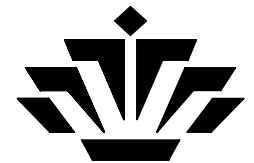


ASSEMBLY

| ITEM | DESCRIPTION | QUANTITY |
|------|-------------------------------|----------|
| 1 | BODY - 3/8 X 2.13 CRS | 1 |
| 2 | CYLINDER - 3/8 X 1.25 CRS | 1 |
| 3 | RETAINER - 3/8 X .13 CRS | 1 |
| 4 | NUT - .190-32 UNF | 1 |
| 5 | STUD - 3/16 DRILL ROD | 1 |
| 6 | PISTON - 3/16 DRILL ROD | 1 |
| 7 | PIN - 3/16 DOWEL | 1 |
| 8 | CRANK - 3/8 X .13 CRS | 1 |
| 9 | BASE - .25 X 1.5 X 1.5 ALUM | 1 |
| 10 | FLYWHEEL - 1.0 X .500 CRS | 1 |
| 11 | SHAFT - 3/16 X 1.0 DOWEL | 1 |
| 12 | SPRING - TO SUIT | 1 |
| 13 | SCREW - .190-32 X .50 FHS | 1 |
| 14 | SET SCREW - .138-32 X .25 LNG | 1 |

| | | |
|----------------------------------|--------|----------------------------|
| TOLERANCES - DEC.INCH / FRACTION | | |
| UNLESS OTHERWISE SPECIFIED | | |
| MACHINING: | | FRACTIONS: ± 1/64 |
| DECIMAL PLACES | TOL'S | CAD |
| ONE X.X | ± .02 | |
| TWO X.XX | ± .01 | |
| THREE X.XXX | ± .005 | |
| ANGLES ± 1/2° | | THIRD ANGLE PROJECTION |
| IF IN DOUBT - ASK | | CONFORMS TO ANSII14.5-1982 |

3/8 SQUARE STEAM ENGINE

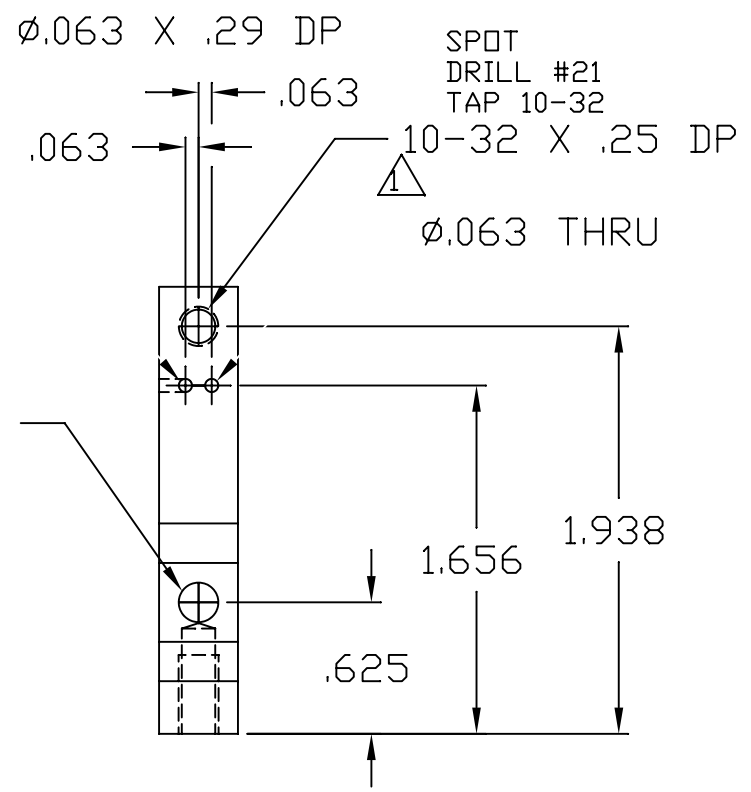
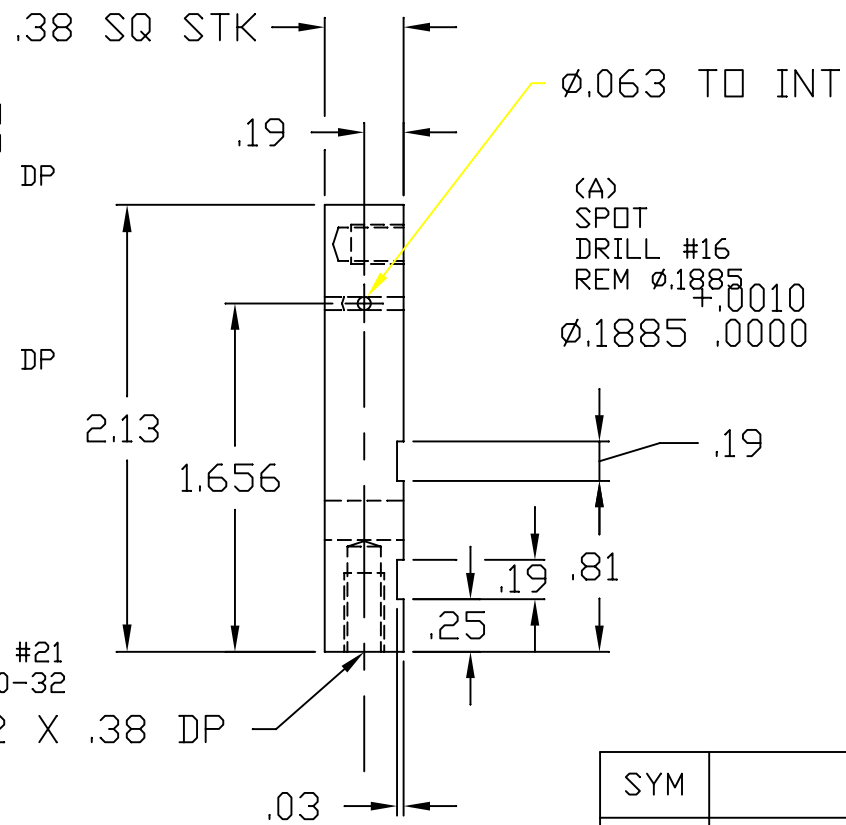


