

May 25, 2011

# **CROWN MACHINE uwp, INC.**

## Used Machinery Evaluation Report

Marysville (2 locations) and Bay City, MI

One Werner & Pfleiderer (Coperian) ZSK-250, 250mm  
Twin Screw Extruder and Ancillary Equipment:  
Drive, Gear Box, Diverter Valve, Screen Changer  
and Control Panels  
(evaluated April 5, 2011)



CROWN Machine uwp, Inc. (CROWN) is a technical leader in the designing and manufacturing of extrusion, pelletizing, and reclaim machines for the global plastics and recycling industry. Since its inception, CROWN has worked to advance plastics processing technology with an ongoing commitment to precision engineering and innovative design. Due to development efforts, CROWN now has a number of patents for its latest Underwater Pelletizer product lines. As an industry leader with over 40 years of experience in manufacturing plastics processing equipment, CROWN continues to create innovative machines that help our customers increase productivity and improve quality. CROWN approaches each customer's process equipment need with a commitment to develop solutions that resolve difficult processing problems.

These evaluations were conducted by:

George Holmes, General Manager - Crown Machine uwp, Inc.

- Degree in advanced mathematics
- Leader in equipment design; research and development
- Holder of several patents in the design and manufacture of plastics processing equipment
- 40 years of successful entrepreneurial leadership in OEM machinery, both rebuilding and manufacturing

John Sengebusch, Vice President of Operations - Crown Machine uwp, Inc.

- 35 years experience in the manufacturing and rebuilding of plastics OEM machinery
- Extensive experience in identifying and developing key customer and vendor relationships
- Directs crucial operational activities to successfully deliver OEM machinery to customers
- Certified Master Mechanic and
- Qualified metallurgist and analyst of heat treatment processes

This report has been prepared on the basis of limited one day evaluations of the extruder and ancillary equipment stored in warehouses at each site. The operating unit was largely disassembled, had pieces stacked on top of each other and some crated and not available for viewing. The 5,000 hp GE drive was in a remote location. None of the units could be run. No utilities were available. Wear and surface conditions of the machinery that were accessible were observed, inspection covers opened and shafts hand turned to check gear wear where possible, measurements of screws and barrels that were exposed were taken. Also the documentation that was available at the Flint Hills Resources Engineering Department was reviewed.

Some reasonable opinions about each unit can be drawn from these observations. These opinions may be considered as guides to take further action. We have made recommendations based on these observations. Any greater evaluation would require moving the equipment to Crown Machine's Addison, IL development lab, or another similar facility, to set up the units and to dry run them.

## Marysville, MI - Flint Hills Resources, and Bay City, MI – York Electrical Contractors

The 250mm Twin Screw Extruder unit has been significantly disassembled and stored in a temperature controlled environment; some equipment is in crates, others under tarps, and others fully exposed. Almost all of the equipment was in a Flint Hills Resources Polymers LLC (FHR) warehouse at 3280 Atlantic St in Marysville, MI. The 5000Hp GE AC Motor unit has been stored at York/ Dobson, an electrical contractor located in Bay City, MI. The documents for this line are in the Engineering Department at the FHR plant site on Range Road in Marysville.



Examples of storage conditions

## Inspection

Description: This was originally delivered to Huntsman Corp in February, 1996 to their Woodbury, NJ Polypropylene facility. It was moved to Marysville, MI with the closing of the Woodbury location with the expectation that this line would be installed when the polypropylene unit was debottlenecked, but it was reported to us there wasn't sufficient space, and it was never installed.

ZSK 250 Werner & Pfleiderer (Coperian) 250mm Twin Screw Extruder

From plate:	Reference Number	614248
	Year of Construction	1995
	Type & Size	BD108/205-R70
	Ratio	5,345/8,00

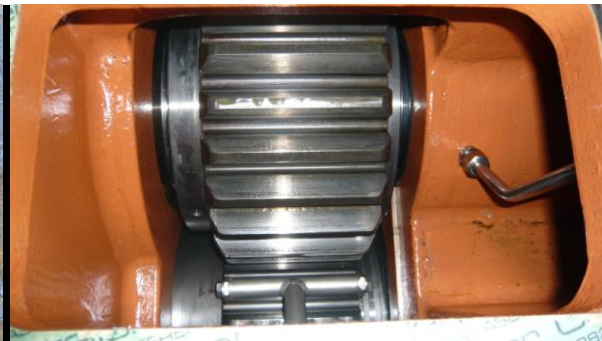
Underwater Pelletizers • Twin Screw Extruders • Single Screw Extruders

Power (kW)	3249/2171
Speed input (m <sup>-1</sup> )	1185
Speed output (m <sup>-1</sup> )	1/° 221,6 148 °\ 2
Service factor	AGMA S <sub>f</sub> = 1.5
Lubricant	See W&P
Viscosity Class	Maintenance
List of Lubricants	Instructions
Oil Contents (l)	ca. 2000
Oil Required (l/min)	560
Oil Pressure (bar)	1-2

$$T_{out\ max} = 70009Nm/ shaft$$

Base Frame

Gear Reduction Unit



General condition: The Gear Box shows little wear. The main shaft was hand rotated to check the full range of gears.

