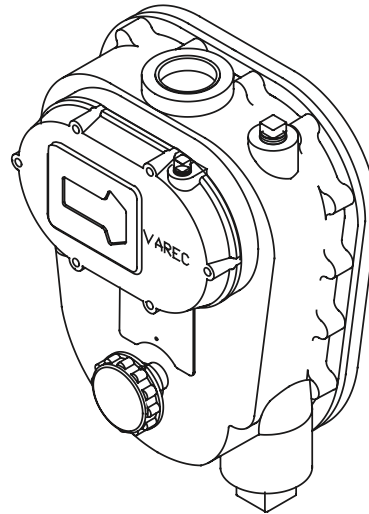


2500 Automatic Tank Gauge

Mechanically operated, float and tape gauges for continuous liquid level measurement in bulk storage tanks

Varec[®]

Service Manual



www.varec.com

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Preface

This manual is intended for users of the Varec 2500 Automatic Tank Gauge (ATG).

Chapter 1 – Maintenance Routines

This chapter describes suggested maintenance routines for the 2500 ATG.

Chapter 2 – Maintenance Kits and Spare parts

This chapter describes the specific maintenance kits or spare parts available for the 2500 ATG.

Chapter 3 – Disassembly and Assembly Instructions

This chapter describes the procedures involved in disassembling and reassembling the 2500 ATG.

Chapter 4– Troubleshooting

This chapter describes essential information concerning common problems with the 2500 ATG

Safety Precaution Definitions

The following types of warnings have been categorized by Varec for this product. Read and understand this Manual before installing, operating or performing maintenance on a Model 2500 Automatic Tank Gauge. Follow all precautions and warnings noted herein when installing, operating or performing maintenance on this equipment.

Note! Follow these specific instructions to optimize the procedure or process

Caution! Damage to equipment may result if this precaution is disregarded.

Warning! Direct injury to personnel or damage to equipment which can cause injury to personnel may result if this precaution is not followed.

Safety Precautions

Caution! Read and understand static and lightning electrical protection and grounding described in API 2003. Make certain that the tank installation, operation and maintenance conforms with the practice set forth therein.

Warning! Make certain that the tank is empty and not in service. Ensure that the tank has been leak and pressure tested as appropriate for the liquid to be stored. Observe appropriate safety precautions in flammable or hazardous liquid storage areas. Do not enter a tank that has contained hydrocarbons, vapors, or toxic materials, until a gas-free environment is certified. Carry breathing equipment when entering a tank where oxygen may be displaced by carbon dioxide, nitrogen or other gases. Wear safety glasses as appropriate. Use a hard hat.

Warning! The mechanical connections between the guide cables, the float, the tape and the gaugehead provide a resistance to ground that is adequate for the safe electrical drain of electrostatic charges that may accumulate in the tank and the product. Worker activity and worker clothing may accumulate electrostatic charges on the body of a worker. Care should be used in flammable environments to avoid the hazard.

Whenever the back cover of the gaugehead is removed, stand to one side as the last bolt is removed. If the negator motor spring is broken, the broken pieces may cause injury when the cover is removed.

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1 Maintenance Routines

A regular schedule of maintenance is recommended for the 2500 ATG. The frequency of such inspections depends on the specific environmental conditions and operation. Due to the various conditions, even from tank to tank on the same site, installations should be studied and a routine of inspection and maintenance should be planned that is best suited to individual needs. Regular maintenance will lengthen the service life and assure more accurate reading of the gauge. In the table below (1.1) we have provided a guide for a routine maintenance procedure. Varec can provide spare parts, maintenance kits and preventive maintenance advice, training, or warranties. Please consult your product Operations and Maintenance Manual or a representative for further details.

Hazardous environments

Warning! Observe appropriate safety precautions in flammable or hazardous liquid storage areas. Do not enter a tank that has contained hydrocarbons, vapors, or toxic materials, until a gas-free environment is certified. Carry breathing equipment when entering a tank where oxygen may be depleted with carbon dioxide, nitrogen or other gases.

Electrostatic Discharge Hazard

Warning! The mechanical connections between the guide cables, the float, the tape and the gaugehead provide a resistance to ground that is adequate for the safe electrical drain of electrostatic charges that may accumulate in the tank and the product. Worker activity and worker clothing may accumulate electrostatic charges on the body of a worker. Care should be used in flammable environments to avoid the hazard. Observe American Petroleum Institute (API) Recommended Practice 2003 or other appropriate industry or Military Standard.

1.1 Suggested Periodic Maintenance Routine

Routine	Inspection every 90 Days	Inspection every 6 Months	Inspection and maintenance every 1 Year	Inspection and maintenance every 5 Years	Overhaul in conjunction with API 653 every 10 Years
Operation check	x	x	x		
Leak check	x	x	x		
Sediment check	x	x	x		
Deformation check	x	x	x		
Calibration		x	x		
Float and guide cables		x	x		
Lubricate			x		
Oil filled gauge check			x		
Corrosion check			x		
Basic Maintenance			As required - depending on service conditions		
Extended Maintenance			As required - depending on service conditions		
Refurbish			x	As required - depending on service conditions	Recommended

1.1.1 General Inspection

It is recommended that the first inspection after the unit has been placed in service be made at the end of the first thirty-day period. Subsequent inspections should be made every 90 days. The user may adjust the schedule for his own convenience and safety, depending upon the product. Varec maintenance service contracts are available – please consult a sales or service representative for further details.

1.1.2 Operation check

Check the operation of the gauge using the check knob on the front of the gauge. The dial should show the movement of the float when the check knob is rotated.

Caution! Do not release the checker knob and allow the springs to return the mechanism. Over time the springs will break and jam the gauge.

Caution! Do not turn the operation checker knob on systems that have no float and that are directly connected to a floating roof.

1.1.3 Leak check

Check the gaugehead and conduit for signs the product in the tank is not leaking. If the gaugehead is oil filled check for signs the gaugehead is not leaking oil.

1.1.4 Sediment check

Remove the NPT fitting on the bottom of the gaugehead and check for sediment.

1.1.5 Deformation check

Check the pipework conduit for deformations that might inhibit the movement of the tape.

1.1.6 Calibration check

Check the accuracy of the gauge against a hand dip measurement in the tank and calibrate the gauge if necessary. Refer to the 2500 ATG Installation and Operations Manual for complete calibration instructions.

1.1.7 Float and guide cables check

Using a manway or inspection cover check the guidecables and float. The guidecables should be tight and free of kinks to allow the float to run freely. Check for sediment on the cables and float that might inhibit movement.

1.1.8 Lubrication

Caution! Do Not use any type of grease, WD-40 or Lithium based lubricant.

Warning! Before lubrication ensure the chemical compatibility of the lubricant with the product in the tank.

Lubricate the moving parts of the gaugehead at regular intervals with a Silicone or Teflon aerosol lubricant such as Penske Car Care Silicone Spray (available at most auto parts stores) or ZEP 45NC www.zep.com.

Other lubricants recommended for general service

Low pour point, food grade, water white, mineral oil

- Brand Names: ARCO Prime Grade 70
- Lyondell DuoPrime 70, Product Code 16402

Other lubricants for service below 25°F (–4°C)

Automotive antifreeze and water, 50/50 mix

(Propylene Glycol-based antifreeze such as “Sierra” should be considered for environmentally sensitive areas.)

Caution! These oils may not be compatible with edible oils and edible liquids. Use product compatible substitutes for tanks holding products for human or animal consumption or products that may react chemically with the oil.

1.1.9 Oil-filled Gauges

Caution! Gauges measuring caustic liquids require that the gaugehead be oil filled.

Check the oil is not leaking and change the oil at regular intervals. Dispose of the old oil according to local environmental regulations.

Oil filling the gaugehead is highly recommended to protect the internal parts from possible corrosion attack by product vapors. Oil filling also provides lubrication for the moving parts and could extend service intervals and overall gaugehead life.

Fill the gaugehead through the top 1/2–NPT plug. Approximately 4.75 quarts (4.5 liters) of oil are required. To fill the counter assembly with oil, it is necessary to change the bottom NPT condensate drain plug. Replace it with a solid 1/4–NPT plug or reverse the top solid plug with the bottom plug. Fill the hole in the condensate drain plug with RTV 737 sealant. The counter assembly will hold approximately 1.06 quarts (1.0 liter).

The appropriate oil selected from above (section 1.1.8 Lubrication) may also be used in conduit Oil Seal Units.

1.1.10 Corrosion check

Check for signs of corrosion. Interior corrosion of the pipe carrying the tape may become deposited in the mechanism and affect the accuracy.