UNCHARLOTTE

| | | | | | |
|-------------------|-----------|---------------------------|---------------|----------|--------------|
| DRAWN 09-05-95 | BY REH | CHECKED 09-05-95 | BY RE HEGE | APPROVED | BY |
| SCALE FULL | | FILE NAME ENGINE_3.DWG | | A | SHEET 1 of 9 |
| | | | | | REV. - |

- 1) MILL TO LENGTH
- 2) (A) ϕ .1885 THRU
- 3) (B) 10-32 X .25 DP
- 4) .063 THRU
- 5) .063 X .29 DP
- 6) SKIM SURFACE
- 7) MILL .19 SLOTS
- 8) ϕ .063 TO INT
- 9) (B) 10-32 X .38 DP

(B)
SPOT
DRILL #21
TAP 10-32
10-32 X .38 DP



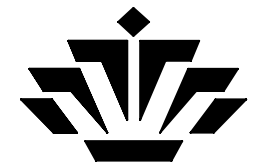
DETAIL 1

MAT: .375 SQ FGS

| SYM | REVISION | DATE | BY |
|-------------|-----------------------|----------|-----|
| \triangle | WAS .190 X 32 | 11-28-00 | REH |
| | ADDED MACHINING NOTES | 11-28-00 | REH |
| | DELETED GD&T | 11-28-00 | REH |

