DRAWN	DATE	Kalmar Industries Corp.	SHEET
EC	09-19-03	415 E. Dundee Ottawa, Ks. 66067, USA. PHONE (785) 242-2200	1 OF 4
EO	REV		
031391	A		
APPROVED		ENGINEERING SPECIFICATIONS OR INSTRUCTIONS	ESN-0037

NOTE: KALMAR INDUSTRIES CORP. WILL BE REFERRED TO AS "KALMAR" IN THIS DOCUMENT

SCOPE: THIS SPECIFICATION COVERS CARBON STEEL CASTINGS FOR GENERAL APPLICATIONS THAT REQUIRE UP TO 70 ksi [485 MPa] MINIMUM TENSILE STRENGTH.

1. DRAWING REQUIREMENTS

DESIGN ENGINEERING IS RESPONSIBLE TO INDICATE ON THE DRAWING:

A. AMOUNT OF ADDITIONAL MATERIAL FOR MACHINED CLEANUP. AREAS ARE TO BE SHOWN ON DRAWING AS "PHANTOM" LINES. (MAY BE SPECIFIED AS A NOTE ON THE DRAWING)

B. DRAFT ANGLE TO BE USED FOR REMOVING PATTERN FROM THE MOLD. (MAY BE SPECIFIED AS A NOTE ON THE DRAWING)

C. LOCATION OF IDENTIFICATION MARKINGS. VENDOR'S TRADEMARK, PART NUMBERS, ETC..

D. ANY AREA OF NO WELD REPAIR.

E. AREAS WHERE MAGNETIC PARTICLE EXAMINATION TO A HIGHER LEVEL THAN STATED IN THIS SPECIFICATION IS REQUIRED.

2. REQUIREMENTS

CASTINGS PRODUCED UNDER THIS SPECIFICATION ARE REQUIRED TO MEET ALL ASPECTS STATED HERE AND IN ASTM A27.

A. MECHANICAL PROPERTIES

GRADE	TENSILE STRENGTH MIN. ksi	YIELD POINT MIN. ksi	ELONGATION IN IN 2 in., MIN, %	RED. OF AREA MIN, %
U-60-30	60	30	22	30
60-30	60	30	24	35
65-35	65	35	24	35
70-36	70	36	22	30
70-40	70	40	22	30

B. CHEMICAL REQUIREMENTS

	COMPOSITION, %				
GRADE	CARBON, MAX	MANGANESE, MAX	SILICON, MAX	SULFUR, MAX	PHOSPHORUS, MAX
U-60-30	0.25	0.75	0.80	0.06	0.05
60-30	0.30	0.60	0.80	0.06	0.05
65-35	0.30	0.70	0.80	0.06	0.05
70-36	0.35	0.70	0.80	0.06	0.05
70-40	0.25	1.20	0.80	0.06	0.05

C. HEAT TREATMENT – SEE ASTM A27 SECTION 5

GRADES N-2, 60-30, 65-35 & 70-40 SHALL BE HEAT TREATED BY FULLY ANNEALING, NORMALIZING, OR QUENCHING AND TEMPERING.

D. DIMENSIONS AND TOLERANCES

ANGLES ±1°

DIMENSION	TOLERANCE	
	−	+
0 − 12"	−3/32	+1/8
13" − 24"	−1/8	+3/16
25" − UP	−1/8	+1/4

MACHINED DIMENSIONS: THE FOUNDRY IS TO ALLOW ENOUGH MATERIAL FOR FULL CLEAN-UP AS INDICATED ON THE DRAWING.

SEE ESN-0032 FOR ADDITIONAL DIMENSIONAL REQUIREMENTS

E. IDENTIFICATION MARKINGS

EACH CASTING SHALL BE IDENTIFIED BY FOUNDRY SYMBOL, PART NUMBER, & DATE CODE IN LOCATION IDENTIFIED ON ON THE DRAWING.

3. REPAIRS

REPAIRS TO CASTINGS SHALL BE MADE BY METHODS APPROVED BY "KALMAR". REPAIRS TO CASTINGS MAY BE MADE EXCEPT IN AREAS DESIGNATED ON THE DRAWING AS "NO WELD REPAIR".

A. MAJOR REPAIRS OR SURFACES TO BE MACHINED
   (a) PREHEAT OF CASTING TO 400°F MIN. REQUIRED IF CARBON EQUIVALENCY IS 0.38 OR GREATER.
   (b) OXYACETYLENE WELD WITH E7018 ROD OR EQUIVALENT MIG WIRE.
   (c) ANNEAL ENTIRE CASTING AT 1650°F FOR 1 HOUR MINIMUM OR 1 HOUR PER INCH OF SECTION THICKNESS IF PART WAS PREVIOUSLY HEAT TREATED.

B. MINOR REPAIR WHERE SURFACE WILL NOT BE MACHINED
   (a) PREHEAT TO 350°F.
   (b) OXYACETYLENE WELD WITH E7018 ROD OR EQUIVALENT MIG WIRE.
   (c) STRESS RELIEVE FOR 1 HOUR MINIMUM OR 1 HOUR PER INCH OF OF SECTION THICKNESS.

