

## OPERATION AND MAINTENANCE MANUAL FOR SERIES 8RS, 8S AND 8T ANGLE WRENCHES

### NOTICE

Series 8RS, 8S and 8T Angle Wrenches are designed for heavy-duty close-quarter threaded fastener applications which require precise torque repeatability.

Ingersoll-Rand is not responsible for customer modification of tools for applications on which Ingersoll-Rand was not consulted.

### ⚠ WARNING



**IMPORTANT SAFETY INFORMATION ENCLOSED.  
READ THIS MANUAL BEFORE OPERATING TOOL.**

**IT IS THE RESPONSIBILITY OF THE EMPLOYER TO PLACE THE INFORMATION  
IN THIS MANUAL INTO THE HANDS OF THE OPERATOR.  
FAILURE TO OBSERVE THE FOLLOWING WARNINGS COULD RESULT IN INJURY.**

### PLACING TOOL IN SERVICE

- Always operate, inspect and maintain this tool in accordance with American National Standards Institute Safety Code for Portable Air Tools (ANSI B186.1).
- For safety, top performance, and maximum durability of parts, operate this tool at 90 psig (6.2 bar/620 kPa) maximum air pressure at the inlet with 1/2" (13 mm) inside diameter air supply hose.
- Always turn off the air supply and disconnect the air supply hose before installing, removing or adjusting any accessory on this tool, or before performing any maintenance on this tool.
- Do not use damaged, frayed or deteriorated air hoses and fittings.
- Be sure all hoses and fittings are the correct size and are tightly secured. See Dwg. TPD905-1 for a typical piping arrangement.
- Always use clean, dry air at 90 psig maximum air pressure. Dust, corrosive fumes and/or excessive moisture can ruin the motor of an air tool.
- Do not lubricate tools with flammable or volatile liquids such as kerosene, diesel or jet fuel.
- Do not remove any labels. Replace any damaged label.

### USING THE TOOL

- Always wear eye protection when operating or performing maintenance on this tool.
- Always wear hearing protection when operating this tool.

- Keep hands, loose clothing and long hair away from rotating end of tool.
- Note the position of the reversing lever before operating the tool so as to be aware of the direction of rotation when operating the throttle.
- Anticipate and be alert for sudden changes in motion during start up and operation of any power tool.
- Keep body stance balanced and firm. Do not overreach when operating this tool. High reaction torques can occur at or below the recommended air pressure.
- Tool accessories may continue to rotate briefly after throttle is released.
- Air powered tools can vibrate in use. Vibration, repetitive motions or uncomfortable positions may be harmful to your hands and arms. Stop using any tool if discomfort, tingling feeling or pain occurs. Seek medical advice before resuming use.
- Use accessories recommended by Ingersoll-Rand.
- Use only impact sockets and accessories. Do not use hand (chrome) sockets or accessories.
- The Throttle Valve Cap is under pressure from the Throttle Valve Spring. Use care when removing the Throttle Valve Cap. (On tools where applicable.)
- Whenever the Angle Head is installed or repositioned, the Throttle Lever must be positioned so that reaction torque will not tend to retain the throttle in the "ON" position.
- This tool is not designed for working in explosive atmospheres.
- This tool is not insulated against electric shock.

### NOTICE

The use of other than genuine Ingersoll-Rand replacement parts may result in safety hazards, decreased tool performance, and increased maintenance, and may invalidate all warranties.

Repairs should be made only by authorized trained personnel. Consult your nearest Ingersoll-Rand Authorized Servicenter.

Refer All Communications to the Nearest  
Ingersoll-Rand Office or Distributor.

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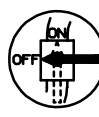
# WARNING LABEL IDENTIFICATION


## ⚠ WARNING


FAILURE TO OBSERVE THE FOLLOWING WARNINGS COULD RESULT IN INJURY.

	<p><b>⚠ WARNING</b></p> <p>Always wear eye protection when operating or performing maintenance on this tool.</p>
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	<p><b>⚠ WARNING</b></p> <p>Always wear hearing protection when operating this tool.</p>
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	<p><b>⚠ WARNING</b></p> <p>Always turn off the air supply and disconnect the air supply hose before installing, removing or adjusting any accessory on this tool, or before performing any maintenance on this tool.</p>
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	<p><b>⚠ WARNING</b></p> <p>Air powered tools can vibrate in use. Vibration, repetitive motions or uncomfortable positions may be harmful to your hands and arms. Stop using any tool if discomfort, tingling feeling or pain occurs. Seek medical advice before resuming use.</p>
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	<p><b>⚠ WARNING</b></p> <p>Do not carry the tool by the hose.</p>
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	<p><b>⚠ WARNING</b></p> <p>Do not use damaged, frayed or deteriorated air hoses and fittings.</p>
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	<p><b>⚠ WARNING</b></p> <p>Keep body stance balanced and firm. Do not overreach when operating this tool.</p>
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	<p><b>⚠ WARNING</b></p> <p>Operate at 90 psig (6.2 bar/ 620 kPa) Maximum air pressure.</p>
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## PLACING TOOL IN SERVICE

### LUBRICATION



Ingersoll-Rand No. 10

Ingersoll-Rand No. 28  
Ingersoll-Rand No. 66

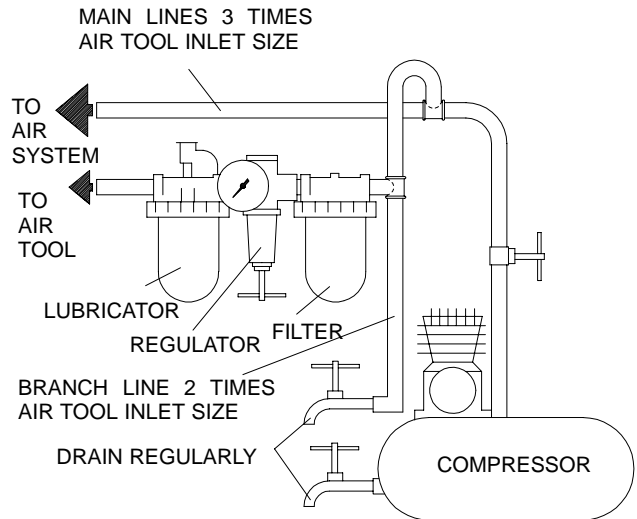
Always use an air line lubricator with these tools.  
We recommend the following Filter-Lubricator-Regulator Unit:

For USA - No. C28-04-FKG0-28

**Before starting the Tool and after each two or three hours of operation**, unless the air line lubricator is used, detach the air hose and inject about 2.5 cc of Ingersoll-Rand No. 10 Oil into the air inlet.

**After each forty-eight hours of operation**, or as experience indicates, inject about 1 cc of Ingersoll-Rand No. 28 Grease into the gear case Grease Fitting.

**After each forty-eight hours of operation**, or as experience indicates, inject about 1 cc of Ingersoll-Rand No. 66 Grease into the angle head Grease Fitting.



(Dwg. TPD905-1)

**HOW TO ORDER AN ANGLE WRENCH**

**INLINE HANDLE REVERSIBLE STALL**

Model	Torque Range (Soft Draw)				Free Speed rpm	Square Drive in.
	50 psi pressure		90 psi pressure			
	ft-lb	Nm	ft-lb	Nm		
8RSL32	12.0	16.3	18.0	24.4	1,200	3/8
8RSM32	15.0	20.3	23.0	31.2	930	3/8
8RSN32	19.0	25.8	30.0	40.7	700	3/8
8RSP53	26.0	35.3	40.0	54.2	510	1/2
8RSQ53	32.0	43.4	50.0	67.8	430	1/2

**INLINE HANDLE NONREVERSIBLE STALL**

8SM32	16.0	21.7	23.0	31.2	1,110	3/8
8SN32	21.0	28.5	30.0	40.7	840	3/8
8SP53	28.0	38.0	40.0	54.2	610	1/2

**INLINE HANDLE NONREVERSIBLE SHUT-OFF**

8TM32	16.0	21.7	23.0	31.2	1,110	3/8
8TN32	21.0	28.5	30.0	40.7	840	3/8
8TP53	28.0	38.0	40.0	54.2	610	1/2
8TQ53	35.0	47.5	50.0	67.8	520	1/2

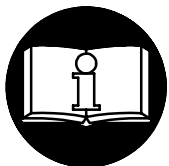
# MANUEL D'EXPLOITATION ET D'ENTRETIEN DES CLÉS D'ANGLE DES SÉRIES 8RS, 8S ET 8T

## NOTE

Les clés d'angle des séries 8RS, 8S et 8T sont destinées au serrage dans des espaces restreints des grosses fixations filetées nécessitant une répétabilité précise du couple.

Ingersoll-Rand ne peut être tenu responsable de la modification des outils par le client pour les adapter à des applications qui n'ont pas été approuvées par Ingersoll-Rand.

## ATTENTION



**D'IMPORTANTES INFORMATIONS DE SÉCURITÉ SONT JOINTES.  
LIRE CE MANUEL AVANT D'UTILISER L'OUTIL.  
L'EMPLOYEUR EST TENU À COMMUNIQUER LES INFORMATIONS  
DE CE MANUEL AUX EMPLOYÉS UTILISANT CET OUTIL.**

**LE NON RESPECT DES AVERTISSEMENTS SUIVANTS PEUT CAUSER DES BLESSURES**

### MISE EN SERVICE DE L'OUTIL

- Toujours exploiter, inspecter et entretenir cet outil conformément au Code de sécurité des outils pneumatiques portatifs de l'American National Standards Institute (ANSI B186.1).
  - Pour la sécurité, les performances optimales et la durabilité maximale des pièces, cet outil doit être connecté à une alimentation d'air comprimé de 6,2 bar (620kPa) maximum à l'entrée, avec un flexible de 13 mm de diamètre intérieur.
  - Couper toujours l'alimentation d'air comprimé et débrancher le flexible d'alimentation avant d'installer, déposer ou ajuster tout accessoire sur cet outil, ou d'entreprendre une opération d'entretien quelconque sur l'outil.
  - Ne pas utiliser des flexibles ou des raccords endommagés, effilochés ou détériorés.
  - S'assurer que tous les flexibles et les raccords sont correctement dimensionnés et bien serrés. Voir Plan TPD905-1 pour un exemple type d'agencement des tuyauteries.
  - Utiliser toujours de l'air sec et propre à une pression maximum de 6,2 bar. La poussière, les fumées corrosives et/ou une humidité excessive peuvent endommager le moteur d'un outil pneumatique.
  - Ne jamais lubrifier les outils avec des liquides inflammables ou volatils tels que le kérosène, le gasol ou le carburant d'aviation.
  - Ne retirer aucune étiquette. Remplacer toute étiquette endommagée.
- ### UTILISATION DE L'OUTIL
- Porter toujours des lunettes de protection pendant l'utilisation et l'entretien de cet outil.
  - Porter toujours une protection acoustique pendant l'utilisation de cet outil.
  - Tenir les mains, les vêtements flous et les cheveux longs, éloignés de l'extrémité rotative de l'outil.
  - Noter la position du levier d'inversion avant de mettre l'outil en marche de manière à savoir dans quel sens il va tourner lorsque la commande est actionnée.
  - Prévoir, et ne pas oublier, que tout outil motorisé est susceptible d'à-coups brusques lors de sa mise en marche et pendant son utilisation.
  - Garder une position équilibrée et ferme. Ne pas se pencher trop en avant pendant l'utilisation de cet outil. Des couples de réaction élevés peuvent se produire à, ou en dessous, de la pression d'air recommandée.
  - La rotation des accessoires de l'outil peut continuer pendant un certain temps après le relâchement de la gâchette.
  - Les outils pneumatiques peuvent vibrer pendant l'exploitation. Les vibrations, les mouvements répétitifs et les positions inconfortables peuvent causer des douleurs dans les mains et les bras. N'utiliser plus d'outils en cas d'inconfort, de picotements ou de douleurs. Consulter un médecin avant de recommencer à utiliser l'outil.
  - Utiliser les accessoires recommandés par Ingersoll-Rand.
  - N'utiliser que les douilles et les accessoires pour clés à chocs. Ne pas utiliser les douilles et accessoires (chromés) de clés manuelles.
  - Le chapeau de la soupape de commande est soumis à la pression du ressort de soupape. Prendre les soins nécessaires lors de la dépose du chapeau de soupape de commande. (Sur les outils concernés).
  - A chaque fois que le renvoi d'angle est installé ou repositionné, le levier de commande doit être positionné de manière à ce que le couple de réaction n'ait pas tendance à maintenir le levier de commande en position "MARCHE".
  - Cet outil n'est pas conçu pour fonctionner dans des atmosphères explosives.
  - Cet outil n'est pas isolé contre les chocs électriques.