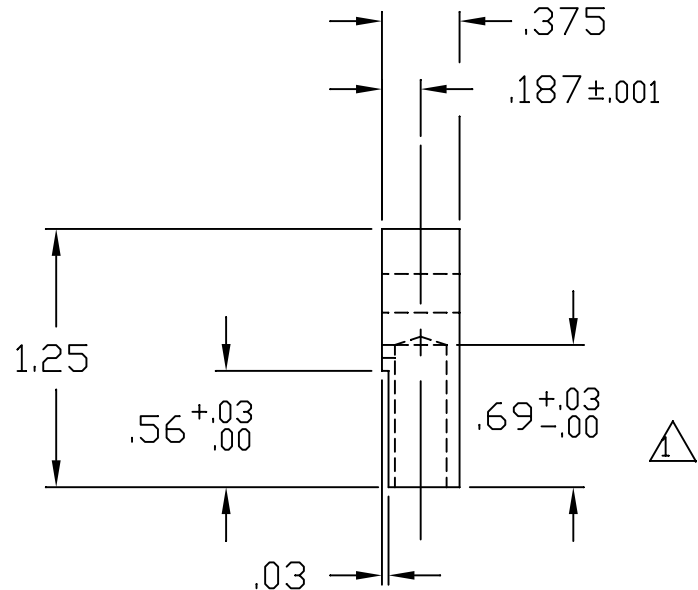
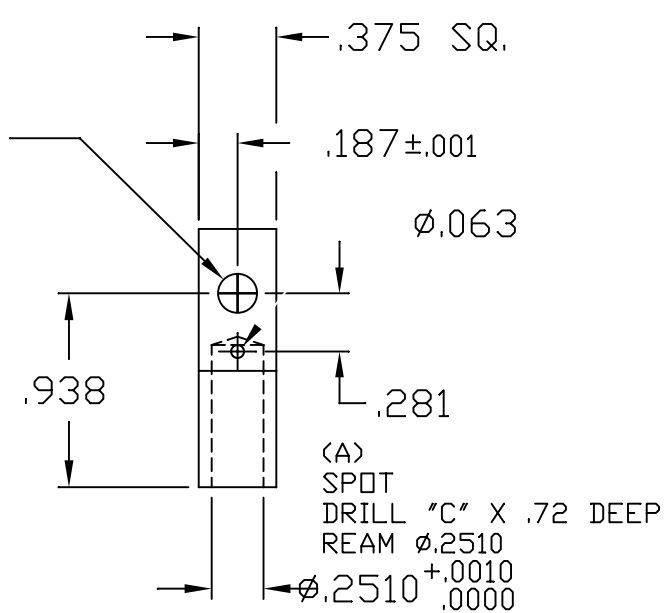
| TOLERANCES - DEC.INCH / FRACTION | | | |
|----------------------------------|-----------------|------------------------|--|
| UNLESS OTHERWISE SPECIFIED | | | |
| MACHINING: | | FRACTIONS: $\pm 1/64$ | |
| DECIMAL PLACES | TOL'S | CAD | |
| ONE X.X | ± 0.02 | | |
| TWO X.XX | ± 0.01 | | |
| THREE X.XXX | ± 0.005 | | |
| ANGLES | $\pm 1/2^\circ$ | THIRD ANGLE PROJECTION | |
| IF IN DOUBT - ASK | | | |
| CONFORMS TO ANSI Y14.5-1982 | | | |

3/8 SQUARE STEAM ENGINE



| | | | | | |
|-------------------|-----------|---------------------------|---------------|--------------|-----------|
| DRAWN 09-05-95 | BY REH | CHECKED 09-05-95 | BY RE HEGE | APPROVED | BY |
| SCALE FULL | | FILE NAME ENGINE_3.DWG | | SHEET 2 of 9 | |
| | | | | | REV. - |

(B)
SPOT
DRILL #16
REAM ϕ .1885
 ϕ .1885^{+0.0010}/_{.0000}



- 1) MILL TO LENGTH
- 2) (A) ϕ .2510
- 3) (B) ϕ .1885
- 4) ϕ .063 THRU ONE WALL
- 5) SKIM SURFACE
- 6) .03 X .56 UNDERCUT

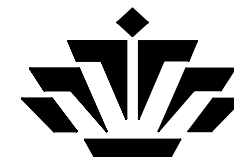
DETAIL 2

MAT: .375 SQ FGS

| SYM | REVISION | DATE | BY |
|-----|-----------------------|----------|-----|
| △ | RELOCATED .69 DIM. | 11-28-00 | REH |
| | ADDED MACHINING NOTES | 11-28-00 | REH |
| | DELETED GD&T | 11-28-00 | REH |

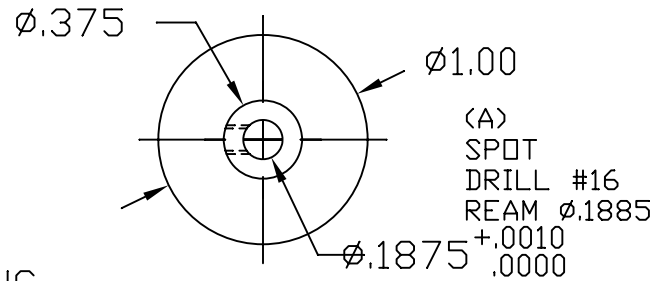
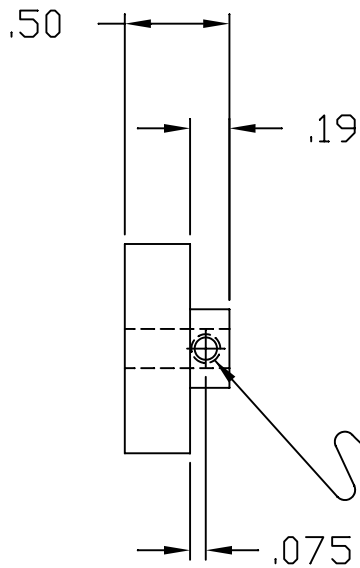
| TOLERANCES - DEC.INCH / FRACTION | | | |
|----------------------------------|---------|---|--|
| UNLESS OTHERWISE SPECIFIED | | | |
| MACHINING: | | FRACTIONS: ± 1/64 | |
| DECIMAL PLACES | TOL'S | CAD | |
| ONE X.X | ± 0.02 | THIRD ANGLE PROJECTION CONFORMS TO ANSI Y14.5-1982 | |
| TWO X.XX | ± 0.01 | | |
| THREE X.XXX | ± 0.005 | | |
| ANGLES | ± 1/2° | | |
| IF IN DOUBT - ASK | | | |