VENDOR MAY SUBMIT ALTERNATE WELD PROCEDURE FOR APPROVAL BY "KALMAR". "KALMAR" IS TO BE NOTIFIED WHEN MAJOR WELD REPAIRS ARE REQUIRED. MAJOR WELD REPAIRS ARE CONSIDERED TO BE 2 SQUARE INCHES OF AREA OR 25% OF THE THICKNESS OR GREATER.

4. QUALITY ASSURANCE PROVISIONS

A. RESPONSIBILITY FOR INSPECTION
VENDOR IS RESPONSIBLE FOR THE PERFORMANCE OF SUCH INSPECTIONS TO INSURE COMPLIANCE WITH THE PURCHASE ORDER REQUIREMENTS AND THIS SPECIFICATION. THE PURCHASER RESERVES THE RIGHT TO PERFORM ANY INSPECTION DEEMED NECESSARY TO VERIFY CONFORMANCE TO THE SPECIFIED REQUIREMENTS, AND TO REQUIRE PROOF OF TESTING TO BE FURNISHED.

B. EXAMINATION

1. VISUAL

ALL CASTINGS OF EACH LOT SHALL BE EXAMINED TO DETERMINE COMPLIANCE WITH REQUIREMENTS, VISUAL DEFECTS, WORKMANSHIP, IDENTIFICATION, ETC..

2. DIMENSIONAL

A REPRESENTATIVE NUMBER OF CASTINGS IN EACH LOT SHALL BE MEASURED TO DETERMINE COMPLIANCE WITH REQUIREMENTS.

C. TEST COUPONS

1. TEST COUPONS SHALL BE POURED WITH EACH HEAT. A MICRO-STRUCTURE SAMPLE SHALL BE POURED WITH THE APPROXIMATE LAST CASTING OF EACH HEAT.

2. TEST COUPONS SHALL RECEIVE THE SAME THERMAL TREATMENT AS THE CASTINGS REPRESENTED.

3. TEST SPECIMENS OBTAINED FROM TEST COUPONS SHALL BE PER ASTM A27.

4. MECHANICAL PROPERTIES FOR TEST SPECIMENS SHALL BE DETERMINED AS DESCRIBED IN ASTM A27 AND MUST MEET MECHANICAL PROPERTIES.

D. CASTING SOUNDNESS

1. UNLESS OTHERWISE SPECIFIED ALL CASTINGS ARE EXPECTED TO MEET ASTM E125 CLASS 3 MAGNETIC PARTICLE INSPECTION. IF A HIGHER GRADE IS REQUIRED EITHER ON ENTIRE CASTING OR ANY PORTION OF CASTING, REQUIREMENT SHALL BE ON DRAWING.

2. MAGNETIC PARTICLE INSPECTION SHALL BE PERFORMED PER ASTM E709.

3. INTERPRETATION SHALL BE PER ASTM E125.

4. UNLESS OTHERWISE STATED ON PURCHASE ORDER (1) CASTING PER HEAT SHALL BE EXAMINED TO DETERMINE COMPLIANCE.

5. SAMPLE CASTINGS

   A. UNLESS OTHERWISE SPECIFIED, SAMPLE CASTINGS ARE EXPECTED TO MEET ALL SPECIFICATIONS AND REQUIREMENTS AS FINAL PART.

   B. THE FOUNDRY PROCEDURE, PROCESSING AND PRACTICE USED ON A SAMPLE CASTING SHALL BE FOLLOWED ON ALL SUBSEQUENT CASTINGS.

   C. FOUNDRY REQUESTED CHANGES MAY REQUIRE ADDITIONAL SAMPLE CASTINGS. PURCHASER TO DETERMINE NEED OF FURTHER SAMPLE CASTINGS.

6. REJECTION

   A. CASTINGS SHALL BE REJECTED FOR FAILURE TO MEET REQUIREMENTS OF THIS SPECIFICATIONS OR DOCUMENTS.

   B. CASTINGS SHALL BE REJECTED FOR FAILURE TO CONFORM SUBSTANTIALLY WITH ACCEPTED SAMPLE CASTING.

7. WORKMANSHIP

   CASTING SHALL REPRESENT GOOD PRACTICE AND BE FREE FROM SHRINKS, BLOW HOLES, UNFUSED CHAPLETS, CRACKS, POROSITY, OR ANY OTHER DEFECT IN WHICH "KALMAR"'S OPINION WOULD ADVERSELY AFFECT THE SERVICE OF THE PART.

8. MACHINE FINISH

   ALL PARTS THAT ARE TO BE MACHINED WILL BE MACHINED COMPLETE AND THEN PAINTED BLACK.

9. PRESERVATION AND SHIPMENT

   A. PRESERVATION AND SHIPMENT SHALL BE PER GOOD COMMERCIAL PRACTICE.

   B. PACKING AND MARKING SHALL BE ADEQUATE TO ENSURE ACCEPTANCE AND SAFE DELIVERY BY THE CARRIER FOR THE MODE OF TRANSPORTATION SELECTED.

   C. PURCHASE ORDER MAY SPECIFY ALTERNATIVE METHODS FOR PRESERVATION AND SHIPMENT.

10. DOCUMENTATION

   A. APPLICABLE DOCUMENTS
      1. ASTM A27
      2. ASTM E709
      3. ASTM E125

   B. REFERENCE DOCUMENTS
      1. ASTM A370
      2. ASTM E8