## NOTE

L'utilisation de rechanges autres que les pièces d'origine Ingersoll-Rand peut causer des risques d'insécurité, réduire les performances de l'outil et augmenter l'entretien, et peut annuler toutes les garanties.

Les réparations ne doivent être effectuées que par des réparateurs qualifiés autorisés. Consultez votre Centre de Service Ingersoll-Rand le plus proche.

Adressez toutes vos communications au Bureau Ingersoll-Rand ou distributeur le plus proche.

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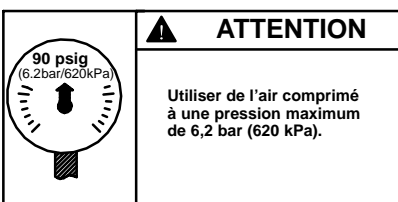
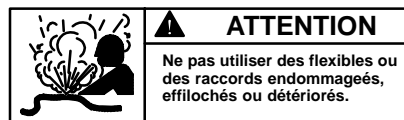
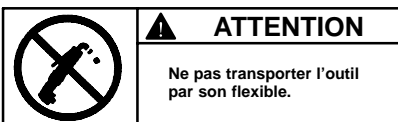
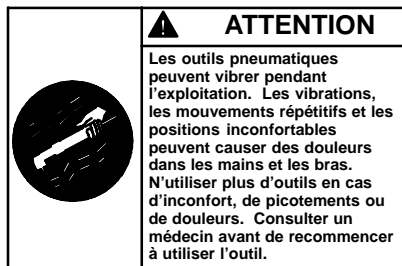
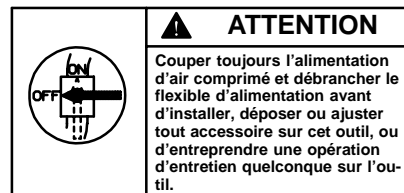
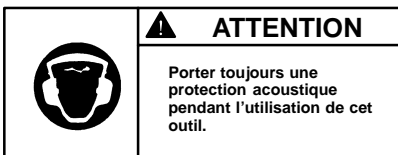
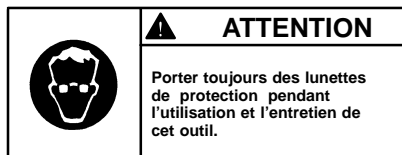
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**PROFESSIONAL TOOLS**

# SIGNIFICATION DES ETIQUETTES D'AVERTISSEMENT

## ATTENTION

LE NON RESPECT DES AVERTISSEMENTS SUIVANTS PEUT CAUSER DES BLESSURES



## MISE EN SERVICE DE L'OUTIL

### LUBRIFICATION



Ingersoll-Rand No. 10



Ingersoll-Rand No. 28  
Ingersoll-Rand No. 66

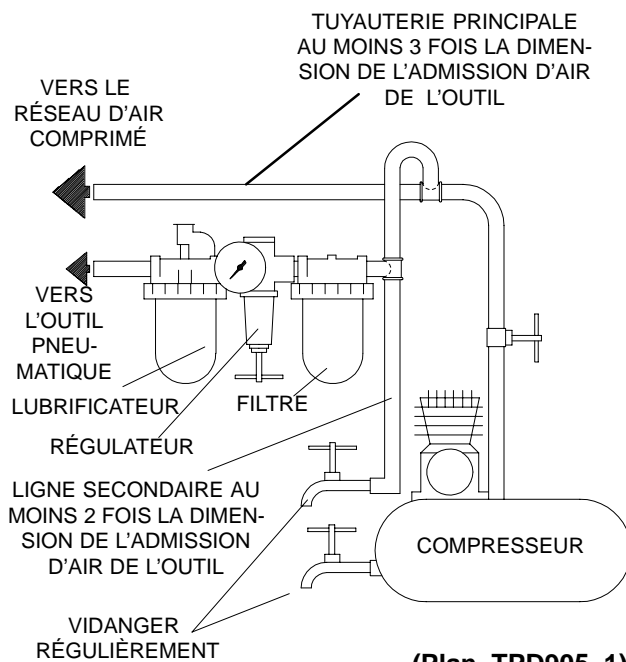
Utiliser toujours un lubrificateur avec ces outils. Nous recommandons l'emploi du filtre-régulateur-lubrificateur suivant :

É.U. – No. C28-04-FKG0-28

**Toutes les deux ou trois heures de fonctionnement**, si un lubrificateur de ligne n'est pas utilisé, débrancher le flexible d'alimentation et verser environ 2,5 cm<sup>3</sup> d'huile Ingersoll-Rand No 10 dans le raccord d'admission de l'outil.

**Toutes les quarante-huit heures de fonctionnement**, ou en fonction de l'expérience, injecter environ 1 cm<sup>3</sup> de graisse Ingersoll-Rand No. 28 dans le raccord de graissage du boîtier d'engrenages.

**Toutes les quarante-huit heures de fonctionnement**, ou en fonction de l'expérience, injecter environ 1cm de graisse Ingersoll-Rand No. 66 dans le raccord de graissage du renvoi d'angle.



# MISE EN SERVICE DE L'OUTIL

## SPÉCIFICATIONS

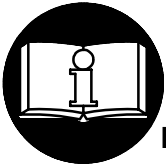
Modèle	Dispositif de couple	Plage de couple (Serrage élastique)		Vitesse à vide tr/mn	entr. carré in.
		50 psi ft-lbs (Nm)	90 psi ft-lbs (Nm)		
8RSL32	calage	12,0 (16,3)	18,0 (24,4)	1.200	3/8
8RSM32	calage	15,0 (20,3)	23,0 (31,2)	930	3/8
8RSN32	calage	19,0 (25,8)	30,0 (40,7)	700	3/8
8RSP53	calage	26,0 (35,3)	40,0 (54,2)	510	1/2
8RSQ53	calage	32,0 (43,3)	50,0 (67,8)	430	1/2
8SM32	calage	16,0 (21,7)	23,0 (31,2)	1.110	3/8
8SN32	calage	21,0 (28,5)	30,0 (40,7)	840	3/8
8SP53	calage	28,0 (38,0)	40,0 (54,2)	610	1/2
8TM32	arrêt	16,0 (21,7)	23,0 (31,2)	1.110	3/8
8TN32	arrêt	21,0 (28,5)	30,0 (40,7)	840	3/8
8TP53	arrêt	28,0 (38,0)	40,0 (54,2)	610	1/2
8TQ53	arrêt	35,0 (47,5)	50,0 (67,8)	520	1/2

# MANUAL DE USO Y MANTENIMIENTO PARA LLAVES ANGULARES MODELO 8RS, 8S Y 8T

## NOTA

Las Llaves Angulares Serie 8RS, 8S y 8T están diseñadas para fijaciones de roscas robustas en operaciones de mínima distancia que requieran repetibilidad de par con precisión.

Ingersoll-Rand no aceptará responsabilidad alguna por la modificación de las herramientas efectuada por el cliente para las aplicaciones que no hayan sido consultadas con Ingersoll-Rand.



## ⚠ AVISO

**SE ADJUNTA INFORMACION IMPORTANTE DE SEGURIDAD.  
LEA ESTE MANUAL ANTES DE USAR LA HERRAMIENTA.**

**ES RESPONSABILIDAD DE LA EMPRESA ASEGURARSE DE QUE EL OPERARIO  
ESTE AL TANTO DE LA INFORMACION QUE CONTIENE ESTE MANUAL.**

**EL HACER CASO OMISO DE LOS AVISOS SIGUIENTES PODRIA OCASIONAR LESIONES.**

### PARA PONER LA HERRAMIENTA EN SERVICIO

- Utilice, examine y mantenga siempre esta herramienta conforme al código de seguridad para herramientas neumáticas portátiles de la American National Standards Institute (ANSI B186.1).
- Para seguridad, máximo rendimiento y durabilidad de piezas, use esta herramienta a una máxima presión de aire de 90 psig (6,2 bar/620kPa) en la admisión de manguera de suministro de aire de diámetro interno de 13 mm.
- Corte siempre el suministro de aire y desconecte la manguera de suministro de aire antes de instalar, desmontar o ajustar cualquier accesorio de esta herramienta, o antes de realizar cualquier operación de mantenimiento de la misma.
- No utilice mangueras de aire y accesorios dañados, desgastados ni deteriorados.
- Asegúrese de que todas las mangueras y los accesorios sean del tamaño correcto y estén bien apretados. Vea Esq. TPD005-1 para un típico arreglo de tuberías.
- Use siempre aire limpio y seco a una máxima presión de 90 psig. El polvo, los gases corrosivos y/o el exceso de humedad podrían estropear el motor de una herramienta neumática.
- No lubrique las herramientas con líquidos inflamables o volátiles tales como queroseno, gasoil o combustible para motores a reacción.
- No saque ninguna etiqueta. Sustituya toda etiqueta dañada.

### USO DE HERRAMIENTA

- Use siempre protección ocular cuando utilice esta herramienta o realice operaciones de mantenimiento en la misma.
- Use siempre protección para los oídos cuando utilice esta herramienta.

- Mantenga las manos, la ropa suelta y el cabello largo alejados del extremo giratorio de la herramienta.
- Note la posición de la palanca de inversión antes de funcionar la herramienta para estar consciente de su dirección giratoria cuando funcione el estrangulador.
- Anticipe y esté alerta a los cambios repentinos en el movimiento durante la puesta en marcha y el manejo de toda herramienta motorizada.
- Mantenga una postura de cuerpo equilibrada y firme. No estire demasiado los brazos al manejar la herramienta. Pueden ocurrir reacciones de alto par a, o menos de, la recomendada presión de aire.
- Los accesorios de la herramienta podrían seguir girando brevemente después de haber soltado la palanca de estrangulación.
- Las herramientas neumáticas pueden vibrar durante el uso. La vibración, repetición o posiciones incómodas pueden dañarle los brazos y manos. En caso de incomodidad, sensación de hormigueo o dolor, deje de usar la herramienta. Consulte a un médico antes de volver a usarla otra vez.
- Utilice únicamente los accesorios Ingersoll-Rand recomendados.
- Utilice únicamente bocas y accesorios para llaves de impacto. No utilice bocas o accesorios manuales (cromados).
- La Tapa de Válvula de Estrangulación está presionada por el Muelle de Válvula de Estrangulación. Tenga cuidado al sacar la Tapa de Válvula de Estrangulación. (En las herramientas que la aplican).
- Cuando se instale o reposicione la Cabeza Angular, la Palanca de Estrangulación deberá posicionarse de forma que la reacción de par no tienda a retener el estrangulador en la posición de MARCHA.
- Esta herramienta no ha sido diseñada para trabajar en ambientes explosivos.
- Esta herramienta no está aislada contra descargas eléctricas.

## NOTA

El uso de piezas de recambio que no sean las auténticas piezas Ingersoll-Rand podría poner en peligro la seguridad, reducir el rendimiento de la herramienta y aumentar los cuidados de mantenimiento necesarios, así como invalidar toda garantía.

Las reparaciones sólo serán realizadas por personal cualificado y autorizado. Consulte con el centro de servicio Ingersoll-Rand autorizado más próximo.

Toda comunicación se deberá dirigir a la oficina o al distribuidor Ingersoll-Rand más próximo.

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## ETIQUETAS DE AVISO


### AVISO


EL HACER CASO OMISO DE LOS AVISOS SIGUIENTES PODRIA OCASIONAR LESIONES.