1.1.11 Basic maintenance

Basic maintenance should be conducted as required depending on the service conditions. The basic maintenance kit provides all the recommended parts that may need replacing during such a procedure. Follow the dis/assembly instructions in the following chapter when replacing any parts on the gaugehead.

1.1.12 Extended maintenance

Extended maintenance should be conducted as required depending on the service conditions. The extended maintenance kit provides all the recommended parts that may need replacing during such a procedure. Follow the dis/assembly instructions in the following chapter when replacing any parts on the gaugehead.

1.1.13 Overhaul maintenance

A complete gauge installation overhaul should be conducted as part of an API 653 tank overhaul. The overhaul maintenance kit provides all the recommended parts that may need replacing during such a procedure. Follow the dis/assembly instructions in the following chapter when replacing any parts on the gaugehead.

2 Spare Parts and Maintenance Kits

Varec can supply individual spare parts for the 2500 Gaugehead, maintenance kits and installation accessories. The following kits are specifically designed to assist with a regular schedule of maintenance and improve the quality and performance of your 2500 ATG.

This chapter details the contents of each kit and provides an illustration to assist in locating the part within the assembly. Please refer to chapter 3 – Disassembly and Assembly Instructions before you carry out any maintenance on the gaugehead.

Part #	Description
13-08766	2500 Basic Maintenance Kit – Imperial
13-08767	2500 Basic Maintenance Kit – Metric
13-08768	2500 Extended Maintenance Kit – Imperial
13-08769	2500 Extended Maintenance Kit – Metric
13-08770	2500 Overhaul/Refurbishing Kit – Imperial
13-08771	2500 Overhaul/Refurbishing Kit – Metric
13-10652	Negator Cassette Kit
13-0974-00	Shoulder Bushing Retrofit Kit

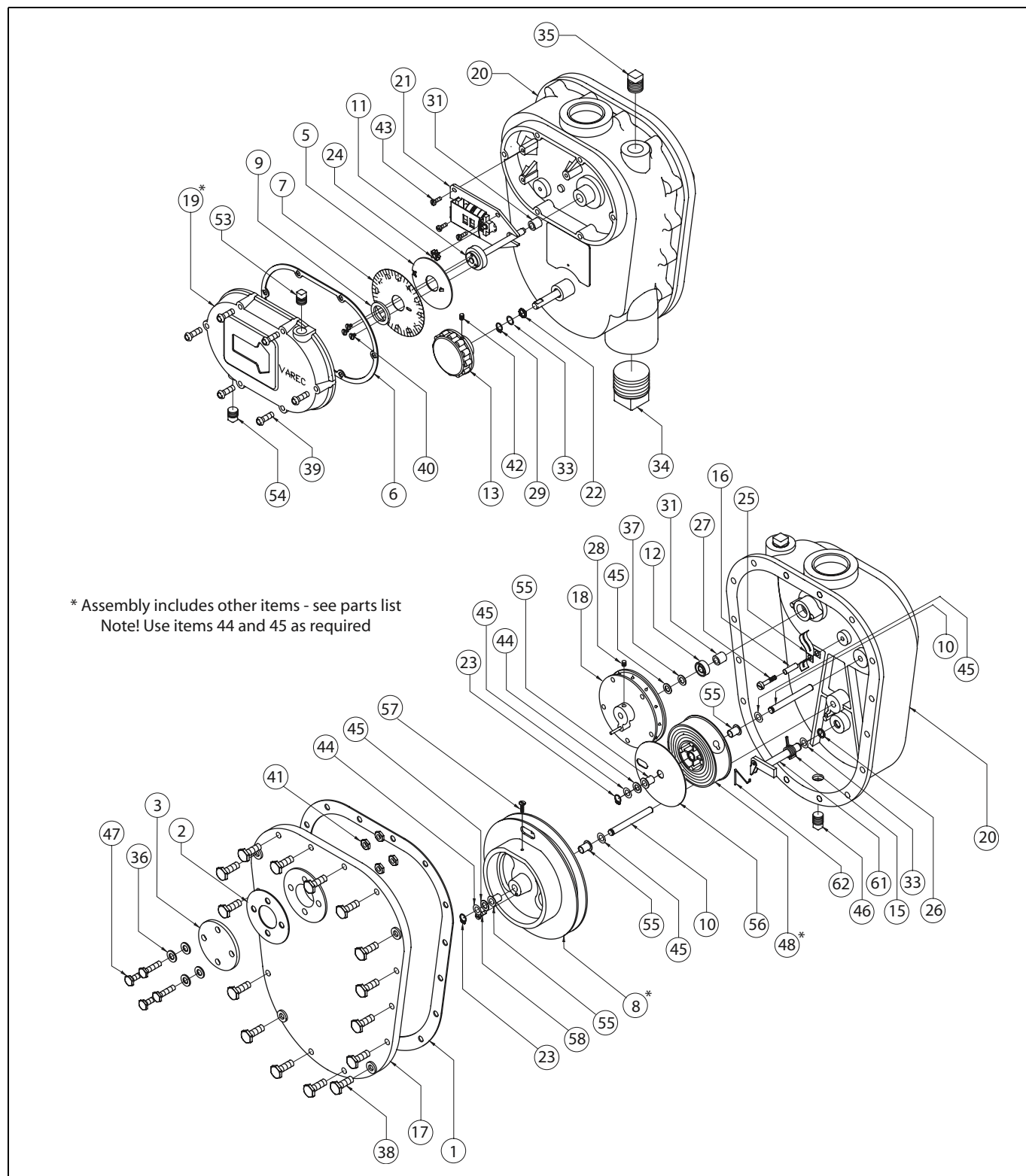
2.1 2500 ATG Gaugehead Spare Parts

Item	Part	Description
1	B4396-071	Back Cover Gasket (Cast gaugehead)
1	02-04490-071	Back Cover Gasket
2	B5059-071	Back Cover Cap Gasket
3	B5060-001	Back Cover Cap
4	B7415-093	Washer
5	B8235-005	Imperial Dial Gear
5m	B8327-005	Metric Dial Gear
6	B7720-071	Counter Cover Gasket
7	B8218-001	Imperial Dial (Fractional or Decimal) – Innage
7m	B8325-001	Metric Dial – Innage
8	BA7761	Tape Storage Sheave Assembly (Includes items: 55x2, 57 & 58)
9	B8234-001	Dial Retainer
10	B7693-005	Shaft
11	BA17597	Counter Shaft Assembly

Item	Part	Description
12	B10221-093	Seal
13	P34-4	Knob
14	BA14055	Gauge Check Assembly (includes items 61 & 62)
15	B7796-005	Spring
16	B6547-005	Tape Keeper Post
17	02-04488	Back Cover
18	06-08558	Imperial Sprocket Sheave Assembly
18m	06-08559	Metric Sprocket Sheave Assembly
19	DA4044	Counter Cover Assembly (includes items 53 & 54)
20	02-08815	Gaugehead Body
21	BM18849-100	Imperial Counter Assembly
21m	BM18850-100	Metric Counter Assembly
22	P14-146	O Ring
23	P10-2	Retaining Ring
24	P25-16	Pinion Gear
25	B7300-005	Tape Keeper Spring
26	P14-23	O Ring Seal
27	P31-669	Binding Head Mach. Screw
28	P031-04-1697	Set Screw
29	P10-29	Grip Ring
31	P13-20	Bushing
33	02-08543	Washer
34	P030-04-822	1-1/2 NPT Plug
35	P30-237	1/2 NPT Plug
36	P031-32-1661	Washer
37	B4847-005	Washer
38	P031-05-1721	Hex Head Cap Screw
39	P031-07-1679	Rd. Head Mach. Screw
40	P031-01-1719	Binding Head Mach. Screw
41	P31-247	Hex Jam Nut

Item	Part	Description
42	P31-612	Hex Socket Set Screw , Cup Pt.
43	P031-08-1720	Self Tap Screw
44	P31-1	Washer
45	P31-13	Shim Washer
46	P030-04-802	3/8 NPT Plug
47	P031-05-1601	Hex Head Cap Screw 68
48	P1-5	Negator Motor Only
	BA7762	Negator Motor Sheave Assembly (includes items 55x2 & 56)
49	P031-11-1807	HSCS (not shown)
51	06-10364	Tape Storage Sheave Assembly – Cassette (not shown)
52	06-10490	Handle (Crank) (not shown)
53	P30-236	Top Counter 1/4 NPT Plug
54	B12759-003	Bottom Counter 1/4 NPT Drain Plug
55	02-09598	Bushing shoulder (PTFE)
56	B14872-101	Motor Top Plate
57	P31-671	Screw
58	P31-692	Screw
59	BM3784	Original handle (Crank) Not Shown
61	06-05-152-005	Gauge Check
62	B7795-005	Gauge Check Spring
65	P109-18-010	Thread Protector (not shown)
66	16-08843	Label (not shown)