3/8 SQUARE
STEAM ENGINE



UNC CHARLOTTE


| | | | | | |
|-------------------|-----------|---------------------------|---------------|--------------|-----------|
| DRAWN 09-05-95 | BY REH | CHECKED 09-05-95 | BY RE HEGE | APPROVED | BY |
| SCALE FULL | | FILE NAME ENGINE_3.DWG | | SHEET 3 of 9 | |
| | | | | | REV. - |

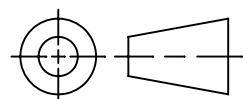


 6-32 UNC
 (B)
 SHORTEN DRILL IN CHUCK
 SPOT
 DRILL #36
 TAP 6-32

DETAIL 10
 MAT: MILD STEEL

- 1) FACE ONE SIDE
- 2) FACE TO LENGTH
- 3) TURN $\phi 0.375 \times .19$
- 4) (A) $\phi 0.1875$ THRU
- 5) MOUNT IN VISE
- 6) FIND CENTER AND EDGE
- 7) (B) 6-32 THRU ONE WALL

| SYM | REVISION | DATE | BY |
|---|-----------------------|----------|-----|
|  | WAS .138 X 32 | 11-28-00 | REH |
| | ADDED MACHINING NOTES | 11-28-00 | REH |

| TOLERANCES - DEC.INCH / FRACTION | | | |
|----------------------------------|-------------|---|--|
| UNLESS OTHERWISE SPECIFIED | | MACHINING: | |
| DECIMAL PLACES | | TOL'S | |
| ONE X.X | ± 0.02 | FRACTIONS: $\pm 1/64$ | |
| TWO X.XX | ± 0.01 | CAD | |
| THREE X.XXX | ± 0.005 |  | |
| ANGLES $\pm 1/2^\circ$ | | THIRD ANGLE PROJECTION | |
| IF IN DOUBT - ASK | | | |
| CONFORMS TO ANSII14.5-1982 | | | |

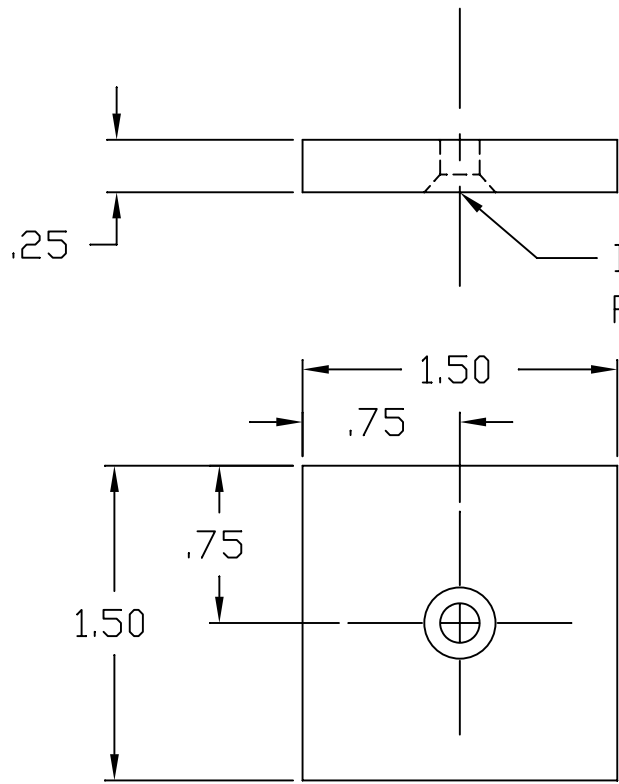
3/8 SQUARE
STEAM ENGINE

| | | | |
|-------------------|-----------|---------------------------|---------------|
| DRAWN 09-05-95 | BY REH | CHECKED 09-05-95 | BY RE HEGE |
| SCALE FULL | | FILE NAME ENGINE_3.DWG | |