	<p><b>ADVERTENCIA</b></p> <p>Use siempre protección ocular cuando utilice esta herramienta o realice operaciones de mantenimiento en la misma.</p>
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	<p><b>ADVERTENCIA</b></p> <p>Use siempre protección para los oídos cuando utilice esta herramienta.</p>
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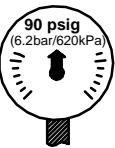
	<p><b>ADVERTENCIA</b></p> <p>Cortar siempre el suministro de aire y desconectar la manguera de suministro de aire antes de instalar, retirar o ajustar cualquier accesorio de esta herramienta, o antes de realizar cualquier operación de mantenimiento de la misma.</p>
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	<p><b>ADVERTENCIA</b></p> <p>Las herramientas neumáticas pueden vibrar durante el uso. La vibración, los movimientos repetitivos o las posiciones incómodas podrían dañarle los brazos y las manos. En caso de incomodidad, sensación de hormigueo o dolor, dejar de usar la herramienta. Consultar al médico antes de volver a utilizarla.</p>
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	<p><b>ADVERTENCIA</b></p> <p>No coger la herramienta por la manguera para levantarla.</p>
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	<p><b>ADVERTENCIA</b></p> <p>No utilizar mangueras de aire y accesorios dañados, desgastados ni deteriorados.</p>
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	<p><b>ADVERTENCIA</b></p> <p>Mantener una postura del cuerpo equilibrada y firme. No estirar demasiado los brazos al manejar la herramienta.</p>
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	<p><b>ADVERTENCIA</b></p> <p>Manejar la herramienta a una presión de aire máxima de 90 psig (6,2 bar/620 kPa).</p>
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## PARA PONER LA HERRAMIENTA EN SERVICIO

### LUBRICACION



Ingersoll-Rand N° 10



Ingersoll-Rand N° 28  
Ingersoll-Rand N° 66

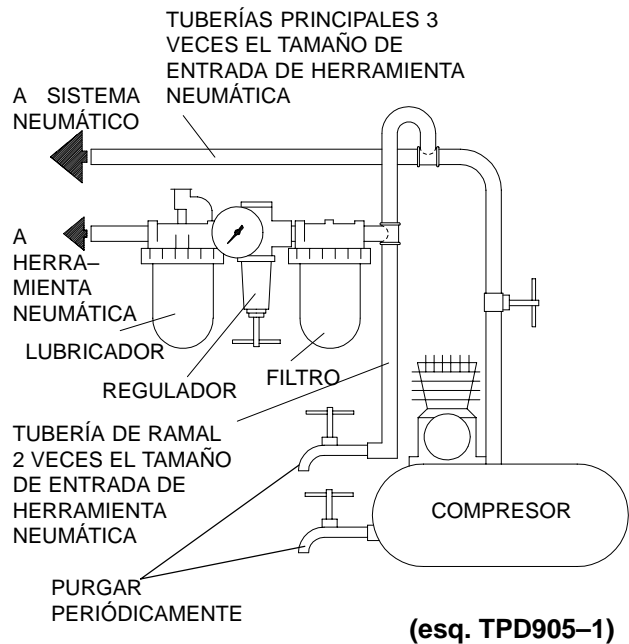
Utilice siempre un lubricador de aire comprimido con estas llaves de impacto. Recomendamos la siguiente unidad de Filtro-Lubricador-Regulador:

EE.UU. - N°. C28-04-FKG0-28

**Antes de poner la herramienta en marcha y después de cada dos o tres horas de uso**, a menos que se haya puesto lubricante de línea de aire comprimido, desconecte la manguera de aire e inyecte unos 2,5 cc de Aceite Ingersoll-Rand N° 10 en la admisión de aire.

**Después de cada cuarenta y ocho horas de uso**, o como indique la experiencia, inyecte así como 1 cc de Grasa Ingersoll-Rand N° 28 en el Engrasador de carcasa de engranajes.

**Después de cada cuarenta y ocho horas de uso**, o como indique la experiencia, inyecte así como 1 cc de Grasa Ingersoll-Rand N° 66 en el Engrasador de la cabeza angular.





# PARA PONER LA HERRAMIENTA EN SERVICIO

## ESPECIFICACIONES

Modelo	Dispositivo de Par	Gama de Par (Junta blanda)		Velocidad Constante	Cuadr adillo
		50 psi ft-lbs (Nm)	90 psi ft-lbs (Nm)		
8RSL32	cala	12,0 (16,3)	18,0 (24,4)	1.200	3/8
8RSM32	cala	15,0 (20,3)	23,0 (31,2)	930	3/8
8RSN32	cala	19,0 (25,8)	30,0 (40,7)	700	3/8
8RSP53	cala	26,0 (35,3)	40,0 (54,2)	510	1/2
8RSQ53	cala	32,0 (43,3)	50,0 (67,8)	430	1/2
8SM32	cala	16,0 (21,7)	23,0 (31,2)	1.110	3/8
8SN32	cala	21,0 (28,5)	30,0 (40,7)	840	3/8
8SP53	cala	28,0 (38,0)	40,0 (54,2)	610	1/2
8TM32	cierre	16,0 (21,7)	23,0 (31,2)	1.110	3/8
8TN32	cierre	21,0 (28,5)	30,0 (40,7)	840	3/8
8TP53	cierre	28,0 (38,0)	40,0 (54,2)	610	1/2
8TQ53	cierre	35,0 (47,5)	50,0 (67,8)	520	1/2

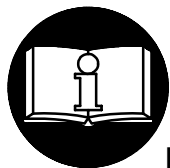
# IMANUAL DE FUNCIONAMENTO E MANUTENÇÃO PARA FERRAMENTAS PNEUMÁTICAS ANGULARES SÉRIES 8RS, 8S E 8T

P

## AVISO

As Ferramentas Pneumáticas Angulares Modelos 8RS, 8S e 8T são concebidas para aplicações de aperto com rosca regulável em trabalhos pesados onde é necessário repetitividade de torque.

A Ingersoll-Rand não é responsável por modificações feitas pelo cliente em ferramentas nas quais a Ingersoll-Rand não tenha sido consultada.



## ⚠️ ADVERTÊNCIA

**INFORMAÇÃO DE SEGURANÇA IMPORTANTE EM ANEXO  
LEIA ESTE MANUAL ANTES DE OPERAR A FERRAMENTA.  
É DA RESPONSABILIDADE DO EMPREGADOR COLOCAR A INFORMAÇÃO  
DESTE MANUAL NAS MÃOS DO OPERADOR.**

**O NÃO CUMPRIMENTO DAS SEGUINTE ADVERTÊNCIAS PODE RESULTAR EM FERIMENTOS.**

### COLOCANDO A FERRAMENTA EM FUNCIONAMENTO

- Sempre opere, inspecione e mantenha esta ferramenta de acordo com o Código de Segurança do Instituto Americano de Padrões Nacionais para Ferramentas Pneumáticas Portáteis (ANSI B186.1).
- Para segurança, máximo desempenho e máxima durabilidade das peças, opere esta ferramenta com uma pressão de ar máxima de 6,2 bar/620 kPa (90 psig) na entrada da mangueira de alimentação de ar com diâmetro interno de 13 mm (1/2”).
- Desligue sempre a alimentação de ar e desconecte a mangueira de alimentação de ar antes de instalar, remover ou ajustar qualquer acessório nesta ferramenta, ou antes de executar qualquer serviço de manutenção nesta ferramenta.
- Não use mangueiras de ar ou adaptadores danificados, gastos ou deteriorados.
- Certifique-se de que todas as mangueiras e adaptadores sejam do tamanho correcto e estejam apertados com firmeza. Veja o Desenho TPD905-1 para um arranjo típico de tubagem.
- Use sempre ar seco e limpo com pressão máxima de 90 psig. Pó, fumos corrosivos e/ou humidade excessiva podem arruinar o motor de uma ferramenta pneumática.
- Não lubrifique as ferramentas com líquidos inflamáveis ou voláteis tais como querosene, diesel ou combustível de jactos.
- Não remova nenhum rótulo. Reponha qualquer rótulo danificado.

### USANDO A FERRAMENTA

- Use sempre óculos de protecção quando estiver operando ou executando serviço de manutenção nesta ferramenta.
- Use sempre protecção contra ruído ao operar esta ferramenta.

- Mantenha as mãos, partes do vestuário soltas e cabelos compridos afastados da extremidade em rotação.
- Observe qual é a posição da alavanca que reverte o sentido de rotação antes de operar esta ferramenta de modo a estar atento ao sentido de rotação quando operar o regulador de pressão.
- Antecipe e esteja alerta a mudanças repentinas no movimento quando ligar e operar qualquer ferramenta motorizada.
- Mantenha a posição do corpo equilibrada e firme. Não exagere quando operar esta ferramenta. Torques de reacção elevados podem ocorrer na ou abaixo da pressão de ar recomendada.
- Os acessórios da ferramenta podem continuar a girar brevemente após a pressão ter sido aliviada.
- Ferramentas accionadas pneumáticamente podem vibrar em uso. Vibração, movimentos repetitivos ou posições desconfortáveis podem ser prejudiciais às mãos e aos braços. Pare de usar a ferramenta caso ocorra algum desconforto, sensação de formigueiro ou dor. Procure assistência médica antes de retornar ao trabalho.
- Use acessórios recomendados pela Ingersoll-Rand.
- Use somente soquetes e acessórios de impacto. Não use soquetes ou acessórios de mão (cromo).
- O Tampo da Válvula Reguladora de Pressão está sob pressão da Mola da Válvula. Tenha cuidado ao removê-lo. (*Aplicável a algumas ferramentas.*)
- Sempre que a Cabeça Angular seja instalada ou substituída, a Alavanca Reguladora de Pressão deve ser posicionada de tal modo que o torque de reacção não tenha tendência de reter a posição “LIGADO” na alavanca reguladora de pressão.
- Esta Ferramenta não foi concebida para trabalhos em atmosferas explosivas.
- Esta Ferramenta não está isolada contra choques eléctricos.

## AVISO

O uso de peças de substituição que não sejam genuinamente da Ingersoll-Rand podem resultar em riscos de segurança, diminuição do desempenho da ferramenta, aumento da necessidade de manutenção e pode invalidar todas as garantias.

As reparações devem ser feitas somente por pessoal treinado autorizado. Consulte o Centro de Serviços da Ingersoll-Rand mais próximo.

Envie Todos os Comunicados Para o Distribuidor ou Escritório da Ingersoll-Rand Mais Próximo.

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**PROFESSIONAL TOOLS**


# IDENTIFICAÇÃO DO RÓTULO DE ADVERTÊNCIA

## ⚠ ADVERTÊNCIA

O NÃO CUMPRIMENTO DAS SEGUINTE ADVERTÊNCIAS PODE RESULTAR EM FERIMENTO.




**⚠ ADVERTÊNCIA**  
Use sempre óculos de protecção quando estiver operando ou executando algum serviço de manutenção nesta ferramenta.




**⚠ ADVERTÊNCIA**  
Use sempre protecção contra o ruído ao operar esta ferramenta.




**⚠ ADVERTÊNCIA**  
Desligue sempre a alimentação de ar e desconecte a mangueira de alimentação de ar antes de instalar, remover ou ajustar qualquer acessório nesta ferramenta, ou antes de executar algum serviço de manutenção nesta ferramenta.



**⚠ ADVERTÊNCIA**  
Ferramentas accionadas pneumáticamente podem vibrar em uso. Vibração, movimentos repetitivos ou posições desconfortáveis podem ser prejudiciais às mãos e aos braços. Pare de usar a ferramenta caso ocorra algum desconforto, sensação de formigamento ou dor. Procure assistência médica antes de retornar ao trabalho.




**⚠ ADVERTÊNCIA**  
Não carregue a ferramenta segurando na mangueira.



**⚠ ADVERTÊNCIA**  
Não use mangueiras de ar ou adaptadores danificados, gastos ou deteriorados.



**⚠ ADVERTÊNCIA**  
Mantenha a posição do corpo equilibrada e firme. Não exagere quando operar esta ferramenta. Torques de reacção elevados podem ocorrer sob a pressão de ar recomendada.



**⚠ ADVERTÊNCIA**  
Opere com pressão do ar Máxima de 90-100 psig (6,2-6,9 bar).

## COLOCANDO A FERRAMENTA EM FUNCIONAMENTO

### LUBRIFICAÇÃO



Ingersoll-Rand No. 10



Ingersoll-Rand No. 28  
Ingersoll-Rand No. 66

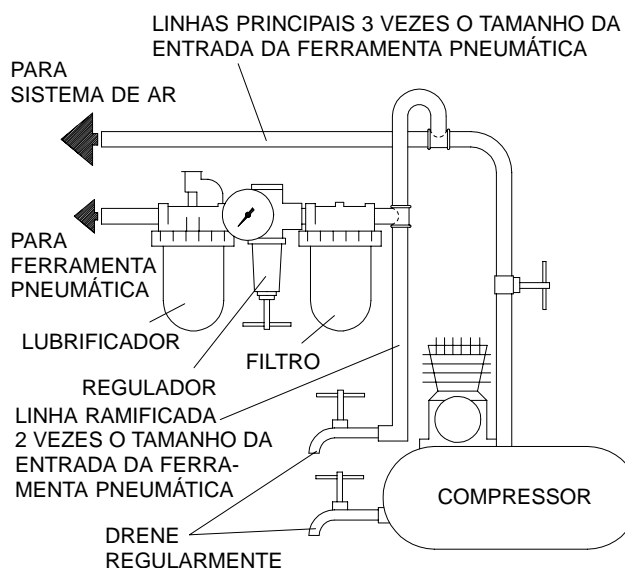
Use sempre um lubrificador de ar de linha com estas ferramentas. Nós recomendamos a seguinte Unidade Filtro-Lubrificador-Regulador:

Para E.U.A. – No. C28-04-FKG0-28

**Antes de ligar a Ferramenta e depois de duas ou três horas de operação**, ao menos que um lubrificador de ar de linha seja usado, desligue a mangueira de ar e injecte aproximadamente 2,5 de Óleo Ingersoll-Rand No. 10 na entrada de ar.