Fig. 2-1 2500 ATG Gaugehead spare parts



2.2 Basic Maintenance Kit

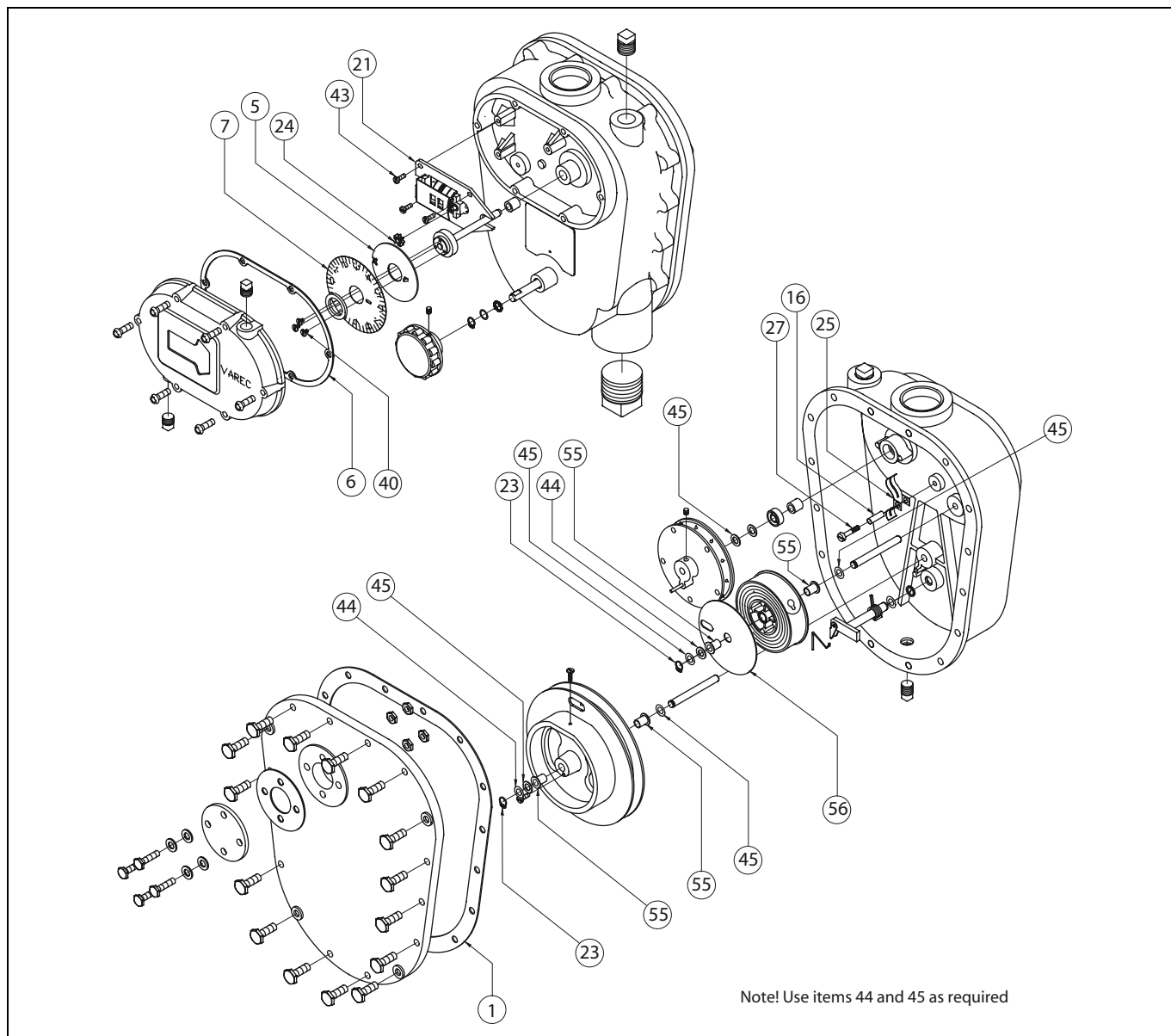
2.2.1 List of parts

Part No.	Description
13-08766	1 – Basic Maintenance Kit – Imperial
13-08767	2 – Basic Maintenance Kit – Metric

This kit provides all the necessary parts required for basic maintenance on the 2500 Automatic Tank Gaugehead. Depending on your selection above, you will receive the following metric or imperial parts required.

Item	Part No.	Description	Quantity in kit
1	B4396-071	Back Cover Gasket	1
	02-04490-071	Back Cover Gasket	1
5	B8235-005	Imperial Dial Gear	1 (Imperial kit only)
5m	B8327-005	Metric Dial Gear	1 (Metric kit only)
6	B7720-071	Counter Cover Gasket	1
7	B8218-001	Imperial Dial (Fractional or Decimal)	1 (Imperial kit only)
7m	B8325-001	Metric Dial	1 (Metric kit only)
16	B6547-005	Tape Keeper Post	1
21	BM18849-100	Imperial Counter Assembly	1 (Imperial kit only)
21m	BM18850-100	Metric Counter Assembly	1 (Metric kit only)
23	P10-2	Retaining Ring	6
24	P25-16	Pinion Gear	1
25	B7300-005	Tape Keeper Spring	1
27	P31-669	Binding Head Mechanical Screw	1
40	P031-01-1719	Binding Head Mechanical Screw	3
43	P031-08-1720	Self Tap Screw	3
44	P31-1	Washer	6
45	P31-13	Shim Washer	16
55	02-09598	Shoulder Bushing	4
56	B14872-101	Motor Top Plate	1
na	Ba012g03ae	Service Manual	1

Fig. 2-2 2500 ATG Basic Maintenance Kit



2.3 Extended Maintenance Kit

2.3.1 List of parts

Part No.	Description
13-08768	1 – Extended Maintenance Kit – Imperial
13-08769	2 – Extended Maintenance Kit – Metric

This kit provides all the parts required for extended maintenance on the 2500 Automatic Tank Gaugehead. Depending on your selection above, you will receive the following metric or imperial parts required.

Item	Part No.	Description	Quantity in kit
1	B4396-071	Back Cover Gasket	1
	02-04490-071	Back Cover Gasket	1
4	B7415-093	Washer	1
5	B8235-005	Imperial Dial Gear	1 (Imperial kit only)
5m	B8327-005	Metric Dial Gear	1 (Metric kit only)
6	B7720-071	Counter Cover Gasket	1
7	B8218-001	Imperial Dial (Fractional or Decimal)	1 (Imperial kit only)
7m	B8325-001	Metric Dial	1 (Metric kit only)
9	B8234-001	Dial Retainer	1
12	B10221-093	Seal	1
14	BA14055	Gauge Check Assembly	1
15	B7796-005	Spring	1
16	B6547-005	Tape Keeper Post	1
21	BM18849-100	Imperial Counter Assembly	1 (Imperial kit only)
21m	BM18850-100	Metric Counter Assembly	1 (Metric kit only)
22	P14-146	O Ring	1
23	P10-2	RETAINING RING, 5/16 SS	1
24	P25-16	Pinion Gear	1
25	B7300-005	Tape Keeper Spring	1
26	P14-23	O Ring Seal	1
27	P31-669	Binding Head Mach. Screw	1
29	P10-29	Grip Ring	1

Item	Part No.	Description	Quantity in kit
31	P13-20	Bushing	1
33	02-08543	Washer	2
37	B4847-005	Washer	1
39	P031-07-1679	Rd. Head Mach. Screw	6
40	P031-01-1719	Binding Head Mach. Screw	3
42	P31-612	Hex Socket Set Screw , Cup Pt.	1
43	P031-08-1720	Self Tap Screw	3
44	P31-1	Washer	1
45	P31-13	Shim Washer	18
48	BA7762	Negator Motor Assembly (includes items 55x2 & 56)	1
55	02-09598	Shoulder Bushing	2
57	P31-671	Screw	1
58	P31-692	Screw	1
59	BM3784	Original handle (Crank) Not Shown	1
AA	BM5478-600	Tape Clamp Assembly	1
BB	A371-071	Cover Gasket (sheave Elbow)	2
CC	02-08563	Cover Gasket (sheave Elbow)	2
na	Ba012g03ae	Service Manual	1

2.3.2 Additional items

Varec also recommends the replacement of the tape (or tape and cable combination) when performing extended maintenance, based on your specific installtion (tank) type.