UNCHARLOTTE

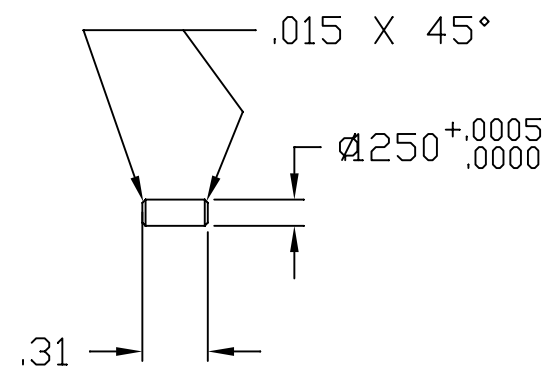
| | |
|----------|----|
| APPROVED | BY |
| | |



DRILL & C'SINK
FOR 10-32 FHS

- 1) MILL SQUARE
- 2) DRILL #7 THRU
- 3) C'SINK TO SUIT

DETAIL 9
MAT: ALUMINUM



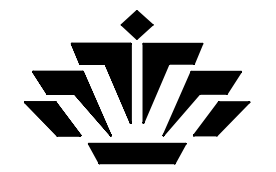
DETAIL 7
MAT: Ø.125 X 5/16 STD DOWEL

| SYM | REVISION | DATE | BY |
|-----|-----------------------|----------|-----|
| | WAS Ø.190-32 | 11-28-00 | REH |
| | WAS Ø.125 DRILL ROD | 11-28-00 | REH |
| | ADDED MACHINING NOTES | 11-28-00 | REH |

| TOLERANCES - DEC.INCH / FRACTION | |
|---------------------------------------|---------|
| UNLESS OTHERWISE SPECIFIED MACHINING: | |
| DECIMAL PLACES | TOL'S |
| ONE X.X | ± 0.02 |
| TWO X.XX | ± 0.01 |
| THREE X.XXX | ± 0.005 |
| ANGLES ± 1/2° | |
| IF IN DOUBT - ASK | |

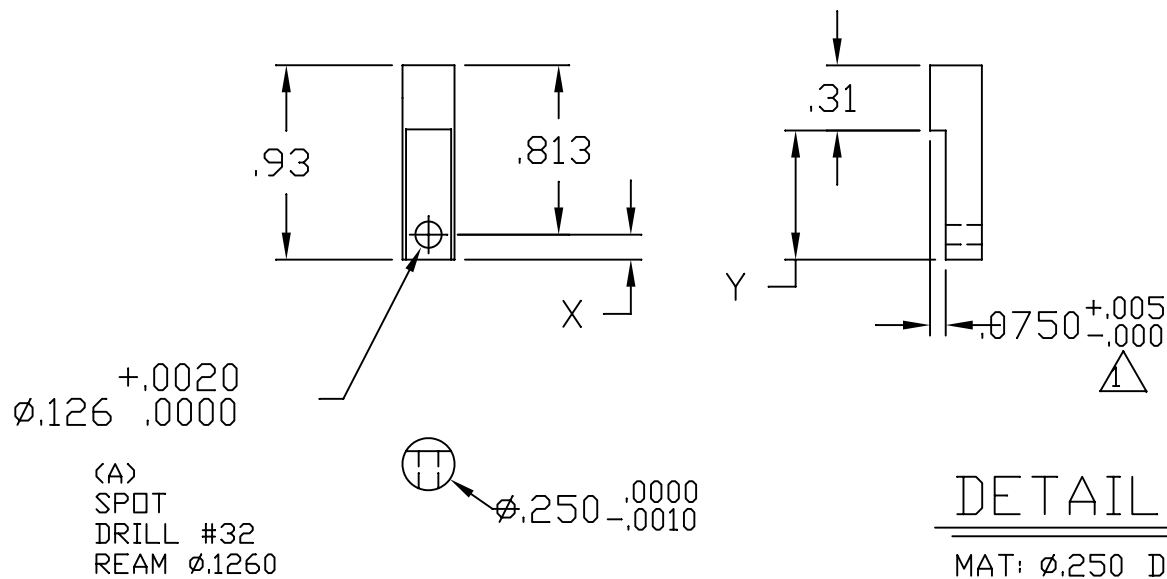
| | |
|----------------------------|--|
| FRACTIONS: ± 1/64 | |
| CAD | |
| | |
| THIRD ANGLE PROJECTION | |
| CONFORMS TO ANSII14.5-1982 | |

3/8 SQUARE
STEAM ENGINE



UNCHARLOTTE

| | | | | | |
|-------------------|---------------------------|---------------------|---------------|-----------|----|
| DRAWN 09-05-95 | BY REH | CHECKED 09-05-95 | BY RE HEGE | APPROVED | BY |
| SCALE FULL | FILE NAME ENGINE_3.DWG | A | SHEET 5 of 9 | REV. - | |



