adequate brakes and weight to permit safe stopping in emergency situations, and to reduce front to rear rocking while transporting. Caution had to be used when travelling over uneven terrain because of minimal ground clearance (FIGURE 2).

Rear visibility when transporting was restricted. Extended rear view mirrors on the towing vehicle were required for adequate rear vision. The rear lights of the towing truck were obscured by the dryer. Adequate signal devices were required for travelling on public roads.

FIGURE 2. Minimal Ground Clearance on Uneven Terrain.

Setup: The GT 380 was set up by one man in about 1 hour. The machine was supported by four adjustable legs that required blocking unless set on a concrete foundation. The dryer was unstable when jacking into transport or field position unless properly anchored.

The power take-off drive was easily attached to the tractor. The propane supply was easily connected to the dryer plumbing. The power supply cord for the control circuit required lengthening to reach the tractor. It is recommended that the manufacturer consider lengthening the power supply cord.

The GT 380 did not require additional grain conveyors to load from or into trucks.

Fan: The recommended fan speed was 2600 rpm at a power take-off speed of 525 rpm. However, the fan (FIGURE 3) only achieved 2470 rpm at the maximum permissible power take-off speed of 540 rpm. A tractor with a 1000 rpm power take-off is recommended to permit operating the tractor at low engine speed. It is important that the operator does not exceed permissible power take-off speeds. The fan was easily engaged and disengaged by a clutch (FIGURE 4). The clutch was very convenient as it allowed quieter and cleaner loading and unloading operations.

Burner: The spark-ignited burner (FIGURE 3) was started with a switch at the control panel (FIGURE 5). Fuel pressure was monitored on a gauge near the control panel. The burner performed well for all conditions encountered.

Grain Filling: The GT 380 could be filled using tile foldaway loading auger (FIGURE 6) or a portable auger with a discharge height of 14 ft (4.3 m). The loading auger was easily lowered to ground level by one man. The loading auger extended 9.8 ft (3.0 m) from the dryer providing easy access when filling from a truck or most hopper bottom bins. Supervision was required during filling. The loading auger was easily engaged or disengaged. Allowances of 3 to 6 in (75 to 150 mm) for grain expansion during the drying period were necessary when filling to prevent spillage during drying.

The holding capacity of the GT 380 was about 346 bu (12.6 m³). Batches smaller than the holding capacity could be dried, but at least 250 bu (9.1 m³) of grain was required.

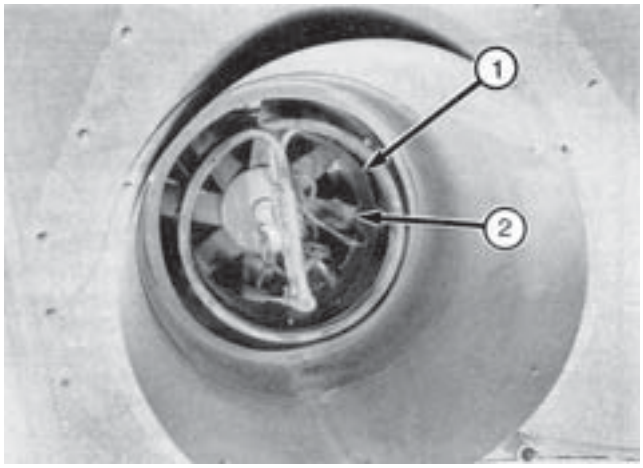


FIGURE 3. Fan Housing: (1) Burner, (2) Fan.

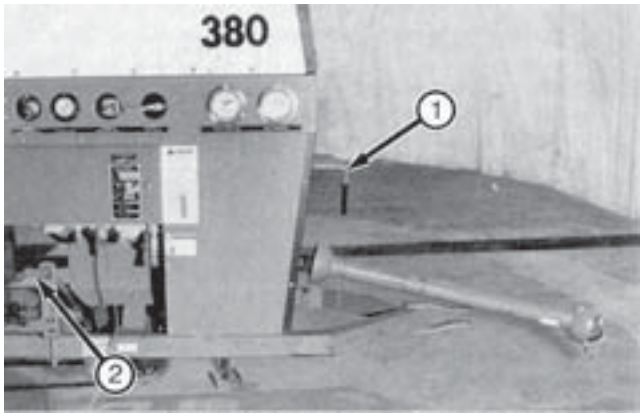


FIGURE 4. Controls: (1) Fan Clutch Lever, (2) Loading Auger Clutch Lever.