Item	Part No.	Description
EE	B7650-606	Tape – Imperial (Length 136'), (316 SS) for a tank 60 ft high
	B7650-306	Tape – Imperial (Length 80'), (316 SS) for a tank 32 ft high
	B9736-606	Tape – Metric (Length 41.25 m), (316 SS) for a tank 18.29 m high
	B9736-306	Tape – Metric (Length 24.38 m), (316 SS) for a tank 9.75 m high

Item	Part No.	Description
FF	B7678-606	Tape and Cable (Ø 3/32") Combination – Imperial (Length 133') for a tank 60 ft high
	B7678-306	Tape and Cable (Ø 3/32") Combination – Imperial (Length 73') for a tank 30 ft high
	B13982-606	Tape and Cable (Ø 3/32") Combination – Metric (length 44.5 m) for a tank 18 m high
	B7678-106	Tape and Cable (Ø 3/32") Combination – Imperial (Length 73') for a tank 30 ft high
	B13982	Tape and Cable (Ø 3/32") Combination – Metric (Length 22.2 m) for a tank 9 m high

Fig. 2-3 2500 ATG Extended Maintenance Kit

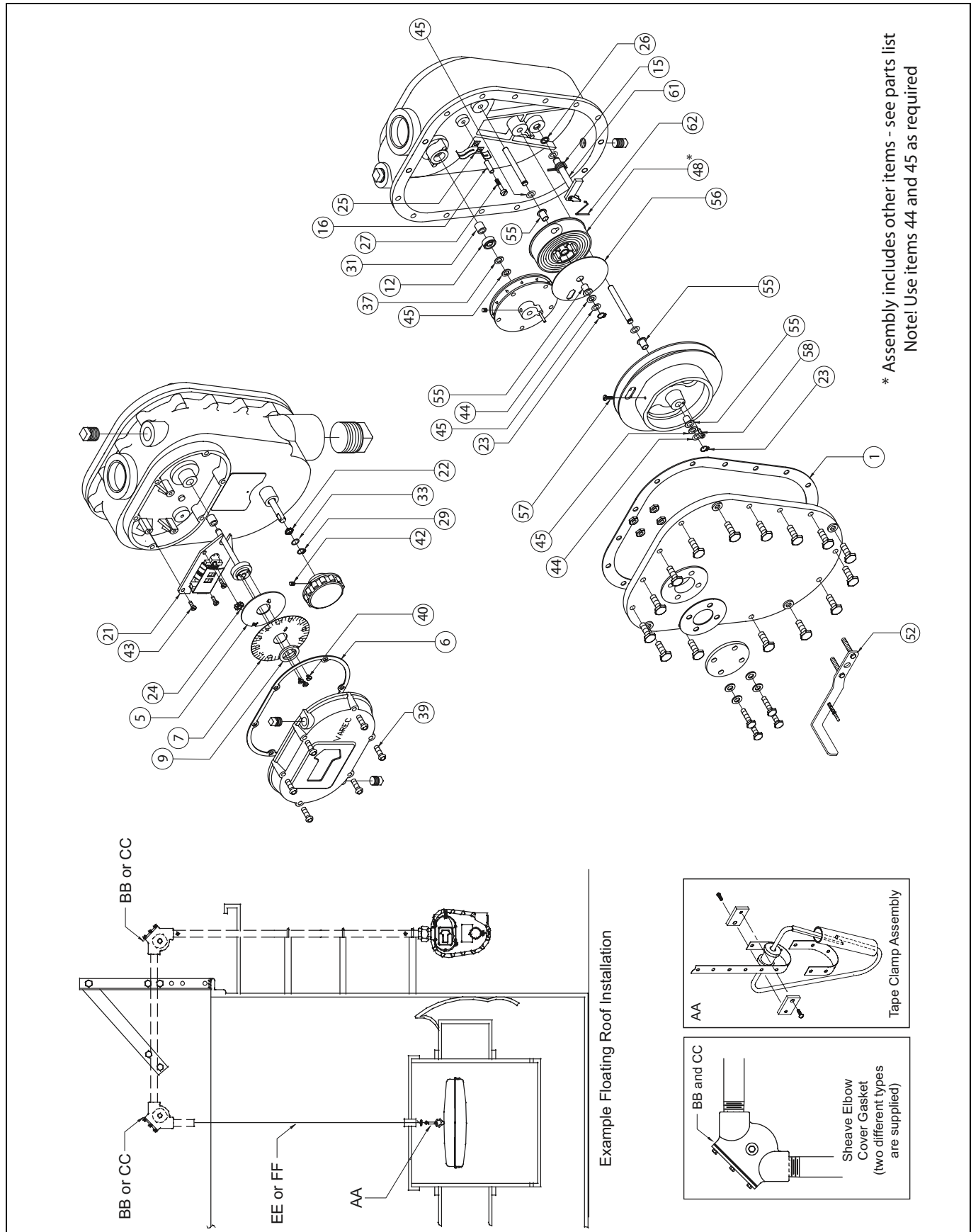
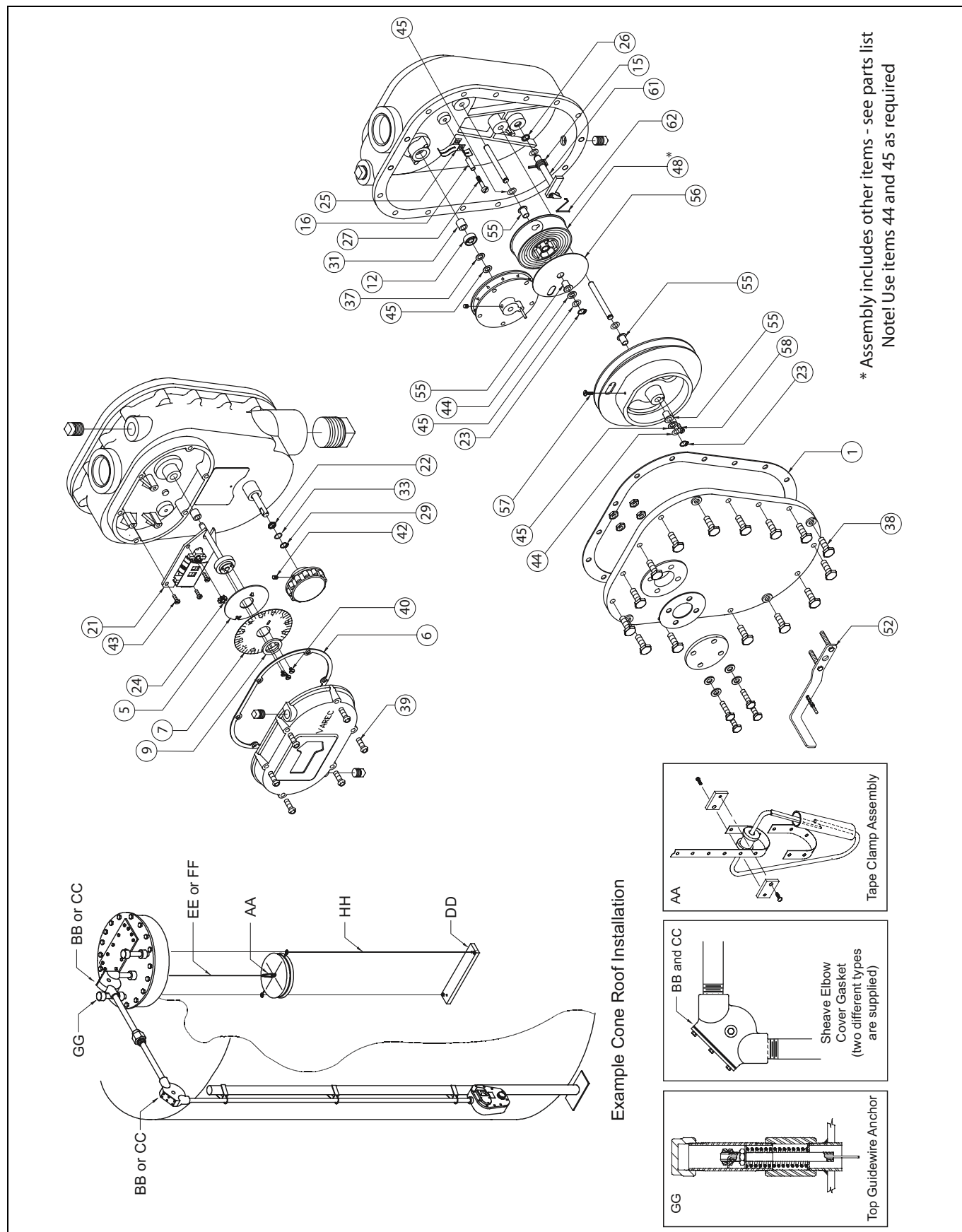


Fig. 2-4 2500 ATG Overhaul /Refurbishment Kit



2.4 2500 Overhaul/Refurbishing Kit

2.4.1 List of parts

Part No.	Description
13-08770	Overhaul/Referbishing Maintenance Kit – Imperial
13-08771	Overhaul/Referbishing Kit – Metric

This kit provides all the parts required for overhaul maintenance on the 2500 Automatic Tank installation. Depending on your selection above, you will receive the following metric or imperial parts required.