- 1) FACE TO LENGTH
- 2) CALCULATE X&Y TO .XXX
- 3) MOUNT IN 5C COLLET BLOCK
- 4) MILL .075 BY Y LENGTH (.025 DEEP PER PASS) USING $\phi 1/4$ END MILL
- 5) FIND CENTER & MOVE TO X
- 6) (A) $\phi .1260$ THRU

| SYM | REVISION | DATE | BY |
|-------------|--------------------------|----------|-----|
| | ADDED MACHINING NOTES | 11-28-00 | REH |
| \triangle | WAS .065 CHANGED TO .075 | 01-19-99 | REH |

| TOLERANCES - DEC.INCH / FRACTION | | | |
|----------------------------------|-----------------|--|--|
| UNLESS OTHERWISE SPECIFIED | | | |
| MACHINING: | | FRACTIONS: $\pm 1/64$ | |
| DECIMAL PLACES | TOL'S | CAD | |
| ONE X.X | ± 0.02 | THIRD ANGLE PROJECTION CONFORMS TO ANSII Y14.5-1982 | |
| TWO X.XX | ± 0.01 | | |
| THREE X.XXX | ± 0.005 | | |
| ANGLES | $\pm 1/2^\circ$ | | |
| IF IN DOUBT - ASK | | | |

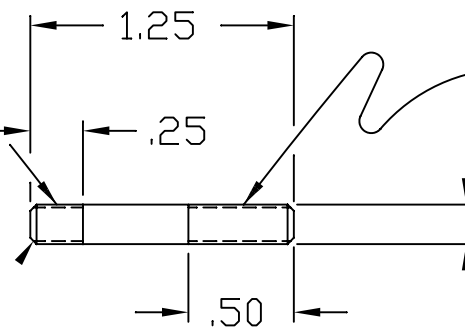
3/8 SQUARE
STEAM ENGINE



UNCHARLOTTE

| | | | | | |
|-------------------|---------------------------|---------------------|---------------|-----------|----|
| DRAWN 09-05-95 | BY REH | CHECKED 09-05-95 | BY RE HEGE | APPROVED | BY |
| SCALE FULL | FILE NAME ENGINE_3.DWG | A | SHEET 6 of 9 | REV. - | |

10-32 UNF
GUIDE DIE WITH TAILSTOCK
THREAD USING 10-32 DIE



10-32 UNF
GUIDE DIE WITH TAILSTOCK
THREAD USING 10-32 DIE

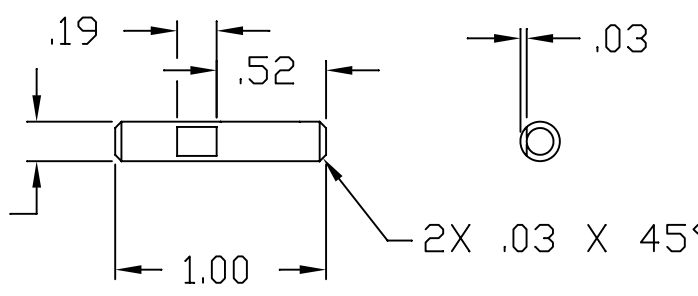
- 1) FACE TO LENGTH
- 2) CHAMFER BOTH SIDES
- 3) THREAD BOTH SIDES

DETAIL 5

MAT: ϕ .1875 DRILL ROD

2X .03 X 45°

ϕ .1875^{+0.0005}/_{.0000}



- 1) FACE TO LENGTH
- 2) CHAMFER BOTH SIDES

DETAIL 11

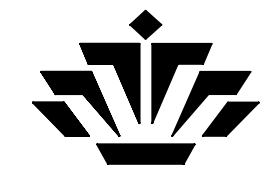
MAT: ϕ .1875 DRILL ROD



| SYM | REVISION | DATE | BY |
|-----|-------------------------------------|----------|-----|
| | WAS .190 X 32 | 11-28-00 | REH |
| | ADDED MACHINING NOTES | 11-28-00 | REH |
| | CHANGED ϕ .250 TO ϕ .1875 | 01-19-99 | REH |

| TOLERANCES - DEC.INCH / FRACTION | | | |
|---------------------------------------|-------------|------------------------------|--|
| UNLESS OTHERWISE SPECIFIED MACHINING: | | | |
| DECIMAL PLACES | TOL'S | FRACTIONS: \pm 1/64 | |
| ONE X.X | \pm 0.02 | CAD | |
| TWO X.XX | \pm 0.01 | THIRD ANGLE PROJECTION | |
| THREE X.XXX | \pm 0.005 | | |
| ANGLES | \pm 1/2° | CONFORMS TO ANSII Y14.5-1982 | |
| IF IN DOUBT - ASK | | | |