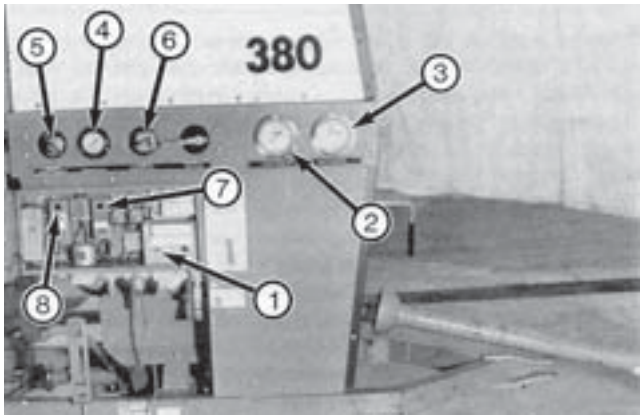


FIGURE 5. Controls and Instruments: (1) Power Switch, (2) Drying Air Temperature Gauge, (3) Grain Temperature Gauge, (4) Fuel Pressure Gauge, (5) Pressure Regulator Valve, (6) Modulating Valve, (7) Grain Temperature Control, (8) High Limit Switch.

Grain Drying: The drying air temperature was set by adjusting a screw on the modulating valve. The maximum drying air temperature limit was adjusted on a high limit temperature switch in the control panel. If this setting was exceeded, the fuel to the burner was automatically shut off. The length of the drying cycle was set on a grain temperature control in the control panel.

FIGURE 6. Grain Filling.

The drying air temperature was controlled by the modulating valve. Drying air temperature was monitored at the control panel and was adequate except when drying corn at temperatures below 20°F (-7°C).

The dryer was equipped with a grain temperature control that would automatically shut off the burner when the grain was dry. The initial drying cycle required supervision to determine the grain temperature corresponding to dry grain. A gauge, located near the control panel, indicated grain temperature, while grain samples obtained from a grain sampling tube at ground level, were monitored for moisture content. The grain samples were very representative if the sampling time was more than 10 minutes. Once set, the grain temperature control automatically shut off the burner. The grain temperature control setting had to be adjusted when grain or outside air conditions changed.

The GT 380 required minimal supervision while drying. Once the modulating valve was set, it provided a steady drying air temperature. Grain flow through the dryer was adequate and uniform for all conditions.

Grain Cooling: Grain cooling occurred after the grain temperature control automatically shut off the burner. Grain temperature was monitored on a gauge by the control panel.

Grain Discharge: Grain was discharged at the top of the dryer. A chute was manually swung around to direct the grain from the vertical auger to a truck positioned on either side of the dryer (FIGURE 7). An optional flexible unloading spout was available to direct the grain to ground level and into additional grain conveyors.

FIGURE 7. Grain Discharge.

Grain Cleaner: The GT 380 was equipped with an optional grain cleaner attachment (FIGURE 8). Fines and small weed seeds were separated and discharged from the dryer as the grain was conveyed past a screen in the vertical auger tube. The screens had to be periodically cleaned with a wire brush. One man could change or clean the screens in about 5 minutes. Screens were available for wheat, barley and corn.

The grain cleaner removed about 30 to 50% of the total dockage in wheat and about 40 to 60% in barley. The grain cleaner housing plugged when drying high moisture corn in freezing weather (FIGURE 9). The housing was cleaned by one man in 15 minutes. The grain cleaner was not evaluated in corn for other conditions. The grain cleaner attachment was useful since it reduced dockage and allowed more efficient grain drying.

FIGURE 8. Grain Cleaner Attachment.