**Depois de quarenta e oito horas de operação**, ou conforme a experiência indicar injecte cerca de 1 cc de Massa Lubrificadora Ingersoll-Rand No. 28 na caixa de engrenagem do Adaptador.

**Depois de quarenta e oito horas de operação**, ou conforme a experiência indicar injecte cerca de 1 cc de Massa Lubrificadora Ingersoll-Rand No. 66 no ângulo da cabeça do Adaptador.



(Desenho TPD905-1)

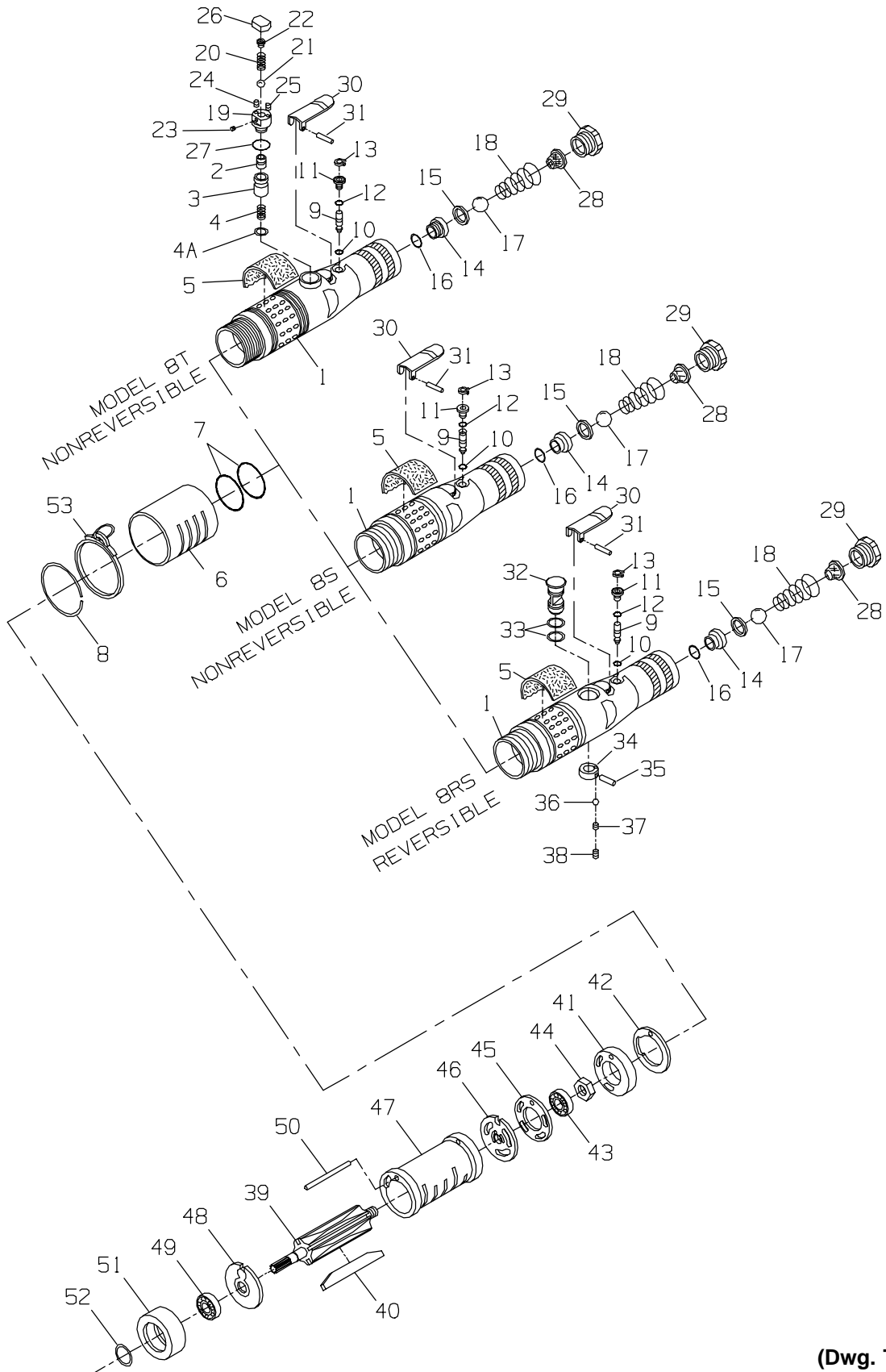
# COLOCANDO A FERRAMENTA EM FUNCIONAMENTO

## ESPECIFICAÇÕES

Modelo	Equipamento de Torque	Intervalo de Torque (Apertos Ligeiros)		Velocidade Livre	Encabadouro Quadrado
		50 psi Nm (pés-lb)	90 psi Nm (pés-lb)	rpm	pol.
8RSL32	paragem	16,3 (12,0)	24,4 (18,0)	1.200	3/8
8RSM32	paragem	20,3 (15,0)	31,2 (23,0)	930	3/8
8RSN32	paragem	25,8 (19,0)	40,7 (30,0)	700	3/8
8RSP53	paragem	35,3 (26,0)	54,2 (40,0)	510	1/2
8RSQ53	paragem	43,3 (32,0)	67,8 (50,0)	430	1/2
8SM32	paragem	21,7 (16,0)	31,2 (23,0)	1.110	3/8
8SN32	paragem	28,5 (21,0)	40,7 (30,0)	840	3/8
8SP53	paragem	38,0 (28,0)	54,2 (40,0)	610	1/2
8TM32	corte automático	21,7 (16,0)	31,2 (23,0)	1.110	3/8
8TN32	corte automático	28,5 (21,0)	40,7 (30,0)	840	3/8
8TP53	corte automático	38,0 (28,0)	54,2 (40,0)	610	1/2
8TQ53	corte automático	47,5 (35,0)	67,8 (50,0)	520	1/2

# MAINTENANCE SECTION

## MOTOR HOUSING ASSEMBLY



(Dwg. TPC592)



# MAINTENANCE SECTION

## PART NUMBER FOR ORDERING



		8RS, 8S	8T
1	Motor Housing Assembly		
	Nonreversible		
	for 8S or 8T models ending in 32 or 53 . . . . .	8SL-A40	8TL-A40
*	for 8T models ending in -EU . . . . .	—	8TL-EU-A40
	Reversible		
	for 8R models ending in 32 or 53 . . . . .	8RSL-A40	—
	for 8R models ending in -EU . . . . .	8RSL-EU-A40	—
*	Warning Label		
	for models ending in -EU . . . . .	EU-99	EU-99
	for all other models . . . . .	WARNING-2-99	WARNING-2-99
2	Shutoff Valve . . . . .	—	8TL-172
3	Shutoff Valve Body . . . . .	—	8TL-170
4	Shutoff Valve Spring . . . . .	—	8TL-171
4A	Shutoff Valve Stop . . . . .	—	8TL-176
◆•	5 Exhaust Silencer . . . . .	8SL-311	8SL-311
•	6 Exhaust Deflector . . . . .	8SL-23	8SL-23
	for models ending in -EU . . . . .	8SL-EU-23	8SL-EU-23
	for all other models . . . . .	8SL-23	8SL-23
◆•	7 Exhaust Deflector Seal (2) . . . . .	AF160-291Z	AF160-291Z
8	Deflector Retaining Ring . . . . .	8SL-203	8SL-203
9	Throttle Valve Plunger Assembly . . . . .	8SL-A302	8SL-A302
◆•	10 Throttle Plunger Seal . . . . .	8SL-259	8SL-259
11	Throttle Plunger Bushing Assembly . . . . .	8SL-A503	8SL-A503
◆•	12 Throttle Plunger Bushing Seal . . . . .	405-159	405-159
13	Throttle Valve Plunger Stop . . . . .	8SL-305	8SL-305
14	Throttle Valve Seat Assembly . . . . .	8SL-A303	8SL-A303
•	15 Valve Seat Face . . . . .	8SL-159	8SL-159
◆•	16 Valve Seat Seal . . . . .	AF120-290	AF120-290
17	Throttle Valve Ball . . . . .	K6U-941	K6U-941
◆	18 Throttle Valve Spring . . . . .	8SL-262	8SL-262
19	Regulator Body Assembly . . . . .	—	8TL-A173
20	Regulator Spring . . . . .	—	8TL-180
21	Regulator Ball . . . . .	—	2U-722
22	Regulator Adjusting Screw . . . . .	—	8TL-174
23	Lock Screw . . . . .	—	8TL-179
24	Bleed Adjusting Screw . . . . .	—	8TL-175
25	Sensor Port Plug . . . . .	—	5081T-266
26	Regulator Body Cap . . . . .	—	8TL-181
◆	27 Regulator Body Seal . . . . .	—	C321-606
◆	28 Air Strainer . . . . .	834-61	834-61
29	Inlet Bushing . . . . .	88V60-38	88V60-38
30	Throttle Lever . . . . .	8SL-273	8SL-273
◆•	31 Throttle Lever Retaining Pin . . . . .	MR-100	MR-100
32	Reverse Valve Assembly . . . . .	8RSL-A329	—
33	Reverse Valve Seal (2) . . . . .	85H-167	—

\* Not illustrated.

◆ Indicates Tune-up Kit part.

• To keep downtime to a minimum, it is desirable to have on hand certain repair parts. We recommend that you stock one (pair or set) of each part indicated by a bullet (•) for every four tools in service.

# MAINTENANCE SECTION

## PART NUMBER FOR ORDERING



		8RS, 8S	8T
34	Reverse Valve Knob .....	8RSL-163	_____
35	Reverse Valve Knob Pin .....	R100B-120	_____
36	Detent Ball .....	8RSL-31	_____
37	Detent Spring .....	5RA-664	_____
38	Detent Adjusting Screw .....	8RSL-662	_____
39	Rotor		
	with L ratio gearing .....	8SL-53	8SL-53
	with M, N, P or Q ratio gearing .....	8SM-53	8SM-53
◆• 40	Vane Packet (set of 5 Vanes) .....	8SL-42-5	8SL-42-5
41	Rear Rotor Bearing Support		
	for nonreversible models .....	8SL-25	8SL-25
	for reversible models .....	8RSL-25	_____
◆• 42	Rear Bearing Support Gasket		
	for nonreversible models .....	8SL-283	8SL-283
	for reversible models .....	8RSL-283	_____
• 43	Rear Rotor Bearing .....	AG210-24Z	AG210-24Z
• 44	Rotor Bearing Retaining Nut .....	8SL-118	8SL-118
◆ 45	Rear End Plate Gasket .....	8SL-739	8SL-739
46	Rear End Plate .....	8SL-12	8SL-12
47	Cylinder		
	for nonreversible models .....	8SL-3	8SL-3
	for reversible models .....	8RSL-3	_____
48	Front End Plate .....	8SL-11	8SL-11
49	Front Rotor Bearing .....	WFS182-24	WFS182-24
50	Cylinder Dowel		
	for nonreversible models .....	8SL-98	8SL-98
	for reversible models .....	8RSL-98	_____
51	Front Rotor Bearing Support Assembly .....	8SL-A26	8SL-A26
52	Front Rotor Bearing Retainer .....	AFH120A-362	AFH120A-362
53	Horizontal Hanger .....	8SL-366	8SL-366
*	Shutoff Valve Label .....	_____	6WT-999
*	Tune-up Kit (includes illustrated parts 5, 7 [2], 10, 12, 16, 18, 27, 28, 31, 40, 42, and 45) .....	_____	8T-TK1