**Feed Section – N/A**

**Feed Hopper – N/A**



### Cylinder Barrel



General condition – Good  
Book Center Line: 205 mm = 8.07 inches  
Recommended Finish Size: 251mm = 9.881 inches  
Right Barrel ID – 9.886 inches at 6 inches in from feed end  
Left Barrel ID – 9.886 inches at 6 inches in from feed end

### Feed Screw



General Condition – Good  
No Recommended Diameter found in documents  
Right Screw OD – 9.763 inches approx 36" from start of flights

**Heating/ Cooling System** – No Pictures

**Basic Extruder Power Supply - Drive 5000 HP GE Motor, located at York in Bay City, MI**



From plate:

Model 5KG86131476501

Rated HP 5000

RPM 1185

AMP 626

Volts 4160

Phase 3 Hertz 60

Power Factor 0.86

Efficiency 95.9%

Service Factor 1.0

Insulation Class F

Temp. Rise 85°C

Stator by RTD at 1.00 SF

Time Rating Continuous

Amb. Temp. (°C) 40 max to -18 min

Altitude (Ft) 3300

Serial Number XKH229001671

Type KG

Frame 8613S

Enclosure WPI

LRA (%) 600

Drive End Brg Sleeve

Lubricant Oil

Lubricant 300 SSU at 100°

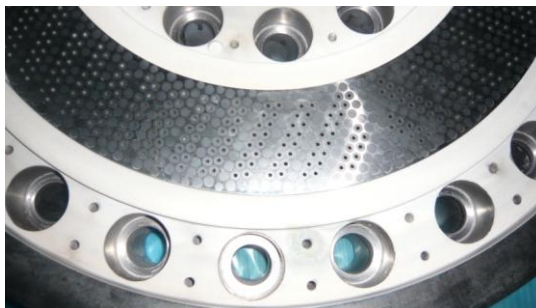
This motor requires Forced Lubrication.

**CAUTION: Do Not Operate without Forced Lubrication**

The GE motor was moved to FHR's electrical contractor, York, so that the required periodic maintenance could be performed.

**Diverter Valve, DAV-250 – No Pictures**

**Die Plate**



**Screen Changer, SWZ-1900** – No Pictures

**Underwater Pelletizer, UG-400** - Not included in sale.

**Control Panel** - No pictures, in crates

**Documentation:** At least 3 complete 16 volume sets of 'Owners' Manuals' (operating instructions for each piece, diagrams, installation instructions, preoperational checks, lubricant specifications, et al) (a copy of the 12 page Index is attached), 4 file drawers of reports, invoices, other documents, and a storage closet with additional documentation for this unit are located in the Engineering Department at the FHR Range Road facility. Included are many engineering drawings such as the Piping & Instrument Diagram (attached), electrical diagrams, downstream equipment diagrams, etc.

## Analysis

A certain degree of care was taken in storing this W-P unit. The overall condition is Good. That is, what was able to be observed did not have irreparable damage. Care has been taken to maintain the GE Drive, surface corrosion on the barrels and screws can be addressed. However, a number of significant evaluations still should be made. Dynamic testing of the gear reduction unit should be run to guarantee its performance capability. Pressure testing of the heating and cooling system would determine if any seal damage has occurred. Spark testing of the electrical system to evaluate the integrity also needs to be run.

## Recommendations

It is the considered recommendation of CROWN Machine uwp, Inc. that the ZSK 250 Werner & Pfleiderer (Coperian) 250mm Twin Screw Extruder is a viable piece of equipment and, with a reasonable investment, could be returned to a fully functional state. For the suitable operation, it could be a value, i.e., a large output machine at a reasonable cost. Subject to "Dynamic Testing" the overall condition is Good to Excellent. The extruder can be reassembled/rebuilt for approximately \$250,000 USD (no electricals or replacement parts are included) and we can provide a mechanical guarantee.