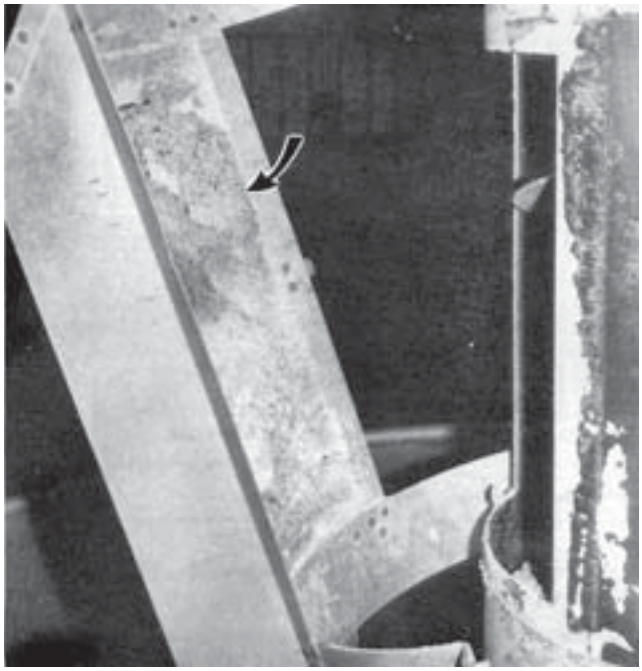


FIGURE 9. Plugged Grain Cleaner Housing.

Cleaning: Ease of cleaning the GT 380 was good. The screens, especially those in the lower grain chamber, partially plugged during operation. The screens could be adequately cleaned with a high pressure washer.

Fines did not collect in the air plenum because the air plenum bottom was open. A cleanout door was provided for the vertical auger sump and an access door allowed entry into the dryer (FIGURE 10). Fines accumulated under the dryer and had to be cleaned up weekly to prevent excessive buildup.

Servicing: The GT 380 had 16 pressure grease fittings. Two required greasing every 4 hours, eight required greasing every 8 hours, one required greasing every 50 hours, and five required greasing every 100 hours. The agitator chain had to be lubricated every 50 hours and the agitator gearbox had to be checked annually.

The grain agitator had to be inspected before and after the first load and then every 100 hours. The agitator was adjusted by one

man in about 1 hour.

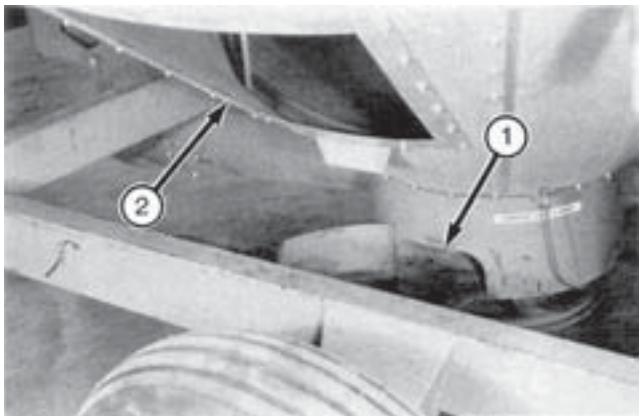


FIGURE 10. Access Doors. (1) Cleanout Door, (2) Dryer Access Door.

RATE OF WORK

Standard Conditions: To provide a meaningful comparison of grain dryer performance, the capacity, and fuel and 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 consumptions 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. Drying capacity varies with the grain type and the amount of moisture removed. FIGURES 11 to 14 present capacity curves for the GT 380 while drying wheat, barley, rapeseed and Hybrid 3996 corn.

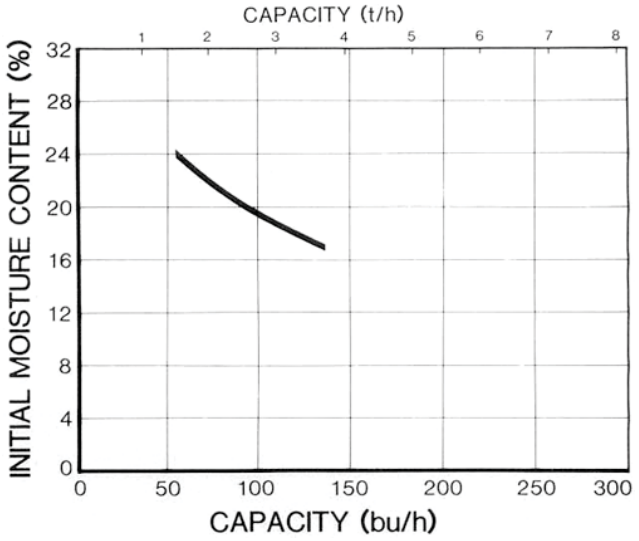


FIGURE 11. Drying Capacity in Wheat.