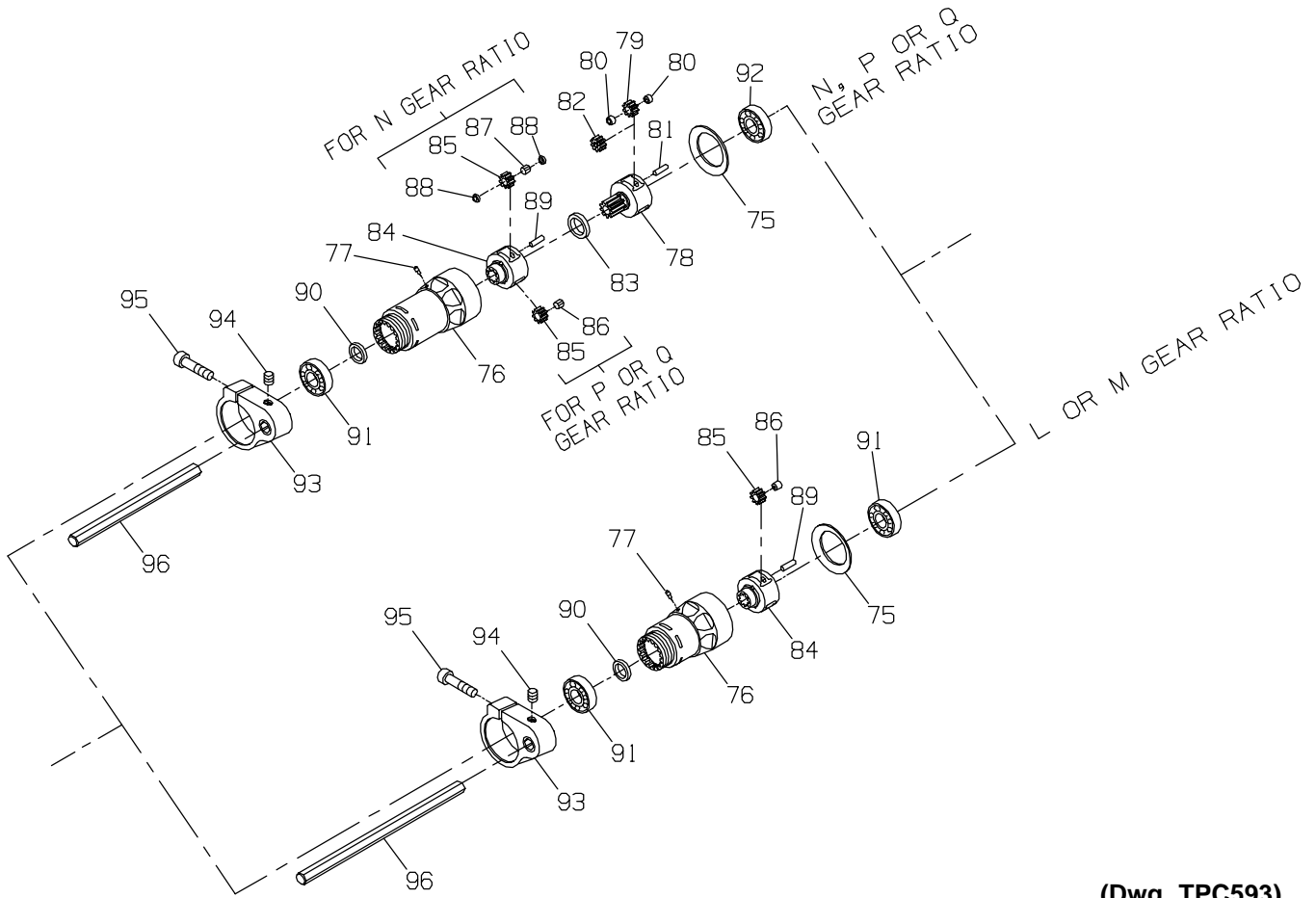
\* Not illustrated.

◆ Indicates Tune-up Kit part.

• To keep downtime to a minimum, it is desirable to have on hand certain repair parts. We recommend that you stock one (pair or set) of each part indicated by a bullet (•) for every four tools in service.

# MAINTENANCE SECTION

## GEAR CASE ASSEMBLY



(Dwg. TPC593)

### PART NUMBER FOR ORDERING

		L Ratio	M Ratio	N Ratio	P Ratio	Q Ratio
75	Motor Clamp Washer .....	8SL-207	8SL-207	8SL-207	8SL-207	8SL-207
76	Gear Case Assembly .....	8SL-A37	8SL-A37	8SN-A37	8SN-A37	8SN-A37
77	Grease Fitting .....	D0F9-879	D0F9-879	D0F9-879	D0F9-879	D0F9-879
	Gear Head Assembly .....	—	—	8SN-A216A	8SP-A216A	8SQ-A216A
78	Gear Head .....	—	—	8SN-216A	8SP-216A	8SQ-216A
79	Planet Gear Assembly (3)					
	for N ratio gearing					
	(16 teeth, color-coded yellow) ..	—	—	8SN-A9	—	—
	for P ratio gearing					
	(15 teeth, color-coded red) .....	—	—	—	8SP-A9	—
	for Q ratio gearing					
	(17 teeth, color-coded green) ...	—	—	—	—	8SQ-A9

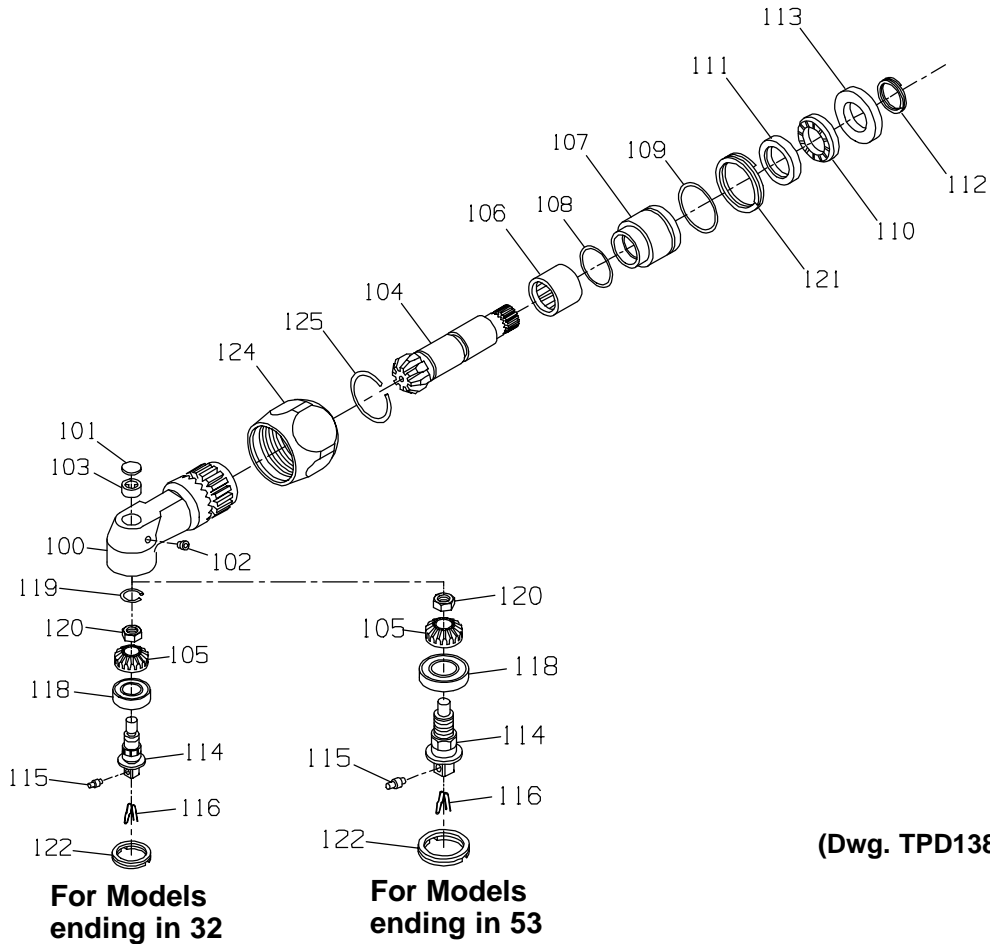


# MAINTENANCE SECTION

## PART NUMBER FOR ORDERING

		↓	↓	↓	↓	↓
		L Ratio	M Ratio	N Ratio	P Ratio	Q Ratio
80	Planet Gear Bearing (2 for each Planet Gear) . . . . .	—	—	8SL-500	8SL-500	8SL-500
81	Planet Gear Shaft (3) . . . . .	—	—	8SN-190	8SN-190	8SN-190
82	Rotor Pinion . . . . .	—	—	8SN-17	8SP-17	8SQ-17
83	Gear Head Spacer . . . . .	—	—	8SN-80	8SN-80	8SN-80
84	Spindle Assembly . . . . .	8SL-A108A	8SM-A108A	8SN-A108A	8SP-A108A	8SP-A108A
	Spindle . . . . .	8SL-108A	8SM-108A	8SN-108A	8SP-108A	8SP-108A
85	Spindle Planet Gear Assembly (3) for L ratio gearing (20 teeth, color-coded black) . . . .	8SL-A10	—	—	—	—
	for M ratio gearing (21 teeth, color-coded white) . . . .	—	8SM-A10	—	—	—
	for N ratio gearing (15 teeth, not color-coded) . . . . .	—	—	8SN-A10	—	—
	for P or Q ratio gearing (18 teeth, color-coded red) . . . . .	—	—	—	8SP-A10	8SP-A10
86	Planet Gear Bearing . . . . .	WFS182-654	WFS182-654	—	WFS182-654	WFS182-654
87	Bearing Roller (15 for each Planet Gear) . . . . .	—	—	8SN-654	—	—
88	Roller Retainer (2 for each Planet Gear) . . . . .	—	—	8SN-655	—	—
89	Planet Gear Shaft (3) . . . . .	8SL-191	8SL-191	8SN-190	8SL-191	8SL-191
90	Spindle Spacer . . . . .	WFS182-111	WFS182-111	WFS182-111	WFS182-111	WFS182-111
91	Spindle Bearing (2 for L and M ratios; 1 for N, P and Q ratios) .	R1602-510	R1602-510	R1602-510	R1602-510	R1602-510
92	Gear Head Bearing . . . . .	—	—	R1602-510	R1602-510	R1602-510
93	Reaction Bar Holder Assembly . . . . .	8SL-A60	8SL-A60	8SL-A60	8SL-A60	8SL-A60
94	Bar Lock Screw . . . . .	9SL-50	9SL-50	9SL-50	9SL-50	9SL-50
95	Adapter Bolt . . . . .	9SL-49	9SL-49	9SL-49	9SL-49	9SL-49
96	Torque Reaction Bar . . . . .	9SL-48	9SL-48	9SL-48	9SL-48	9SL-48

## MAINTENANCE SECTION ANGLE ATTACHMENTS



(Dwg. TPD1385-1)

### PART NUMBER FOR ORDERING



		For Models ending in 32	For Models ending in 53
	Angle Attachment .....	8SA32	8SA53
100	Angle Housing Assembly .....	8SA32-A550	8SA53-A600
101	Angle Housing Cap .....	8SA32-110	182A53-110
102	Grease Fitting .....	D0F9-879	D0F9-879
• 103	Upper Spindle Bearing .....	8SA32-603	182A53-603
•	Matched Gear Set .....	8SA32-A552	182A53-A602
104	Bevel Pinion (not sold separately) .....	_____	_____
105	Bevel Gear (not sold separately) .....	_____	_____
• 106	Bevel Pinion Bearing .....	182A53-606	182A53-606
107	Bevel Pinion Bearing Spacer .....	182A53-A165	182A53-A165
108	Front Seal .....	R18LF-21	R18LF-21
109	Rear Seal .....	C321-606	C321-606
110	Bevel Pinion Thrust Bearing .....	R1610-105	R1610-105
111	Bevel Pinion Thrust Washer .....	182A53-554	182A53-554

- To keep downtime to a minimum, it is desirable to have on hand certain repair parts. We recommend that you stock one (pair or set) of each part indicated by a bullet (•) for every four tools in service.