Item	Part No.	Description	Quantity in kit
1	B4396-071	Back Cover Gasket	1
	02-04490-071	Back Cover Gasket	1
5	B8235-005	Imperial Dial Gear	1 (Imperial kit only)
5m	B8327-005	Metric Dial Gear	1 (Metric kit only)
6	B7720-071	Counter Cover Gasket	1
7	B8218-001	Imperial Dial (Fractional or Decimal)	1 (Imperial kit only)
7m	B8325-001	Metric Dial	1 (Metric kit only)
9	B8234-001	Dial Retainer	1
12	B10221-093	Seal	1
14	BA14055	Gauge Check Assembly	1
15	B7796-005	Spring	1
16	B6547-005	Tape Keeper Post	1
21	BM18849-100	Imperial Counter Assembly	1 (Imperial kit only)
21m	BM18850-100	Metric Counter Assembly	1 (Metric kit only)
22	P14-146	O Ring	1
23	P10-2	Retaining Ring	4
24	P25-16	Pinion Gear	2
25	B7300-005	Tape Keeper Spring	1
26	P14-23	O Ring Seal	1
27	P31-669	Binding Head Mach. Screw	3
29	P10-29	Grip ring	1

Item	Part No.	Description	Quantity in kit
31	P13-20	Bushing	1
33	02-08543	Washer	2
37	B4847-005	Washer	1
38	P031-05-1721	Hex Head Cap Screw	16
39	P031-07-1679	Rd. Head Mach. Screw	6
40	P031-01-1719	Binding Head Mach. Screw	3
42	P31-612	Hex socket set screw, Cup Pt.	1
43	P031-08-1720	Self Tap Screw	3
44	P31-1	Washer	6
45	P31-13	Shim Washer	14
48	BA7762	Negator Motor Assembly (includes items 55x2 & 56)	1
55	02-09598	Shoulder Bushing	2
56	B14872-101	Motor Top Plate	1
57	P31-671	Screw	1
58	P31-692	Screw	1
59	BM3784	Original handle (Crank) Not Shown	1
AA	BM5478-600	Tape Clamp Assembly	1
BB	A371-071	Sheave Elbow Cover Gasket	2
CC	02-08563	Sheave Elbow Cover Gasket	2
DD	AA1025	Anchor Bottom for 2500 ATG and 6700 Liquid level Indicator, (Steel)	1
na	Ba012g03ae	Service Manual	1

2.4.2 Additional items

Varec also recommends the replacement of the tape (or tape and cable combination), anchors and guidewires for a complete overhaul, based on your specific installation (tank) type.

Item	Part No.	Description
EE	B7650-606	Tape – Imperial (Length 136'), (316 SS) for a tank 60 ft high
	B7650-306	Tape – Imperial (Length 80'), (316 SS) for a tank 32 ft high
	B9736-606	Tape – Metric (Length 41.25 m), (316 SS) for a tank 18.29 m high
	B9736-306	Tape – Metric (Length 24.38 m), (316 SS) for a tank 9.75 m high

Item	Part No.	Description
FF	B7678-606	Tape and Cable (Ø 3/32") Combination – Imperial (Length 133') for a tank 60 ft high
	B7678-306	Tape and Cable (Ø 3/32") Combination – Imperial (Length 73') for a tank 30 ft high
	B13982-606	Tape and Cable (Ø 3/32") Combination – Metric (length 44.5 m) for a tank 18 m high
	B7678-106	Tape and Cable (Ø 3/32") Combination – Imperial (Length 73') for a tank 30 ft high
	B13982-606	Tape and Cable (Ø 3/32") Combination – Metric (Length 22.2 m) for a tank 9 m high
GG	BM5200	Top Anchor – welded, (Steel)
	BM5088	Top Anchor – welded, (316 SS)
	BM3646	Top Anchor, (150# Steel)
	BM3647	Top Anchor, (300# Steel)
HH	B10543-306	Guide Wire Tank Height 32 ft.
	B10543-606	Guide Wire Tank Height 60 ft.

2.5 Shoulder Bushing Retrofit Kit

2.5.1 List of parts

Part No.	Description
13-09794-00	Shoulder Bushing Retrofit Kit

This kit provides all the necessary parts required for replacing the shoulder bushings on the 2500 Automatic Tank Gaugehead.

Item	Part#	Description	QTY
23	P10-2	Retaining Ring	4
44	P31-1	Washer	2
45	P31-13	Shim Washer	6
55	02-09598	Shoulder Bushing	2
56	B14872-101	Motor Top Plate	1
na	Ba012g03ae	Service Manual	1

2.6 Negator Cassette and Negator Cassette Kit

2.6.1 List of parts

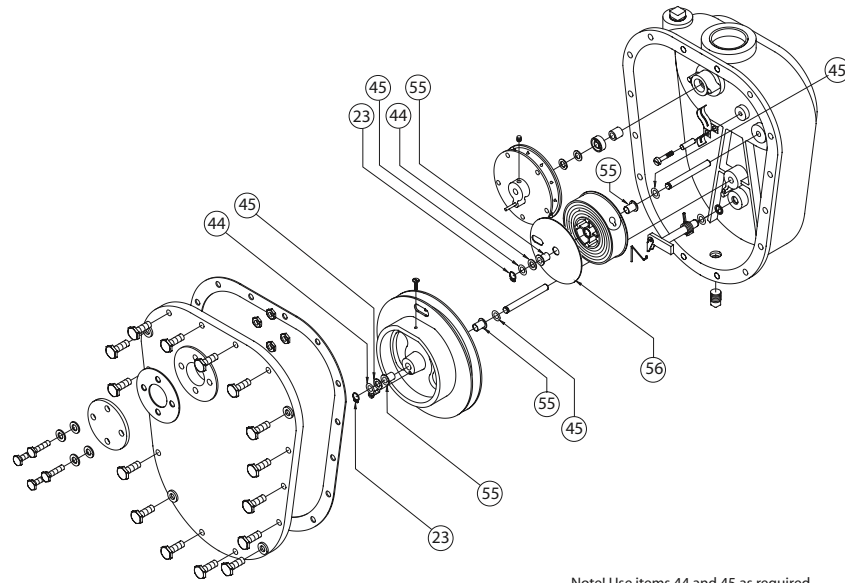
Item	Part No.	Description
50	06-10368	Negaotr Cassette only
68	13-10652	Negator Cassette kit

This kit (item 68) provides all the parts required for converting a 2500 Automatic Tank Gaugehead fitted with a negator motor to a gaugehead with a negator cassette.