3/8 SQUARE
STEAM ENGINE

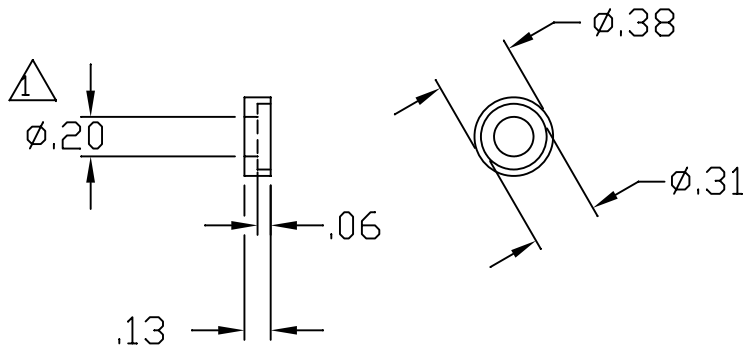
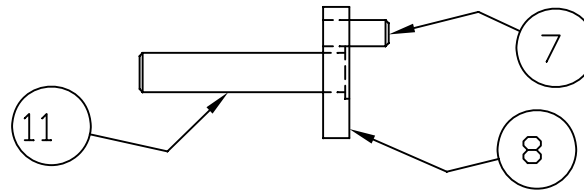


UNCO CHARLOTTE

| | | | | | |
|-------------------|---------------------------|---------------------|---------------|-----------|----|
| DRAWN 09-05-95 | BY REH | CHECKED 09-05-95 | BY RE HEGE | APPROVED | BY |
| SCALE FULL | FILE NAME ENGINE_3.DWG | A | SHEET 7 of 9 | REV. - | |

CRANKSHAFT ASSEMBLY

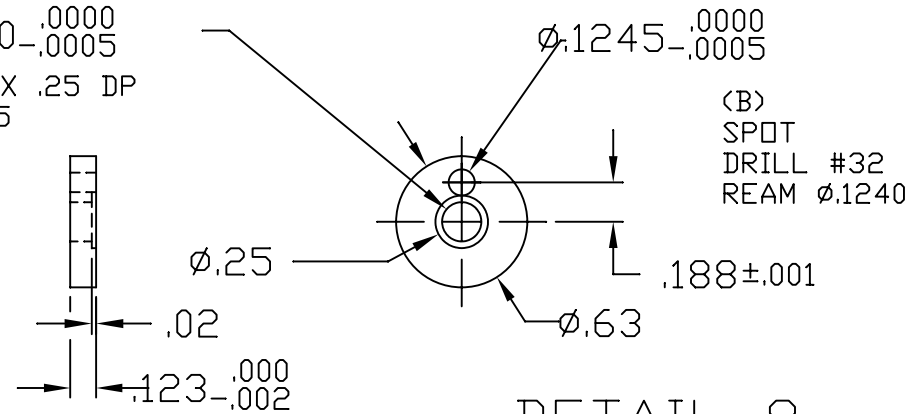
- 1) PRESS DET 11 INTO DET 8 USE LOCTITE
- 2) MOUNT DET 11 IN CHUCK
- 3) FACE BACKSIDE OF DET 8 TO CLEAN UP
- 4) FACE FRONT OF DET 8 TO .123 THICKNESS
- 5) FIND CENTER OF DET 8 IN MILL
- 6) MOVE .188
- 7) (B) ϕ .124 THRU
- 8) PRESS DET 7 INTO DET 8 USE LOCTITE



DETAIL 3
MAT: MILD STEEL

- 1) FACE
- 2) SPOT
- 3) DRILL #7 X .25 DP
- 4) C-BORE WITH ϕ 5/16 END MILL X .06 DP
- 5) START PARTING
- 6) DEBURR ALL OVER
- 7) FINISH PARTING