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 GT 380 varied from 2.3 hours in barley to 3.5 hours in corn, while the rated drying capacity (TABLE 3) varied from 75 bu/h (1.9 t/h) in corn to 124 bu/h (2.7 t/h) in barley.

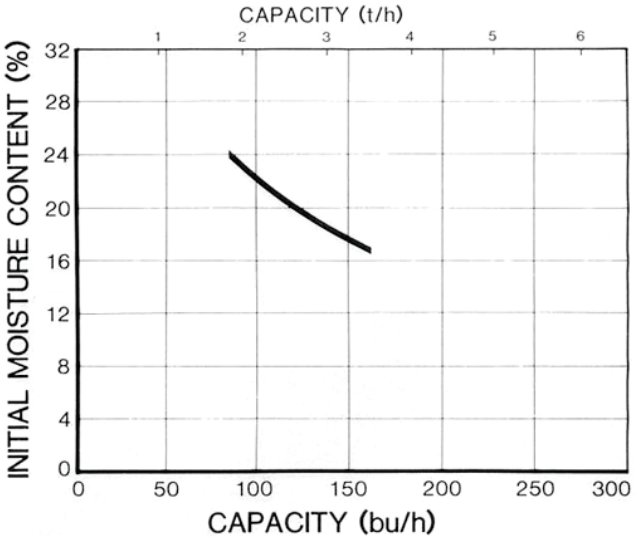


FIGURE 12. Drying Capacity in Barley.

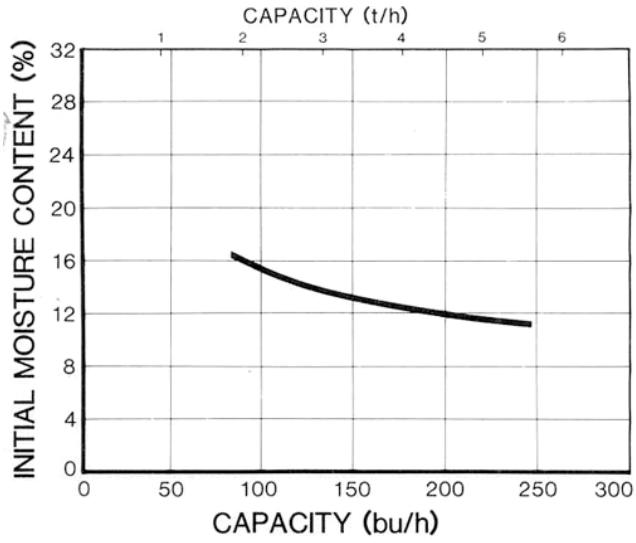


FIGURE 13. Drying Capacity in Rapeseed.

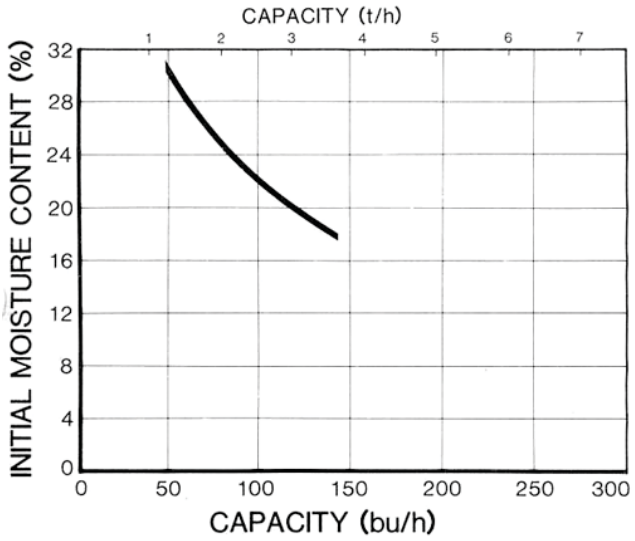


FIGURE 14. Drying Capacity in Corn (Hybrid 3996).