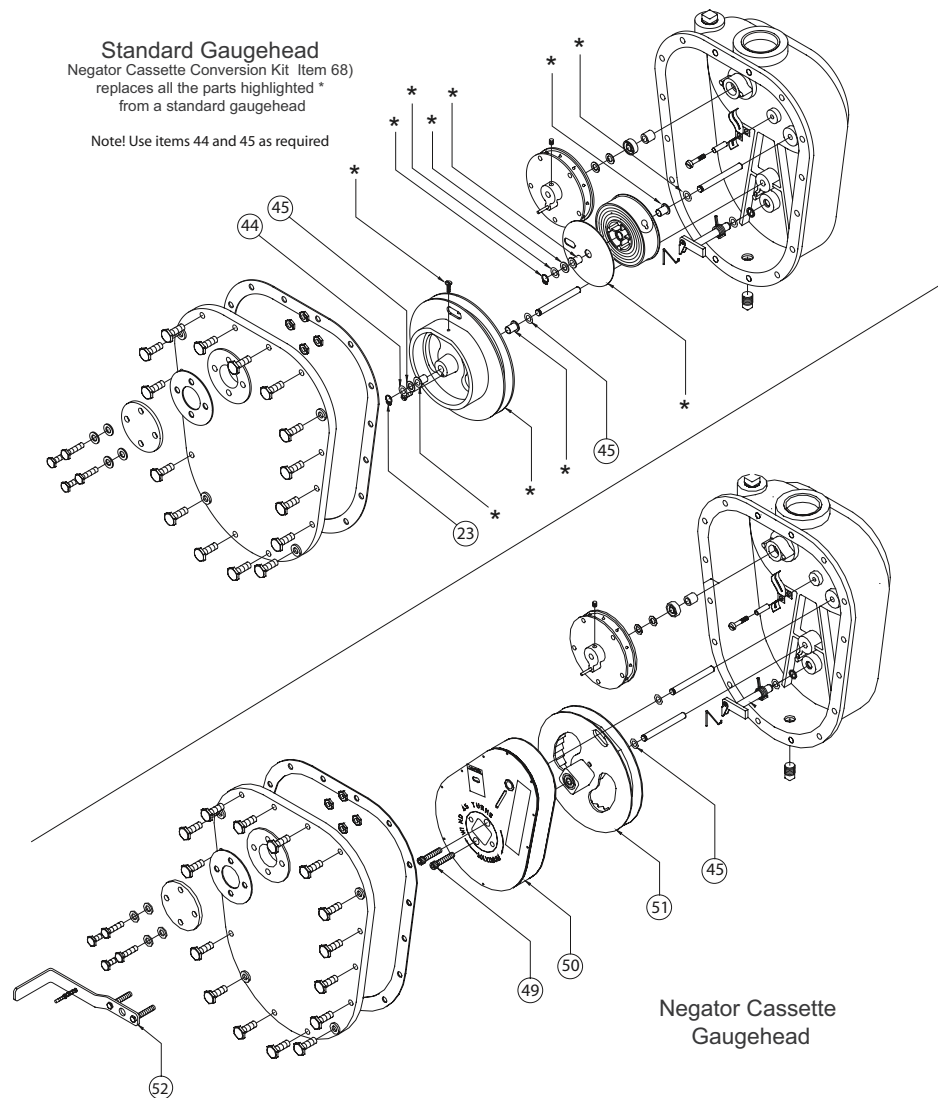
Item	Part#	Item	QTY
4	B7415-093	Teflon Washer (Not shown – used on older gaugeheads)	2
23	P10-2	Retaining Ring, 5/16 SS	1
44	P31-1	Washer 9/16X21/64X1/16 SS.	1
45	P31-13	Shim washer 562X.316/.313X.005SS	6
49	P031-11-1807	HSCS 1/4-20X1-1/4	2
50	06-10368	Negator Cassette	1
51	06-10364	Tape Storage Sheave Assembly – Cassette	1

Item	Part#	Item	QTY
52	06-10490	Handle (Crank)	1
na	Ba012g03ae	Service Manual	1

Fig. 2-5 (Top) 2500 ATG Shoulder Bushing Kit Fig. 2-6 (Bottom) 2500 ATG Negator Cassette Kit



Note! Use items 44 and 45 as required



3 Instructions

Use of the maintenance kits require that the user understand the disassembly of the gaugehead in order to replace parts. The exploded view, Figure 2-1, is the key to understanding the disassembly procedure. References in the following procedures are directed to this figure, unless otherwise indicated. Refer to Model 2500 Instruction Manual for variations of the standard gaugehead configurations, namely 2500 with Crank and 2500 with cassette Models.

3.1 Gaugehead Disassembly

Perform the following steps to disassemble the gaugehead:

Note! Disassemble the gaugehead only as far as needed to replace worn or defective parts.

Warning! Make certain that the tank is empty and not in service. Observe appropriate safety precautions in flammable or hazardous liquid storage areas. Do not enter or access a tank that has contained hydrocarbons, vapors or toxic materials until a gas-free environment is certified. Carry breathing equipment when entering or accessing a tank where oxygen may be depleted with carbon dioxide, nitrogen or other gases.

Warning! The mechanical connections between the guide cables, the float, the tape and the gaugehead provide an electrical resistance path to ground that is adequate for the safe electrical drain of electrostatic charges that may accumulate in the tank and product. Worker activity and worker clothing may accumulate electrostatic charges on the body of a worker. Care should be used in flammable environments to avoid the hazard.

1. Drain the oil from gaugehead if oil-filled.

Warning! Whenever the back cover of the gaugehead is removed, stand to one side as the last bolt is removed. If the motor spring is broken, the broken pieces may cause injury when the cover is removed.

2. Remove the sixteen back cover bolts (38), back cover and back cover gasket (1).
3. If accessory equipment is attached to the back of the gaugehead, disconnect and remove.
4. Attach the installation crank (Figure 3-1 item #7).
5. Open an inspection hatch or manhole for access to the float.

Warning! Use a firm grasp on the crank. Tighten thumbscrew to lock tape storage sheave before releasing grip. The rapid unwinding of the motor spring could result in the crank spinning and striking the operator.

Caution! Do not allow the float to fall back to the floor of the tank. Damage may result.

6. Slowly crank the float to the top of the tank.
7. Tighten the thumbscrew to lock the tape storage sheave. (Figure 3-1 item #3).
8. Secure float to top of tank with secondary wire.

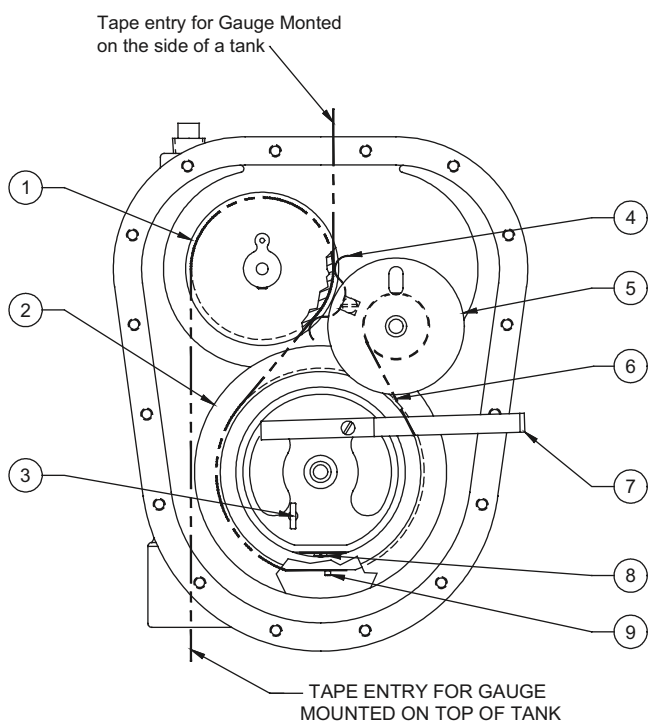
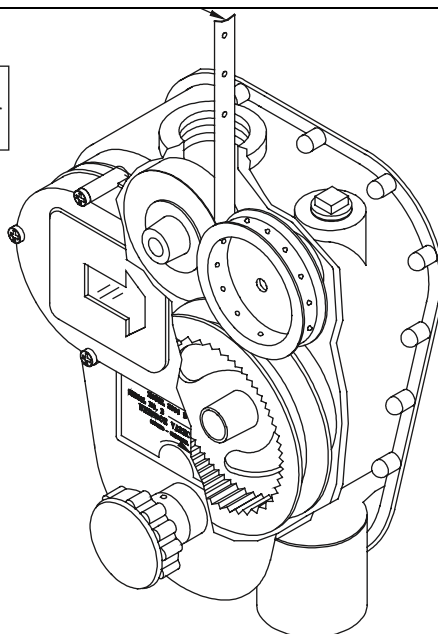
Caution! Do not allow the float to drop to the floor of the tank. Damage will result.

9. Disconnect the perforated tape from the float connector.
10. Loosen the thumbscrew and slowly retract the tape into the gaugehead.

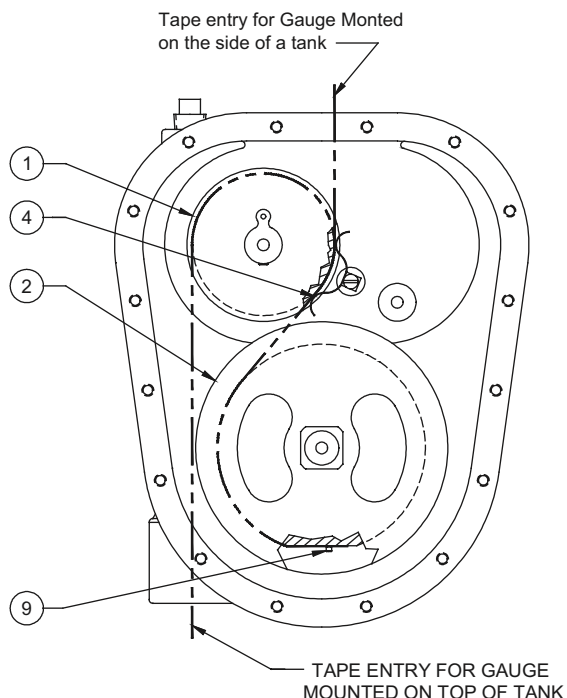
Fig. 3-1 Tape routing and component location

CAUTION:
Do not release crank handle when negator spring motor is being loaded and thumbscrew lock is removed.