(A) ϕ .1870^{+.0000}_{-.0005}
SPOT
DRILL #16 X .25 DP
REAM ϕ .1855



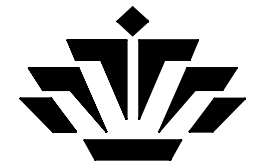
DETAIL 8
MAT: MILD STEEL

- 1) FACE
- 2) (A) ϕ .1870
- 3) PART .15 WIDE

| SYM | REVISION | DATE | BY |
|-------------|-------------------------------------|----------|-----|
| | ADDED MACHINING NOTES | 11-28-00 | REH |
| | DELETED GD&T | 11-28-00 | REH |
| \triangle | ENLARGED DIA OF HOLE WAS ϕ .19 | 01-19-99 | REH |

| TOLERANCES - DEC.INCH / FRACTION | | | |
|----------------------------------|-------------|-----------------------------|--|
| UNLESS OTHERWISE SPECIFIED | | | |
| MACHINING: | | FRACTIONS: \pm 1/64 | |
| DECIMAL PLACES | TOL'S | CAD | |
| ONE X.X | \pm 0.02 | | |
| TWO X.XX | \pm 0.01 | | |
| THREE X.XXX | \pm 0.005 | | |
| ANGLES | \pm 1/2° | THIRD ANGLE PROJECTION | |
| IF IN DOUBT - ASK | | CONFORMS TO ANSIIY14.5-1982 | |

3/8 SQUARE
STEAM ENGINE




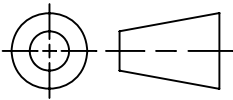
UNC CHARLOTTE

| | | | | | |
|-------------------|---------------------------|---------------------|---------------|-----------|----|
| DRAWN 09-05-95 | BY REH | CHECKED 09-05-95 | BY RE HEGE | APPROVED | BY |
| SCALE FULL | FILE NAME ENGINE_3.DWG | A | SHEET 8 of 9 | REV. - | |

ACAD-R14

| ITEM | DESCRIPTION | QUAN | ROUGH CUT LENGTH |
|------|-------------------------------|------|---------------------|
| 1 | BODY - □.38 X 2.13 CRS | 1 | 3/8 X 3/8 X 2 1/4 |
| 2 | CYLINDER - □.38 X 1.25 CRS | 1 | 3/8 X 3/8 X 1 3/8 |
| 3 | RETAINER - ∅.38 X .13 CRS | 1 | CUT OFF IN LATHE |
| 4 | NUT - .190-32 UNF | 1 | STOCK |
| 5 | STUD - ∅.1875 DRILL ROD | 1 | ∅3/16 X 1 3/8 |
| 6 | PISTON - ∅.2500 DRILL ROD | 1 | ∅ 1/4 X 1 1/16 |
| 7 | PIN - ∅.125 DOWEL | 1 | STOCK |
| 8 | CRANK - ∅.63 X .13 CRS | 1 | CUT OFF IN LATHE |
| 9 | BASE - .25 X 1.5 X 1.5 ALUM | 1 | 1/4 X 1 5/8 X 1 5/8 |
| 10 | FLYWHEEL - ∅1.0 X .500 CRS | 1 | ∅ 1 X 5/8 |
| 11 | SHAFT - ∅.1875 X 1.0 DOWEL | 1 | ∅3/16 X 1 1/8 |
| 12 | SPRING - TO SUIT | 1 | STOCK |
| 13 | SCREW - .190-32 X .50 FHS | 1 | STOCK |
| 14 | SET SCREW - .138-32 X .25 LNG | 1 | STOCK |

CUT LIST

| | | | | | | | | | | | | | | | | | | | | | |
|--|---------|--|--|------------------------------|--|---------|--|---|--|-----------|--|-------------------|--|---------|--|--------------|--|-----------|--|----|--|
| TOLERANCES - DEC.INCH / FRACTION | | | | 3/8 SQUARE STEAM ENGINE | | | |  UNCHARLOTTE | | | | | | | | | | | | | |
| UNLESS OTHERWISE SPECIFIED MACHINING: | | | | | | | | | | | | FRACTIONS: ± 1/64 | | | | | | | | | |
| DECIMAL PLACES | TOL'S | | | CAD | | | |  THIRD ANGLE PROJECTION | | DRAWN | | BY | | CHECKED | | BY | | APPROVED | | BY | |
| ONE X.X | ± 0.02 | | | 09-08-99 | | RE HEGE | | | | 09-08-99 | | RE HEGE | | | | | | | | | |
| TWO X.XX | ± 0.01 | | | | | | | | | | | | | | | | | | | | |
| THREE X.XXX | ± 0.005 | | | | | | | | | | | | | | | | | | | | |
| ANGLES | ± 1/2° | | | | | | | | | | | | | | | | | | | | |
| IF IN DOUBT - ASK | | | | CONFORMS TO ANSII Y14.5-1982 | | | | SCALE | | FILE NAME | | ENGINE_3.DWG | | A | | SHEET 9 of 9 | | REV. - | | | |