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 a corresponding reduction in the grain price depends on whether the grain is seed,

[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 VI for the wet gram to dry grain conversion.

commercial or feed. Feed grain is permitted the greatest damage and seed grain the least 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 GT 380 grain dryer.

TABLE 2. Batch Times

Grain	Filling	Drying	Cooling	Discharge	Total
	Hours	Hours	Hours	Hours	Hours
Wheat	0.2	2.0	0.6	0.1	2.9
Barley	0.2	1.1	0.9	0.1	2.3
Rapeseed	0.2	1.9	0.5	0.1	2.7
Corn (Hybrid 3996)	0.3	2.2	0.9	0.1	3.5

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	99	2.7	11
Barley	19.8	5	200	93	124	2.7	12
Rapeseed	15.0	5	160	71	110	2.5	13
Corn (Hybrid 3996)	25.5	10	230	110	75	1.9	14

Drying Air Temperature: A uniform drying air temperature minimizes grain damage and provides uniform and efficient grain drying. The uniformity of the drying air temperature for the GT 380 was excellent. The drying air temperature gauge accurately indicated the average drying air temperature. See APPENDIX IV for further details.

POWER REQUIREMENTS

A 12 V DC electrical supply was required to operate the control circuit. Power take-off power requirements varied from 14 hp (10.4 kW) in barley to 17 hp (12.9 kW) in wheat. An optional electric drive and a 110 V AC control panel were available. A 25 hp (19 kW) tractor should have sufficient power to operate the GT 380.

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 GT 380 (TABLE 4) at rated drying capacity varied from 4.7 gal/100 bu (9.5 L/t) in rapeseed to 12.7 gal/100 bu (22.7 L/t) in corn. This corresponds to fuel consumption[4], ranging from 5.3 gal/h (24 L/h) in rapeseed to 9.5 gal/h (43 L/h) in corn.

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 GT 380 (TABLE 4) at rated drying capacity varied from 1800 Btu/lb (4100 kJ/kg) in barley and rapeseed to 1900 Btu/lb (4300 kJ/kg) in wheat.

OPERATOR SAFETY

The GT 380 operator manual emphasized safety, and warning decals adequately indicated most dangerous areas. Caution was required when greasing the top vertical auger bearing. No warning was provided and it is recommended that a warning be provided. Drives were well shielded and machine adjustments could be safely made.

TABLE 4. Fuel and Energy Consumption

Crop	Moisture Removed	Fuel Consumption		Specific Fuel Consumption		Specific Energy Consumption	
	%	gal/h	L/h	gal/100 bu	L/t	Btu/lb	kJ/kg
Wheat4	5	6.4	29	6.4	10.6	1900	4300
Barley	5	6.2	28	4.9	10.3	1800	4100
Rapeseed	5	5.3	24	4.7	9.5	1800	4100
Corn (Hybrid 3996)	10	9.5	43	12.7	22.7	1800	4100

Extreme care was needed when transporting on public roads, through gates, over bridges, and beneath power and telephone lines. Transport height of the 8.3 ft (2.5 m) wide test machine was 18.2 ft (5.5 m) when fully assembled, which is high enough to contact many prairie power and telephone lines. Operators must contact the authorities when transporting machines that exceed allowable transport widths or heights.

The GT 380 towed well at normal transport speeds. Care had to be taken to use a towing vehicle with adequate brakes and weight to permit safe stopping in emergency situations and to reduce front to rear rocking while transporting. A hitch safety chain for transporting was not provided.

Tire loads exceeded the Tire and Rim Association maximum rating for 6.70 x 15SL, 4-ply tires by 24%. The tire overload was considered unsafe and hazardous, especially at high transport speeds. It is recommended that the dryer be equipped with tires having suitable load ratings.

Since rear visibility and the rear lights of a towing truck are obscured by the dryer, the operator should ensure that adequate rear view mirrors and signal devices are installed before transporting on public roads. A slow moving vehicle sign was not provided, but is optional. It is recommended the manufacturer consider providing a slow moving vehicle sign as standard equipment.

Sound level at the operator's station was about 103 dBA when the GT 380 was powered with a 60 hp (45 kW) tractor. It is recommended that an operator wear ear protection when working near the GT 380.