# MAINTENANCE SECTION

## PART NUMBER FOR ORDERING



		For Models ending in 32	For Models ending in 53
112	Bevel Pinion Snap Ring . . . . .	182A53-689	182A53-689
113	Bevel Pinion Retainer . . . . .	182A53-589	182A53-589
◇ 114	Socket Adapter Spindle Assembly		
+	3/8" Square Drive Flush Spindle . . . . .	8SA32-P507-3/8	_____
+	1/2" Square Drive Flush Spindle . . . . .	_____	182A53-P507-1/2
+	3/8" Square Drive Recessed Spindle . . . . .	8SA32-P607-3/8	_____
+	1/2" Square Drive Recessed Spindle . . . . .	_____	182A53-A607-1/2
115	Socket Retainer . . . . .	5020-716	804-716
116	Socket Retainer Spring . . . . .	401-718	5UHD-718
◇ *	Flush Socket Spindle		
	1/2" Hexagon . . . . .	8SA34-807	182A54-807
	13 mm Hexagon . . . . .	8SA34-807M	182A13MF-807
	9/16" Hexagon . . . . .	_____	182A55-807
	15 mm Hexagon . . . . .	_____	8SA55-807M
	5/8" Hexagon . . . . .	_____	182A56-807
	17 mm Hexagon . . . . .	_____	8SA56-807M
• 118	Lower Spindle Bearing . . . . .	8SA32-593	182A53-593
◇ 119	Bevel Gear Retainer . . . . .	8SA32-578	_____
◇ 120	Bevel Gear Lock Nut . . . . .	_____	182A53-578
121	Bevel Spacer Retainer . . . . .	182A53-685	182A53-685
122	Spindle Bearing Cap . . . . .	8SA32-531	182A53-531
*	Spindle Bearing Cap Wrench . . . . .	8SA32-26	WFS182-26
124	Attachment Coupling Nut . . . . .	8SA32-27	8SA32-27
125	Coupling Nut Retainer . . . . .	182A53-29	182A53-29

\* Not illustrated.

• To keep downtime to a minimum, it is desirable to have on hand certain repair parts. We recommend that you stock one (pair or set) of each part indicated by a bullet (•) for every four tools in service.

◇ When ordering a Socket Adapter Spindle (114) or Flush Socket Spindle, also order a Bevel Gear Retainer (119) or Bevel Gear Lock Nut (120).

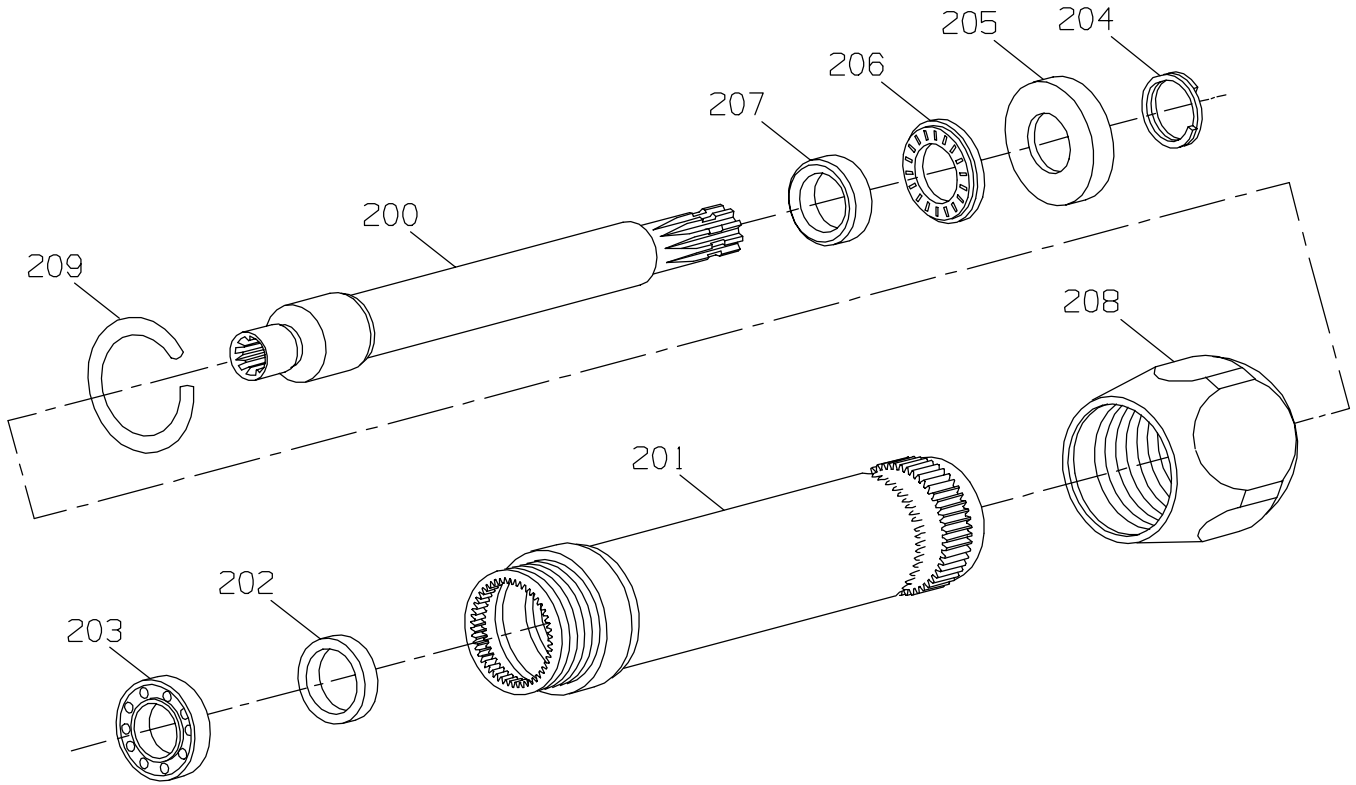
+ **When using Spindle No. 8SA32-P507-3/8 or 182A53-P507-1/2**, the rear face of the socket will be flush with the face of the Angle Housing.

**When using Spindle No. 8SA32-P607-3/8** any socket not exceeding 15/16" diameter will fit up into the Angle Housing, thus reducing the overall height by 1/4".

**When using Spindle No. 182A53-A607-1/2** any socket not exceeding 1-11/32" diameter will fit up into the Angle Housing, thus reducing the overall height by 1/4".

# MAINTENANCE SECTION

## ANGLE HOUSING EXTENSION ASSEMBLY



(Dwg. TPC420)

**PART NUMBER FOR ORDERING** →

**PART NUMBER FOR ORDERING** →

	6" Angle Housing Extension Assembly .....	8SL-A327-6	205	Extension Arbor Retainer . . . .	182A53-589
200	Extension Arbor .....	8SL-327-6	206	Extension Arbor Thrust Bearing .....	R1610-105
201	Arbor Housing .....	8SL-43-6	207	Extension Arbor Thrust Washer .....	182A53-554
202	Arbor Spacer .....	WFS182-111	208	Coupling Nut .....	8SA32-27
203	Arbor Bearing .....	R1602-510	209	Coupling Nut Retainer .....	182A53-29
204	Extension Arbor Snap Ring ..	182A53-689			

## MAINTENANCE SECTION

### WARNING

Always wear eye protection when operating or performing maintenance on this tool.

Always turn off air supply and disconnect air supply hose before installing, removing or adjusting any accessory on this tool, or before performing any maintenance on this tool.

### LUBRICATION

Each time the Series 8RS, 8S, and 8T Angle Wrenches are disassembled for maintenance, repair or replacement of parts, lubricate the tool as follows:

1. Inject approximately 1 cc of Ingersoll-Rand No. 28 Grease into the Grease Fitting (77).
2. Inject approximately 1 cc of Ingersoll-Rand No. 66 Grease into the Grease Fitting (102).
3. Inject approximately 2–1/2 cc of Ingersoll-Rand No. 10 Oil into the air inlet before attaching the air hose.

### DISASSEMBLY

#### General Instructions

1. Do not disassemble the tool any further than necessary to replace or repair damaged parts.
2. Whenever grasping a tool or part in a vise, always use leather-covered or copper-covered vise jaws to protect the surface of the part and help prevent distortion. This is particularly true of threaded members and housings.
3. Do not remove any part which is a press fit in or on a subassembly unless the removal of that part is necessary for repairs or replacement.
4. Do not disassemble the tool unless you have a complete set of new gaskets and O-rings for replacement.
5. Do not press any needle bearing from a part unless you have a new needle bearing on hand for installation. Needle bearings are always damaged during the removal process.

#### Disassembly of the Angle Attachment

1. With the Gear Case Assembly (76) clamped in leather-covered or copper-covered vise jaws with the Angle Housing Assembly (100) upward, unscrew the Attachment Coupling Nut (124).
2. Carefully separate the Angle Housing Assembly from the Gear Case Assembly.

### NOTICE

The Spindle Bearing Cap (122) has left-hand threads. Because an adhesive is used on the threads, it may be necessary to apply moderate heat to release the bond.

### CAUTION

If the application of heat is necessary, apply it only to the area of the Angle Housing Assembly directly over the threads. If this procedure is not followed, the Lower Spindle Bearing (118) may be damaged.

3. Using the No. WFS182–26 Bearing Cap Wrench for the No. 8SA53 Angle Head, or using the No. 8SA32–26 Bearing Cap Wrench for the No. 8SA32 Angle Head, unscrew the Spindle Bearing Cap (122).

### CAUTION

If more than one angle head is disassembled at a time, take care not to mix Bevel Gears (105) and Bevel Pinion (104) from different Angle Heads. These gear sets are specially matched and are available only as matched sets.

4. Withdraw the Socket Adapter Spindle Assembly (114) from the Angle Housing.
5. If required, remove the Bevel Gear Retainer (119) or Bevel Gear Lock Nut (120), the Bevel Gear (105), and the Lower Spindle Bearing (118) from the Socket Adapter Spindle Assembly.
6. If required, release the Socket Retainer (115) by removing the Socket Retainer Spring (116).
7. Remove the Bevel Pinion Snap Ring (112) and slip the Bevel Pinion Retainer (113), Thrust Bearing (110), and Thrust Washer (111) from the bevel pinion shaft.
8. Remove the Bevel Spacer Retainer (121) and withdraw the Bevel Pinion Bearing Spacer (107).

### CAUTION

Do not remove the Pinion from Bevel Pinion Bearing (106) unless you have a new Bearing available.

9. Grasping the bevel pinion shank in leather-covered or copper-covered vise jaws, pull the Pinion from the Angle Housing. Rapping the open end of the Housing with a soft-faced hammer may help remove the Bevel Pinion (104) and Bearing.
10. Press the Upper Spindle Bearing (103) and Angle Housing Cap (101) out of the Angle Housing Assembly.

## MAINTENANCE SECTION

### Disassembly of Gearing Case Assembly

1. Clamp the Gear Case Assembly (76) in leather-covered or copper-covered vise jaws horizontally.
2. Carefully unscrew the Motor Housing Assembly (1) from the Gear Case.

#### NOTICE

**The rear Spindle Bearing (91), Gear Head Bearing (92), and the Motor Clamp Washer (75) will either stay with the Motor Housing Assembly or the Gear Case Assembly.**

3. Remove the Motor Clamp Washer and either Bearing if they stay with the Gear Case Assembly.

#### For N, P, or Q Gear Ratios only

4. Remove the Gear Head (78).

#### NOTICE

**The Planet Gear Assembly (79) holds the Rotor Pinion (82) in place.**

5. Remove the Planet Gear Shaft (81) that secures the Planet Gear Assembly (79).
6. Remove the Rotor Pinion.
7. If required, remove the Planet Gear Bearing (80) from the Planet Gear Assembly.

#### For all Ratios

8. Remove the Spindle Assembly (84).

#### NOTICE

**The Bearing Rollers (87) are free to fall if the Roller Retainer (88) is removed from the Spindle Planet Gear Assembly (85).**

9. Press the Planet Gear Shaft (89) from the splined end of the Spindle Assembly (84).

### Disassembly of Motor

1. Grasp the shaft of the Rotor (50) in leather-covered or copper-covered vise jaws and pull the assembled motor from the Motor Housing Assembly (1).
2. Remove the Front Rotor Bearing Retainer (52) and the Front Rotor Bearing Support Assembly (51).
3. Holding the Cylinder (47), tap the splined end of the Rotor with a light, plastic-faced hammer to remove the Front Rotor Bearing (49), and Front End Plate (48).
4. Remove the Cylinder and Vanes (40) from the Rotor.
5. Remove the Rear Bearing Support Gasket (42) and the Rear Rotor Bearing Support (41).