ITEM	DESCRIPTION
1	SPROCKET SHEAVE
2	TAPE STORAGE SHEAVE
3	THUMBSCREW LOCK
4	TAPE KEEPER
5	MOTOR STORAGE SHEAVE
6	NEGATOR SPRING MOTOR
7	REMOVABLE INSTALLATION CRANK
8	NEGATOR SPRING MOTOR SCREW
9	TAPE SHEAVE PIN OR SCREW



STANDARD MODEL 2500
(WITH NEGATOR SPRING MOTOR)



MODEL 2500 WITH CARTRIDGE
(CARTRIDGE REMOVED FOR TAPE INSTALLATION)

11. Unwind the motor spring (Figure 3-1 item #6) onto the motor storage sheave (Figure 3-1 item #5).
12. Loosen the motor spring screw (Figure 3-1 item #8) and detach motor spring.
13. Remove retaining ring (23), washer (44) and shim washers (45) from motor shaft.
14. Remove motor storage sheave assembly (48) as a unit.
15. Remove retaining ring (23), washer (44) and shim washers (45) from tape storage sheave shaft.
16. Remove tape storage sheave assembly as a unit.

Note! The sheave shafts are pressed into place and retained with a permanent type Loctite compound. DO NOT REMOVE!.

17. Loosen sprocket sheave set screw (28) and remove sprocket sheave assembly (18), Teflon washer if used (4), shim washers (45) and washer (37).
18. Remove tape keeper assembly which includes the screw (27), post (16) and spring (25).
19. Remove six counter cover screws (39), counter cover assembly (19) and counter cover gasket (6).
20. Remove three dial retainer screws (40), dial retainer (9) and dial (7).
21. Remove the dial gear (5).
22. Remove the pinion gear (24).
23. Remove three counter assembly mounting screws (43) and counter assembly (21).
24. Remove counter shaft assembly (11) and any shim washers if needed (45).
25. Loosen check knob set screw (42) . Remove check knob (13), grip ring (29) and shim washer (33).
26. Remove gauge check assembly (14), shim washer (33), and gauge check spring (15).
27. Remove Viton "O" ring (22) on outside of gauge check boss.

Note! The check knob shaft Teflon "O" ring (26) on the inside of the gaugehead is pressed into place with a special setting tool.. If replacement is required, insure that a proper setting tool is available for reinstallation. Do not reuse old "O" ring.

28. Remove Teflon "O" ring (26) only if gaugehead showed signs of leakage.

Note! The counter shaft seal (12) is pressed into place. If replacement is required, insure that proper pressing tools are used for reinstallation. Do not reuse old seal.

29. Remove countershaft seal (12) only if gaugehead showed signs of leakage.

Note! The counter shaft brass bushings are pressed into the bore with special press fixtures. DO NOT REMOVE BUSHINGS.

30. Clean the disassembled gaugehead and any parts that will be reused with a common automotive type spray or dip degreaser. Clean and wipe dry in accordance with the directions of the product used.

3.2 Gaugehead Assembly

Perform the following steps to reassemble the gaugehead:

Note! Generally, assembly will be performed in the reverse order of disassembly.

1. If counter shaft seal (12) is being replaced, use a clean, small paint brush and apply white silicone grease (Dow Corning #4 or equal) to body seal recess. Carefully press seal into place with cavity facing outwards.

2. If check knob Teflon "O" ring (26) is being replaced, lubricate "O" ring with white silicone grease (Dow Corning #4 or equal) and carefully install it into the inside body recess with an appropriate setting tool.
3. Lubricate Viton "O" ring (22) with white silicone grease (Dow Corning #4 or equal) and carefully insert it into the outside body groove.
4. Assemble gauge check hair spring (15) and shim washer (33) on the gauge check assembly (14). Lubricate the shaft (60) with white silicone grease (Dow Corning #4 or equal) and insert it into the body.
5. Install shim washer (33) and grip ring (29) to the external shaft projection of the gauge check assembly (14).
6. Place knob (13) with set screw (42) on the external shaft projection of the gauge check assembly (14). Tighten set screw making sure it contacts the flat on the shaft. Ensure that the gauge check assembly turns smoothly by turning the knob in ¼ turn intervals.
7. Place any previous shim washers (45) on counter shaft assembly (11) and brush the shaft with white silicone grease (Dow Corning 4 or equal). Install counter shaft assembly into the body.
8. Place counter assembly (21) on supports and install three mounting screws (43), but do not tighten.
9. Align counter assembly wheels to zero. Install pinion gear (24) on counter base shaft with the 8-tooth side of the gear nearest the counter base. Mesh the short tooth of the pinion gear into the counter wheel gear.
10. Place dial gear (5), with registering tab upward, on the counter shaft assembly (11).
11. Adjust the dial gear (5) and the counter assembly (21) for a clearance of approximately 0.010" between the pinion gear (24) and the dial gear (5). If the dial gear is below the top of the pinion gear add shim washers (45) under the counter shaft assembly (11) as required. If the dial gear is higher than the pinion gear, remove shim washers from under the counter shaft assembly. If no shim washers are present, lightly tap the counter shaft assembly with a rubber mallet so that the dial gear and the pinion gear are level within 0.010".
12. Adjust the counter assembly (21) to mesh with the pinion gear (24) and the dial gear (5). Rotate the dial gear to check that all gears mesh smoothly and that the counter wheels operate correctly. Tighten the three screws (43) mounting the counter assembly.
13. Slip the dial plate (7) under the red pointer of the counter assembly and onto the hub. Rotate the dial plate until the tab from the dial gear (5) registers with the slot in the dial plate.
14. Install dial retainer (9) on dial (7) and secure it with three screws (40).
15. Place washer (37) and Teflon washer if needed (4) on the counter shaft assembly (11).
16. Place the sprocket sheave assembly on the counter shaft assembly (11).
17. Place the tape storage sheave assembly on the lower shaft.
18. Place the motor storage sheave assembly (48) on the upper right shaft.
19. Align the motor storage (48) and the tape storage sheave assemblies. Ensure that the bottom of the motor storage sheave flange is 0.040 to 0.060" clear of the top surface of the tape storage sheave. Adjust height by using shim washers (45) as required.
20. Align the groove centerline of the sprocket and the tape storage sheave assemblies. Ensure that the top surface of the sprocket sheave flange is 0.030 to 0.040" below the top surface of the tape storage sheave flange. Adjust height by using shim washers (45) as required.
21. When properly aligned, tighten the set screw (28) in the sprocket sheave assembly (18). Test that the counter assembly (21) functions properly with no axial play in the counter shaft and sheave assemblies.
22. Remove the motor storage sheave assembly (48) from the gaugehead.
23. Assemble tape keeper assembly (16) containing item 27, 16, 28. Apply Loctite #262 or equal to screw threads and thread assembly into the gaugehead body.

24.Adjust the tape keeper spring for a clearance of 0.020 to 0.030" against the sprocket sheave assembly.

25.Place the motor storage sheave assembly (48) back into the gaugehead.

26.Secure the tape storage sheave assembly with retaining ring (23). Use washer (44) and shim washers (45) as required. Test that the sheave turns freely with less than 0.004" axial play for Standard Model 2500 and no axial play for 2500 Models with Crank and with cassette.

27.Secure the motor storage sheave assembly (48) with retaining ring (23). Use washer (44) and shim washers (45) as required. Test that sheave turns freely with 0.005 to 0.010" axial play.

28.Attach the spring motor to the tape storage sheave assembly and tighten screw (Fig. 3-1 item#7). Ensure that the spring motor is not twisted out of alignment during screw tightening.

29.Open elbow sheave assemblies and inspect operation and condition. Replace cover gasket, defective sheaves and worn shafts as required. Lubricate the shaft and sheave with a light oil.

Note! To install the gauge tape, load the spring motor, zeroing the display and dial calibration, follow the procedures in the Model 2500 User Instruction Manual, document number 33-08746.

30.Install counter cover assembly (19) and gasket (6) with six screws (39).

31.Mount and connect any auxiliary equipment to gaugehead back cover.

Note! Torque back cover bolts to 6 ft-lb. Do not over torque!

32.Assemble back cover and back cover gasket (1) to gaugehead with sixteen back cover bolts (38).

33.Refill gaugehead with oil if required.

34.Close the tank inspection hatches and manholes.

3.3 Negator Cassette Installation Instructions

Varec's negator cassette is a fully enclosed design to safely contain a damaged or failed negator motor. It will extend negator motor life by keeping pipe scale and debris off the negator motor. The cassette provides quick and easy change out of any future negator motor failures.