The GT 380 is CSA (Canadian Standards Association) certified as meeting the requirements of Gas Fired Equipment for Drying Farm Crops. The safety controls were effective in automatically shutting off the fuel to the burner if the burner flame went out, if the drying air temperature exceeded the set maximum, or if the fan shut down. While drying corn at temperatures below 32°F (0°C), the airflow sensor occasionally froze shut during the cooling cycle and had to be defrosted before the burner could be started for the next batch. It is recommended that the manufacturer consider modifications to the airflow sensor for operating under those conditions. There was no warning system to indicate a safety shutdown and it is recommended that the manufacturer consider providing one.

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

OPERATOR MANUAL

The operator manual was clearly written, well illustrated and very detailed. It contained useful information on safe operation, adjustments, service and lubrication. However, it did not include complete information on transporting, and it is recommended that it be included.

DURABILITY RESULTS

TABLE 5 outlines the mechanical history of the GT 380 during 106 hours of operation while drying 9300 bu (226 t) of grain. The intent of the test was to evaluate the functional performance of the machine. An extended durability test was not conducted.

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

TABLE 5. Mechanical History

Item	Operating Hours	Grain Dried bu	(t)
-The loading auger transport lock and auger grate broke in transport and were repaired at	Beginning of test		
-The sheet metal on the outer screen was ripped by the agitator and repaired at	20	2070	(45)
-The agitator drive pulley loosened and was tightened at	25	2340	(51)
-The power take-off shaft connection to the dryer loosened and was tightened at	62	5890	(142)
-The airflow sensor plugged at	97, 99	8850, 8970	(214, 217)

APPENDIX I
SPECIFICATIONS

MAKE:	GT
MODEL (1981):	380
SERIAL NUMBER:	381303
MANUFACTURER:	Gilmore & Tatge Mfg. Co. Inc. Clay Center, Kansas U.S.A.
GRAIN FILLING:	
-- position	ground level loading auger or top loading
-- height	
-loading auger	18 in (460 mm)
-top loading	13.6 to 13.8 ft (4.1 to 4.2m)
-- loading hopper	
-length	4.1 ft (1.2 m)
-width	30 in (762 mm)
-reach from dryer body	9.8 ft (3.0 m)
-- loading auger	
-diameter	8 in (200 mm)
-speed	540 rpm
-drive	belt
-control	belt tightener clutch
GRAIN CHAMBER:	
-- type	cylindrical and cone-shaped grain column
-- diameter	
-outer	7.9 ft (2.4 m)
-inner	4.9 ft (1.5 m)
-- height	11.8 ft (3.6 m)
-- grain column thickness	18 in (452 mm)
-- grain recirculation	
-type	vertical auger
-diameter	12 in (300 mm)
-length	17.6 ft (5.4 m)
-speed	262 rpm
-drive	belt
-- grain agitator	
-type	two stirring arms
-speed	7.5 rpm
-drive	chain
-- grain cleaner attachment	
-separation device	barley, wheat or corn screens
-location	upper vertical auger tubing
-number of screens	1
-screen area	222 in² (1433 cm²)
GRAIN DISCHARGE:	
-- type	inclined chute
-- height	12 to 12.3 ft (3.65 to 3.73 m)
-- positions	either side of machine
AIR PLENUM:	
-- shape	cylindrical with cone-shaped top and open bottom
-- air transfer to grain	screen
-- screen porosity	
-plenum	52 holes/in² (8 holes/cm²)
-outer	103 holes/in² (16 holes/cm²)
-- screen hole size	
-plenum	0.09 in (2.38 mm)
-outer	0.06 in (1.59 mm)
-- screen area	
-plenum	126 ft² (11.7 m²)
-outer	284 ft² (26.4 m²)
FAN:	
-- type	axial
-- diameter	25 in (650 mm)
-- number of blades	8
-- speed	2470 rpm
-- drive	belt from PTO
-- control	belt tightener clutch
BURNER:	
-- maximum rating	1.8 MBtu/h (1.9 GJ/h)
-- type	0.9 in (21 mm) diameter pipe in 18 in (468 mm) diameter circle
-- fuel	propane
-- ignition	spark
-- temperature adjustment	modulating valve