6. Remove the Rotor Bearing Retaining Nut (44), the Rear Rotor Bearing (43), the Rear End Plate Gasket (45), and the Rear End Plate (46).
7. Examine all motor parts for wear or damage as follows:
  - a. **Vanes** – Check for evidence of cracking, chipping or spalling. Replace the complete set of Vanes if any of these conditions exists.
  - b. **Rotor Bearings** – Check for looseness or roughness. Replace a Bearing if either condition is detected.
  - c. **Cylinder** – Examine the bore. If it is cracked, wavy or rough, replace the Cylinder.
  - d. **End Plates** – Examine the rotor side for scoring. Polish out shallow score marks using fine (320 grit) emery cloth placed on a hard, flat surface. Replace End Plates having deep score marks.
  - e. **Rotor** – Polish the ends of the Rotor with fine emery cloth to remove score marks. Check the spline for excessive wear. Replace a Rotor with a worn or broken spline.

### Disassembly of the Throttle Mechanism

1. Clamp the Motor Housing Assembly (1) in leather-covered or copper-covered vise jaws with the Throttle Lever (30) upward.
2. Drive the Throttle Lever Retaining Pin (31) that secures the Throttle Lever (30), from the Motor Housing.
3. Remove the Throttle Valve Plunger Stop (13), the Throttle Plunger Bushing Assembly (11), and the Throttle Valve Plunger Assembly (9).
4. Rotate the Motor Housing to gain access to the Inlet Bushing (29).
5. Remove the Inlet Bushing, Air Strainer (28), Throttle Valve Spring (18), Throttle Valve Ball (17), Valve Seat Face (15), Throttle Valve Seat Assembly (14), and the Valve Seat Seal (16).

### Disassembly of the Shutoff Valve

#### For Series 8T only

1. Remove the Regulator Body Cap (26).
2. Loosen the Lock Screw (23) and remove the Regulator Adjusting Screw (22).
3. Remove the Regulator Spring (20), and the Regulator Ball (21).
4. Carefully remove the Regulator Body Assembly (19).
5. Remove the Shutoff Valve (2), Shutoff Valve Body (3), the Shutoff Valve Spring (4) and the Shutoff Valve Stop (4A).

## MAINTENANCE SECTION

### Disassembly of the Reverse Valve

For Series 8RS only

#### NOTICE

**The Detent Ball (36) is spring-loaded. Do not lose the Detent Ball or the Detent Spring (37).**

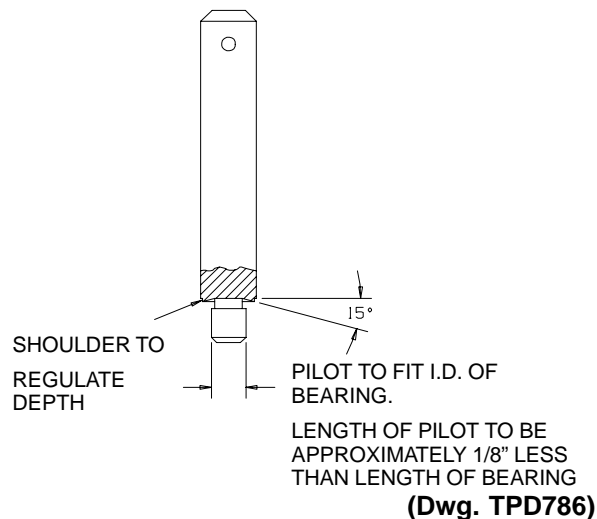
1. Carefully unscrew the Detent Adjusting Screw (38) and remove the Detent Spring and the Detent Ball.
2. Remove the Reverse Valve Knob Pin (35) and the Reverse Valve Knob (34).
3. Pull the Reverse Valve Assembly (32) from the bushing in the Motor Housing Assembly (1).

### ASSEMBLY

#### General Instructions

1. Always press on the **inner** ring of a ball-type bearing when installing the bearing on a shaft.
2. Always press on the **outer** ring of a ball-type bearing when pressing the bearing into a bearing recess.
3. Whenever grasping a tool or part in a vise, always use leather-covered or copper-covered vise jaws. Take extra care with threaded parts and housings.
4. Always clean every part and wipe every part with a thin film of oil before installation.
5. Check every bearing for roughness. If an open bearing must be cleaned, wash it thoroughly in a clean, suitable, cleaning solution and dry with a clean cloth. **Sealed or shielded bearings should not be cleaned.** Work grease into every open bearing before installation.
6. Apply a film of O-ring lubricant to every O-ring before installation.
7. Unless otherwise noted, always press on the stamped end of a needle bearing when installing a needle bearing into a recess. Use a bearing inserting tool similar to the one shown in Dwg. TPD786.

#### Needle Bearing Inserting Tool



\* Registered Trademark of DuPont Corporation.

### Assembly of the Reverse Valve

For Series 8RS only

1. If required, place new Reverse Valve Seals (33) in the grooves on the Reverse Valve Assembly (32).
2. From the Lever (30) side, push the Reverse Valve into the reverse valve bushing in the Motor Housing (1).
3. Place the Reverse Valve Knob (34) onto the exposed hub of the Reverse Valve and secure it using the Reverse Valve Knob Pin (35).
4. Insert the Detent Ball (36), followed by the Detent Spring (37), into the small hole in the Reverse Valve Knob and secure them using the Detent Adjusting Screw (38).

### Assembly of the Shut-off Valve

For Series 8T only

1. Place the Shutoff Valve Stop (4A), Shutoff Valve Spring (4), the Shutoff Valve Body (3), and the Shutoff Valve (2) into the bushing in the Motor Housing.

#### NOTICE

**Make certain the Shutoff Valve Spring seats in the recess in the Shutoff Valve.**

2. Place the Regulator Body Seal (27) on the Regulator Body Assembly (19), apply Loctite Pipe Sealant with Teflon®\* to the threads on the Body and thread the Regulator Body into the Motor Housing Assembly (1) so that it fits snugly.

#### NOTICE

**Do not tighten the Regulator Adjusting Screw (22). The Regulator Spring (20) may be damaged if the Screw is brought down snug.**

3. Place the Regulator Ball (21) followed by the Regulator Spring, smaller diameter first, into the large hole in the top of the Regulator Body. Retain the Ball and Spring using the Regulator Adjusting Screw.
4. Apply Loctite Pipe Sealant with Teflon to the threads of the Sensor Port Plug (25) and insert it into the tapped hole adjacent to the Regulator Adjusting Screw (22) hole.
5. Lock the Regulator Adjusting Screw with the Lock Screw (23).

## MAINTENANCE SECTION

6. Install the Exhaust Deflector Seals (7) into their grooves on the Motor Housing. Wrap the Exhaust Silencer (5) around the Housing in its recess. Slide the Exhaust Deflector (6) over the Seals and retain them using the Deflector Retaining Ring (8). If a Horizontal Hanger (53) is to be used, slide it over the Housing after the Exhaust Deflector and retain it using the Retaining Ring.
7. After assembling the Angle Wrench, adjust the shutoff mechanism as instructed in **Adjustment of Shutoff Valve**.

### Assembly of Throttle

1. Insert the Valve Seat Face (15) into the internal groove and the Valve Seat Seal (16) to the external groove of the Throttle Valve Seat Assembly (14).
2. Insert and firmly seat the assembled Valve Seat, small diameter first, into the tapped end of the Motor Housing (1).
3. With the Housing held firmly in leather-covered or copper-covered vise jaws, inlet bushing end up, place the Throttle Valve Ball (17), the Throttle Valve Spring (18), smaller diameter first, and the Air Strainer (28) into the inlet bushing end.

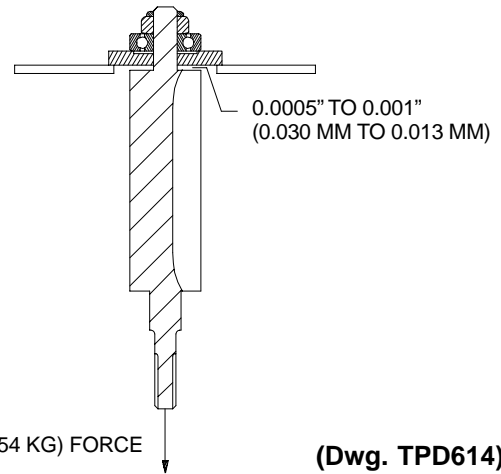
#### NOTICE

**Make certain that the Air Strainer sits within the Inlet Bushing (29).**

4. Thread the Inlet Bushing into the Motor Housing and tighten it to 35 to 45 ft-lb (47 to 61 Nm) torque.
5. Place the Throttle Plunger Bushing Seal (12) on the Throttle Plunger Bushing Assembly (11) and thread the Bushing Assembly into the Motor Housing.
6. Place the Throttle Plunger Seal (10) on the Throttle Valve Plunger Assembly (9) and insert the Plunger, beveled end first, through the Throttle Plunger Bushing Assembly.
7. Install the Throttle Lever (30) using the Throttle Lever Retaining Pin (31) and operate the Lever to check for free movement.

### Assembly of Motor

1. Slide the Rear End Plate (46), recessed face trailing, followed by the Rear Rotor Bearing (43), shielded side trailing, onto the threaded hub of the Rotor (39). Thread the Rotor Bearing Retaining Nut (44) onto the hub a few turns.
2. Support the Rear End Plate, see Dwg. TPD614, and place one 0.001" (0.03 mm) thick shim between the End Plate and a solid rotor boss.



3. While applying a 10 lb (4.54 kg) force downward as illustrated, tighten the Retaining Nut until the spacing of the Rotor and End Plate is approximately 0.001". Remove the shim and manually rotate the pre-loaded Rotor to detect rubbing between the Rotor and End Plate. If rubbing is detected, back the Nut off a turn and repeat this procedure.
4. Stand the assembled Rotor on a workbench with the splined end up. Slide the Cylinder (47) over the Rotor so the 1/8" (3 mm) diameter hole in the Cylinder is aligned with the slot in the Rear End Plate and so the recess port in the end of the Cylinder is to the left of the 1/8" hole when viewed from the splined end.
5. Wipe each Vane (40) with a light coat of Ingersoll-Rand No. 10 Oil. Insert a Vane into each slot in the Rotor. Slide the Front End Plate (48), recessed face trailing, onto the splined Rotor hub.
6. Press the Front Rotor Bearing (49) onto the splined hub and rotate the Rotor manually to make certain it moves freely without binding.

#### NOTICE

**The dowel hole in the bore of the Housing is in line with the Throttle Lever.**

7. Using an 1/8" (3 mm) diameter rod as a guide going through the notch in the Front End Plate, through the hole in the Cylinder, the notch in the Rear End Plate, and the holes in the Rear End Plate Gasket and the Rear Rotor Bearing Support, guide the motor into the bore of the Motor Housing Assembly (1).
8. Carefully remove the guide rod and replace it with the Cylinder Dowel (50).
9. Install the Front Rotor Bearing Retainer (52) in its groove inside the Front Rotor Bearing Support (51).



# MAINTENANCE SECTION

## Assembly of the Gearing Case Assembly

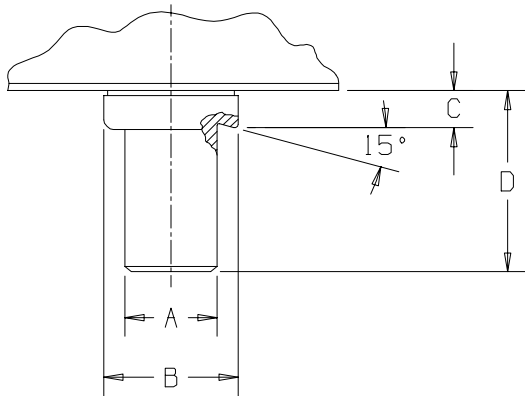
### For the L and M Ratio Gearing

#### NOTICE

**An L or M is stamped on the web of Spindles for L or M ratio gearing.**

1. Press a Planet Gear Bearing (86) into each Spindle Planet Gear (85) to a depth of 0.051" to 0.059" (1.30 mm to 1.50 mm) from the face of the Gear using the proper bearing inserting tool, see Dwg. TPD637-1, Table A, and lubricate the Bearings as instructed in **LUBRICATION**.

### Planet Gear Bearing Inserting Tool



(Dwg. TPD637-1)

2. Insert an assembled Planet Gear into each slot in the Spindle Assembly (84) and press a Planet Gear Shaft (89) into the Spindle through each Planet Gear from the smooth bore hub end of the Spindle.
3. Using the Rotor (50) as a pilot inside the Spindle, insert the Spindle Assembly into the Gear Case Assembly (76).
4. Turn the Gear Case end for end, with the small diameter of the Gear Case up, and slide the Spindle Spacer (90) onto the end of the Spindle.
5. Support the motor end of the Spindle and press the front Spindle Bearing (91) onto the end of the Spindle.