Caution! Damage to equipment may result if this precaution is disregarded.

Warning! Direct injury to personnel or damage to equipment which can cause injury to personnel may result if this precaution is not followed.

3.3.1 DISASSEMBLY

Perform the following steps to prepare the gaugehead for installation of the negator motor cassette.

1. Note and record gauge level reading.
2. Vent all pressure from gaugehead.
3. Drain the oil if the gauge is oil-filled.

Warning! Whenever the back cover of the gaugehead is removed, stand away as the last bolt is removed. If the negator motor is broken, the broken pieces may cause injury. Wear gloves and safety glasses.

4. Remove 16 back cover bolts (38) and back cover (17) with any auxiliary equipment attached.
5. Attach the original installation crank (59) provided with the gauge to the tape storage sheave.

Warning! Use a firm grasp on the crank. Tighten thumbscrew before releasing grip. The rapid action of the spring could result in the crank spinning and striking the operator and damaging equipment.

6. Position an assistant at the outboard sheave elbow to pull up the tape as it is being unwound from the storage sheave.
7. Remove the outboard sheave elbow cover.
8. Turn the installation crank clockwise to unwind the tape from the storage sheave. While unwinding the tape in the gaugehead, withdraw the tape at the outboard sheave elbow. Be careful to insure that the tape does not kink and remains clean.
9. When all tape is removed from the storage sheave, turn the installation crank slowly counter clockwise to wind the negator motor onto the motor sheave.
10. Detach the negator motor (48) from the storage sheave by loosening the securing screw (57).
11. Remove the negator motor (48), bushings, washers and shims.
12. Remove the storage sheave assembly (8), bushings, washers and shims.

3.3.2 ASSEMBLY

1. Install a Teflon washer if needed (4), a shim washer (45) and the new storage sheave (51) over the lower gauge-head shaft (10).
2. The alignment of the sprocket sheave to the tape storage sheave is very important for proper operation of the gauge. Adjust the number of shims to bring the sheaves into the specified alignment as shown on Figure 3.-2
3. Complete the installation of the storage sheave by installing shims (45), a Teflon washer if needed (4), and flat washer (44). Test that the sheave turns freely with no lateral or axial play.

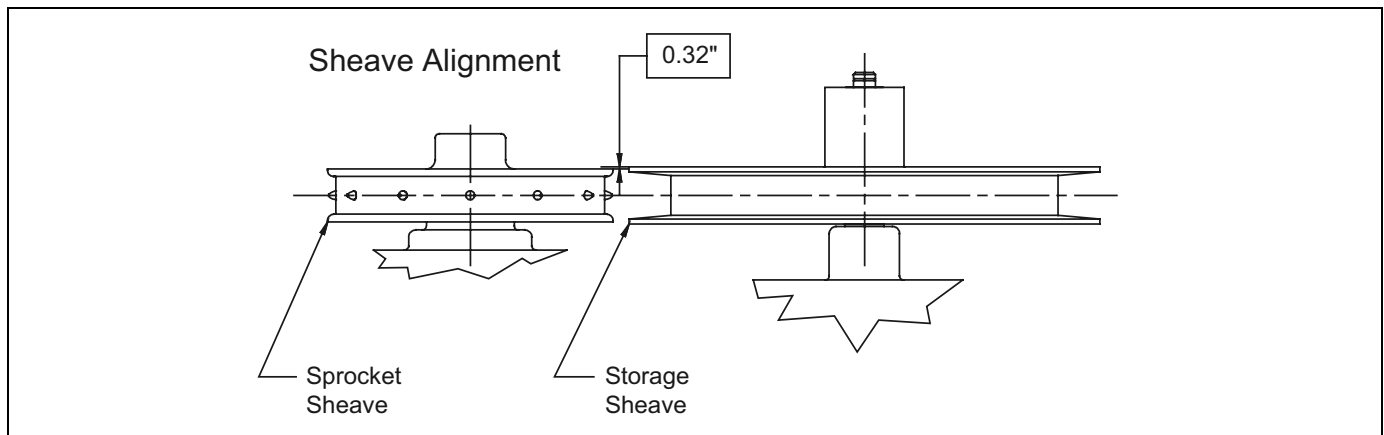
Note! If play is excessive, add shims (45) to remove play.

4. Attach the end of the tape over the sheave pin (28) and wind the tape onto the sheave assembly (18) as the assistant provides some tension on the tape to keep it from kinking or twisting.
5. Prior to installing the cassette (50) into the gaugehead, wind the cassette clockwise using the new crank assembly (52) to the number of turns indicated matching the product level. Lock the crank assembly using the spring loaded screw into the keyhole slot in the cassette.
6. Install the cassette into the gaugehead with the crank assembly locked in position.
7. Install the two socket head screws (49) to secure the cassette to the storage sheave.
8. Grasp the crank assembly handle and unlock it from the cassette. Rotate the handle to allow the take up of any slack in the tape.
9. Remove the crank assembly.
10. Check the tape path to insure that the tape is not twisted or kinked.
11. Test the operation of the gauge by rotating the gauge check knob 1/4 turn clockwise and releasing.
12. Reinstall the outboard sheave elbow cover.
13. Reinstall the back cover and any auxiliary equipment.

Note! The slotted coupling on any auxiliary equipment must engage the drive pin on the sprocket sheave.

14. Check the level indication on the gauge and compare it with the prerecorded level reading. Readjust gauge if levels do not match. Refer to the instruction manuals for re-calibration and operational checkout for the gauge and any auxiliary equipment.
15. Refill the gaugehead with oil if required.

Fig 3.2 Sheave Alignment



3.4 Counter Wheel Assembly

If the screws (43) and retainer are removed from the counter wheel assembly (21) and the pinion gear (24) is disengaged, it will be necessary to remove the dial and pinion gears to realign the counter drums and dial plate (7) to zero or to the calibrated liquid level. The setting of the pinion gear on the 1/2 notch position is a common error during reassemble.

- 1.Align counter drums to zero. Install pinion gear on counter base shaft with the 8-tooth side of the gear nearest the counter base. Mesh the short tooth of the pinion gear into the counter drum gear.
- 2.Install the dial gear without meshing the pinion gear teeth.
- 3.Slip the dial plate under the red pointer and onto the hub. Rotate the dial plate until the tab from the dial gear registers. Install dial retainer and screws.
- 4.Rotate the dial assembly to ensure that it does not bind on the pointer or pinion gear and that it advances the counter drum one digit as it crosses the zero position.

4 Troubleshooting

4.1 Common Problems

Friction is a common problem that affects gauge accuracy. Some liquids produce corrosion in the mechanism. Periodic inspection and maintenance provided by a Varec service contract can prevent problems from occurring. Periodic cleaning, lubrication and replacement of worn parts stops trouble before it starts.

4.1.1 Dials Do Not Respond When Check Knob Rotated

Possible Cause		Action
1	Tape broken?	Yes – Replace tape. Check negator motor attachment to storage sheave. Check for damaged gauge parts. No – Go to 2.
2	Negator motor broken?	Yes – Replace negator. Do not redrill or repair. Wear gloves. Check tape condition. Check for damaged gauge parts. No – Go to 3.
3	Tape rewound?	Yes – Tape detached from float. Replace tape and reattach. Check for damaged gauge parts. No – Go to 4.
4	Dials stopped?	Yes – Check for frozen tape sprocket sheave shaft. Repair/replace. Check for frozen accessory shaft. Repair/replace. Check dial gear engagement with pinion gear. Adjust/replace. Check gauge checker for broken spring and damaged ratchet pawl. Replace. No – Go to 5.
5	Counter dial wheels stopped; dial plate rotates?	Yes – Check for worn/broken counter pinion gear and counter wheels. Replace

Caution! Broken negator spring may cause injury. Stand clear of gaugehead and remove back cover.

4.1.2 Calibration Repeatability Unstable

Possible Cause		Action
1	Dirty gauge housing?	Yes – Clean with automotive type spray degreaser. No – Go to 2.
2	Tape/cable off elbow pulley?	Remove elbow covers Yes – Reseat and lubricate the gauge. No – Go to 3.
3	Elbow pulley shaft/bushing worn/corroded?	Yes – Repair or replace No – Go to 4.
4	Tape pipe/conduit dirty?	Yes – Remove and clean. No – Go to 5.
5	Guide cables loose, kinked or broken?	Yes – Tighten, repair or replace. No – Go to 6.
6	Worn Teflon bushings or bearings?	Yes – Refurbish gauge, replace Teflon bushings or bearings. Special tools may be required.

Caution! Broken negator spring may cause injury. Stand clear of gaugehead and remove back cover.

NOTES

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