ELECTRICAL SYSTEM:		
-- Control circuit	10 amp, 12 V DC	
NO. OF CHAIN DRIVES:	2	
NO. OF BELT DRIVES:	4	
NO. OF PRE-LUBRICATED BEARINGS:	15	
LUBRICATION POINTS:		
-- 4h	2	
-- 8h	8	
-- 50h	2	
-- 100h	5	
-- seasonal	1	
TIRES:	2, 6.70 x 15SL, 4-ply	
OVERALL DIMENSIONS:	**Field Position**	**Transport Position**
-- wheel tread		7.9 ft (2.4 m)
-- height	18.7 ft (5.7 m)	18.2 ft (5.5 m)
-- length	22.7 ft (6.9 m)	14.2 ft (4.3 m)
-- width	11 ft (3.3 m)	8.3 ft (2.5 m)
-- ground clearance	6 to 9 in (150 to 255 mm)	5 in (130 mm)
-- hitch height		18 in (445 mm)
-- clevis gap		1.4 in (36mm)
-- body metal thickness	16 gauge (1.70 mm)	
WEIGHT: (Dryer Empty)		
-- hitch	40 lb (18 kg)	
-- wheels	3307 lb (1500 kg)	
TOTAL	3,347 lb (1518 kg)	
SOUND LEVEL: (At Operator's Station)	103 dBA	
HOLDING CAPACITY:	346 bu (12.6 m3)	
INSTRUMENTS:	fuel pressure gauge, drying air temperature gauge, grain temperature gauge	
OPTIONS:	12 V DC or 110 V AC control panel kits, electric motor side mount kit	
	liquid propane or natural gas fuel systems	
	power take-off drive, hydraulic unloading power head, grain cleaner attachment, flexible unloading spout, 0.06 or 0.09 in (1.59 or 2.38 mm) dryer screens, snorkel kit	

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)	
Barometric pressure	13.8 psia (95 kPa)	
Final grain moisture content	-wheat	14.5%
(Canadian Grain Commission)	-barley	14.8%
	-rapeseed	10.0%
	-corn	15.5%

APPENDIX III
REGRESSION EQUATIONS FOR DRYING CAPACITY RESULTS

Regression equations for the drying capacity results shown in FIGURES 11 to 14 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 ℓn is the natural logarithm. Sample size refers to the number of tests conducted. Limits of the regression may be obtained from FIGURES 11 to 14 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	11	ℓnB = 6.96-0.12M ℓnC = 3.36-0.12M	0.99	484[1]	8
Barley	12	ℓnB = 6.59-0.09M ℓnC = 2.77-0.09M	0.99	1287[1]	6
Rapeseed	13	ℓnB = 12.49-2.88ℓnM ℓnC = 8.70-2.88ℓnM	0.99	453[1]	8
Corn (Hybrid 3996)	14	ℓnB = 6.45-0.08M ℓnC = 2.78-0.08M	0.99	509[1]	9

[1]*Significant at P ≦ .01*

APPENDIX IV
DRYING AIR TEMPERATURE VARIATION

The coefficient of variation[5] (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 GT 380 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	181	83	183	84	3
Barley	200	93	201	94	4
Rapeseed	162	72	162	72	2
Corn	226	108	230	110	4

[5]*The coefficient of variation is the standard deviation of the measured drying air temperatures expressed as a 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

APPENDIX VI
CONVERSION TABLE

1 inch (in)	= 25.4 millimetres (mm)
1 pound (lb)	= 0.45 kilograms (kg)
1 gallon (gal)	= 4.5 litres (L)
100 bushels (bu)	= 3.6 cubic metres (m^3)
1 British thermal unit/pound (Btu/lb)	= 2.3 kilojoule kilogram (kJ/kg)
100 bushels (bu)	= 2.7 tonne (t) wheat
	= 2.2 tonne (t) barley
	= 2.3 tonne (t) rapeseed
	= 2.5 tonne (t) corn

dry grain weight (ton) wet grain weight (ton) x $\frac{\text{(100 - wet moisture content (\%))}}{\text{(100 - dry moisture content (\%))}}$

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