6. Place the Motor Clamp Washer (75), concave (dished) face first, over the unsplined end of the Spindle.
7. Press the rear Spindle Bearing (91) into the large recess in the Front Rotor Bearing Support (51) and slide the Bearing and Support onto the hub of the Spindle.

### For the N, P and Q Ratio Gearing

#### NOTICE

**An N, P, or Q is stamped on the web of Gear Heads for N, P and Q ratio gearing.**

1. **For N ratio gearing** – Apply a liberal amount of the recommended grease to the inside diameter of each Spindle Planet Gear (85) and place fifteen Bearing Rollers (87) against the inside diameter of each Gear. Install a Roller Retainer (88) to each end of each Gear.
- For P and Q ratio gearing** – Press two Planet Gear Bearings (86) into each Planet Gear to a depth of 0.005" to 0.010" (0.13 mm to 0.25 mm) from the face of the Gear.
2. Insert an assembled Gear into each slot in the Spindle and press a Planet Gear Shaft (89) from the smooth bore end of the Spindle into the pin holes to retain the Gears.
3. Using the unassembled Gear Head (78) as a pilot through the center of the assembled Spindle Assembly (84), insert the Spindle and Planet Gears into the Gear Case. Take care to engage the Planet Gears with the internal gear in the Gear Case.
4. Slowly withdraw the Gear Head from the Gear Case.
5. Press two Planet Gear Bearings (80) into each of the Planet Gears (79).
6. Insert an assembled Planet Gear into each slot in the Gear Head, capturing the Rotor Pinion (82) in the Gear Head, and retain the Gears by pressing the Planet Gear Shafts (81) from the smooth outside diameter end of the Gear Head.
7. Slide the Gear Head Spacer (83) over the geared end of the Gear Head and insert this assembly into the Gear Case. Make certain the Gear Head properly meshes with the Spindle Planet Gears (85).

**TABLE A**

Bearing Number	A		B		C		D	
	Min	Max	Min	Max	Min	Max	Min	Max
WFS182-654	0.152" (3.86 mm)	0.153" (3.89 mm)	0.265" (6.73 mm)	0.266" (6.76 mm)	0.051" (1.30 mm)	0.059" (1.50 mm)	0.296" (7.52 mm)	0.312" (7.92 mm)
8SL-500	0.1207" (3.07 mm)	0.1217" (3.09 mm)	0.234" (5.94 mm)	0.235" (5.97 mm)	0.005" (0.13 mm)	0.010" (0.25 mm)	0.125" (3.18 mm)	0.140" (3.56 mm)

## MAINTENANCE SECTION

8. Place the Gear Case Assembly on the workbench with the small diameter up and slide the Spindle Spacer (90) onto the end of the Spindle.
9. Support the motor end of the Gear Head and press the front Spindle Bearing (91) onto the Spindle.
10. Turn the Gear Case end for end and place the Motor Clamp Washer (75), concave (dished) face first, over the Gear Head. Make certain that the outside diameter of the Motor Clamp Washer contacts the end of the ring gear teeth.
11. Press the Gear Head Bearing (92) into the large recess in the Front Rotor Bearing Support and slide the Bearing onto the hub of the Gear Head.
12. Slide the Reaction Bar Holder Assembly (93) over the Gear Case Assembly. Secure it to the Gear Case by tightening the Adapter Bolt (95). Place the Torque Reaction Bar (96) into the Reaction Bar Holder Assembly and secure it with the Bar Lock Screw (94).

### Assembly of Angle Attachment

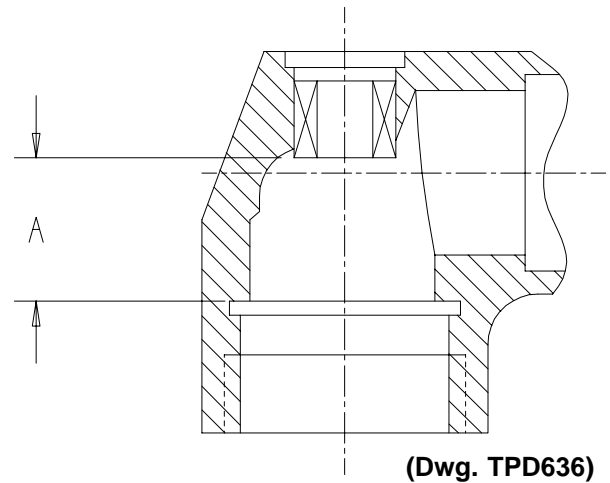
1. Lubricate the Bevel Pinion (104) as instructed in **LUBRICATION** and insert it, gear end first, into the long bore of the Angle Housing Assembly (100).
2. Lubricate the Bevel Pinion Bearing (106) as instructed in **LUBRICATION** and insert it, unstamped end first, into the bore of the Angle Housing, after the Bevel Pinion.
3. Using a bearing inserting tool, see Dwg. TPD786, press the Bearing so the stamped face is 1–11/32” (34 mm) below the end face of the Angle Housing.
4. Install the Front Seal (108) and the Rear Seal (109) onto the Bevel Pinion Bearing Spacer (107).
5. Insert the Spacer, small diameter first, into the long bore of the Angle Housing and retain it using the Bevel Spacer Retainer (121).
6. Lubricate the Bevel Pinion Thrust Bearing (110) as instructed in **LUBRICATION**. Install, in the following order; the Bevel Pinion Thrust Washer (111), Bevel Pinion Thrust Bearing and the Bevel Pinion Retainer (113), recessed face trailing, over the splined end of the Bevel Pinion. Retain these parts using the Bevel Pinion Snap Ring (112).
7. If the Lower Spindle Bearing (118) has been removed, press the new Bearing onto the Socket Adapter Spindle Assembly (114) with the red side closest to the square drive end.
8. Press the Bevel Gear (105), geared side trailing, onto the ground end of the Spindle and into contact with the Lower Spindle Bearing.
9. **For No. 8SA32** – Retain the Bevel Gear using the Bevel Gear Retainer (119).

**For No. 8SA53** – Clean the threads on the Spindle, apply a film of thread locking compound to the threads, apply the Bevel Gear Lock Nut (120) and tighten it to a minimum of 25 ft–lb (34 Nm) torque.

### CAUTION

**Press on the stamped face of the Upper Spindle Bearing (103). Failure to do so will cause damage to the Bearing.**

10. If the Spindle Upper Bearing was removed, press a new Bearing into the Angle Housing (100) from the large threaded end to the dimension, shown in Dwg. TPD636 and Table B.



**TABLE B**

<b>Minimum Dimension “A”</b>		
<b>Angle Attachment</b>	<b>in</b>	<b>mm</b>
8SA32	0.718	18.25
8SA53	0.683	17.35
<b>Maximum Dimension “A”</b>		
8SA32	0.728	18.50
8SA53	0.693	17.60

11. Lubricate the Upper Spindle Bearing as instructed in **LUBRICATION** and press the Angle Housing Cap (101) into its recess.
12. Insert the assembled Socket Adapter Spindle Assembly (114) into the Angle Housing, clean the threads on the Angle Housing and Spindle Bearing Cap (122), apply a film of thread locking compound to the threads and tighten the Bearing Cap to a minimum of 25 ft–lb (34 Nm) torque.

## MAINTENANCE SECTION

13. Slide the Attachment Coupling Nut (124), threaded end trailing, over the splined end of the Angle Housing.
14. Apply the Coupling Nut Retainer (125) to the external groove on the splined end of the Angle Housing.
15. Engage the spline on the Bevel Pinion (104) with the matching spline on the Spindle Assembly (84) and tighten the Coupling Nut (124) to a minimum of 35 ft–lb (47 Nm) torque.

### Adjustment of Shutoff Valve

#### NOTICE

**Adjustment to the Shutoff Valve system is preset at the factory. Do not adjust any part of the Valve unless, after prolonged use of the Tool, the Tool shuts off prematurely or the Tool fails to shut off. Only if either of these conditions exist are you to adjust the Valve. Adjust the Valve according to the procedures below.**

**If premature shutoff occurs, proceed as follows:**

#### NOTICE

**The Bleed Adjusting Screw is located in the tapped port marked “A” on the face of the Regulator Body Assembly. The port marked “S” is a signal port to be used with monitoring equipment.**

1. Set the inlet air pressure at 90 psig (6.2 bar/620 kPa) with the motor running. Slightly rotate the Bleed Adjusting Screw (24) counterclockwise and slowly depress the Throttle lever to determine continual motor operation. If necessary, repeat this procedure until the motor runs and remains running with the Lever depressed.
2. Securely anchor the Wrench and run it on a Model J Skidmore Test Stand a number of times at 50 psig (3.4 bar/340 kPa) air pressure and at 90 psig air pressure. The tool must shut off when tested at each pressure setting. If the Angle Wrench fails to shut off, adjust the Shutoff Valve as follows:
3. Operate the tool at 90 psig as instructed in Step 2. Release the Throttle lever and rotate the Bleed Adjusting Screw slightly clockwise and retest the tool. Continue testing and adjusting the Valve a slight amount each time until the Wrench shuts off properly.

## TEST AND INSPECTION

### PROCEDURE

Run the performance tests at 90 psig (6.2 bar/620 kPa) air pressure at the inlet of the tool using 1/2” (13 mm) inside diameter supply hose.

1. Check the free speed of the Angle Wrench using a hand-held tachometer applied to the spindle. The minimum allowable free speeds are listed below.

Model	Stamped Free Speed, rpm (r/min)	Minimum Free Speed rpm (r/min)
8SM32	1110	1000
8SN32	840	760
8SP53	610	550
8RSL32	1140	1030
8RSM32	890	800
8RSN32	670	610
8RSP53	490	440
8RSQ53	420	380
8TM32	1110	1000
8TN32	840	760
8TP53	610	550
8TQ53	520	470

2. Using a Model J Skidmore tester, operate the Wrench to determine torque output. The minimum allowable torque levels are as follows:

Model	Minimum Torque	
	ft–lb	Nm
8SM32	23	31
8SN32	30	41
8SP53	40	54
8RSL32	16	22
8RSM32	21	28
8RSN32	27	37
8RSP53	36	49
8RSQ53	45	61
8TM32	23	31
8TN32	30	41
8TP53	40	54
8TQ53	50	68

## MAINTENANCE SECTION

3. There must be no objectionable leaks in any non-exhaust areas. The exhaust deflector must rotate manually.
4. The throttle must operate freely and must not remain open when the lever is released with air at the inlet
5. The angle attachment, gear case and motor case must not generate excessive heat. Operate the tool at free speed for 20 seconds.

**WARNING**

**Disconnect the air supply hose to the tool before proceeding.**

6. Rotate the output spindle using a wrench. The spindle must rotate smoothly with no binding.
7. Examine the tool to see that the throttle lever is on the opposite side of and in line with the output spindle.

### TROUBLESHOOTING GUIDE

Trouble	Probable Cause	Solution
Low power or low free speed	Low air pressure	Check the air line pressure at the inlet. The pressure must not exceed 90 psig (6.2 bar/620 kPa) at the inlet.
	Plugged Inlet Bushing Screen or Air Strainer Screen	Clean the Screen in a clean, suitable, cleaning solution. If it cannot be cleaned, replace it.
	Worn or broken Vanes	Replace the <b>complete</b> set of Vanes.
	Loose Rotor Bearing Retaining Nut	Tighten the Nut.
	Worn or broken Cylinder	Replace the Cylinder if it is worn or broken or if the bore is scored or wavy.
	Scoring of End Plates	Replace End Plates if they are scored.
	Improper lubrication or dirt build-up in the motor.	Lubricate the Wrench as instructed in <b>LUBRICATION</b> . If lubrication does not result in satisfactory operation, disassemble the motor inspect and clean all parts.
Scoring	Improper assembly	Make certain that all motor or Cylinder parts are properly aligned prior to clamping the motor assembly.
Gear Case gets hot	Excessing grease	Clean and inspect the Gear Case gearing parts and lubricate as instructed in <b>LUBRICATION</b> .
	Worn or damaged parts	Clean and inspect the Gear Case and gearing. Replace worn or broken components.
Tool fails to shut off	Dirt or burrs on Shutoff Valve or Bushing	Clean the parts and remove the burrs.
	Bleeder ports plugged	Clean the bleeder ports with fine wire.

**NOTICE**

**SAVE THESE INSTRUCTIONS. DO NOT DESTROY.**