

SERIES RR2 90 X 90 ANGLE DRILLS

NOTICE

Series RR2 90 x 90 Angle Drills are designed for drilling operations in the aerospace, automotive, appliance, machining and furniture industries. ARO is not responsible for customer modification of tools for applications on which ARO 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 all regulations (local, state, federal and country), that may apply to hand held/hand operated pneumatic tools.
- 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.
- 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 (6.2 bar/620 kPa) 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, long hair and jewelry away from working 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.

- Keep body stance balanced and firm. Do not overreach when operating this tool. Anticipate and be alert for sudden changes in motion, reaction torques, or forces during start-up and operation.
- Tool accessory 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 ARO.
- This tool is not insulated against electric shock.
- This tool is not designed for working in explosive atmospheres.
- Do not carry or drag the tool by the hose.
- Prevent exposure and breathing of harmful dust and particles created by power tool use:
Some dust created by power sanding, sawing, grinding, drilling and other construction activities contains chemicals known to cause cancer, birth defects or other reproductive harm. Some examples of these chemicals are:
 - lead from lead based paints,
 - crystalline silica from bricks and cement and other masonry products, and
 - arsenic and chromium from chemically treated lumber.

Your risk from these exposures varies, depending on how often you do this type of work. To reduce your exposure to these chemicals: work in a well ventilated area, and work with approved safety equipment, such as those dust masks that are specially designed to filter out microscopic particles.

NOTICE

The use of other than genuine ARO 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 ARO Authorized Servicenter.

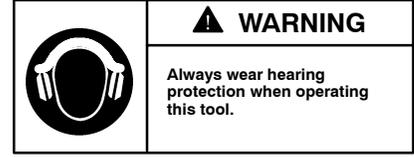
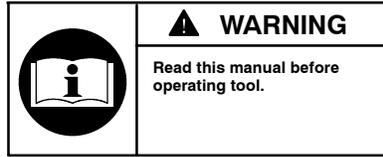
For parts and service information, contact your local ARO distributor, or the Customer Service Dept. of the Ingersoll-Rand Distribution Center, White House, TN at PH: (615) 672-0321, FAX: (615) 672-0801.

ARO Tool Products

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WARNING SYMBOL IDENTIFICATION



PLACING TOOL IN SERVICE

LUBRICATION



IRAX No. 10



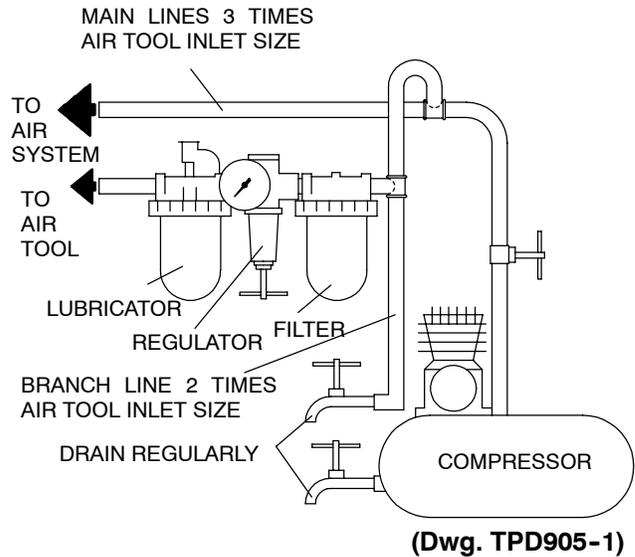
**Gearing:
IRAX No. 67**

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

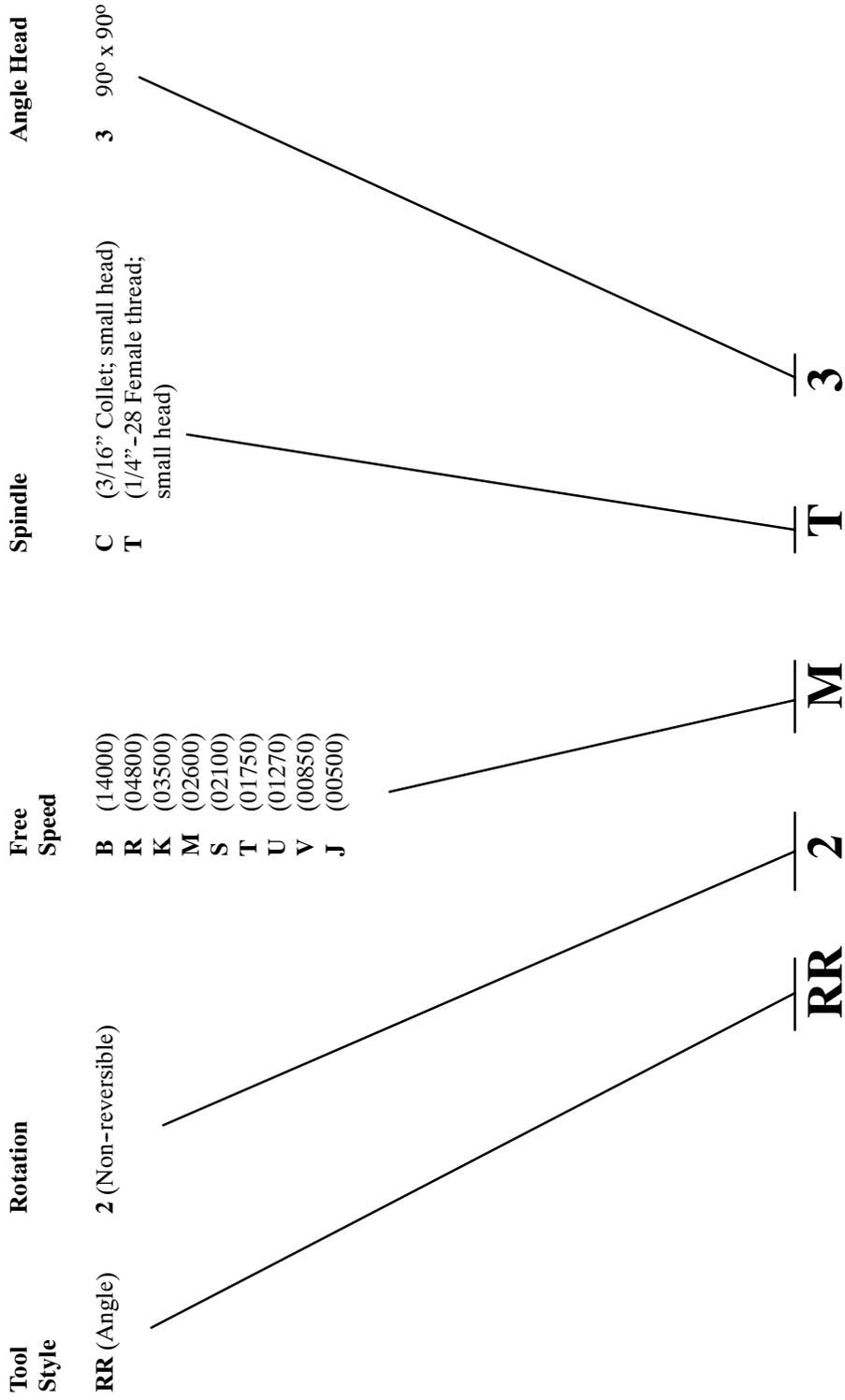
For USA - No. C08-02-FKG0-28

Whenever the tool is disassembled for maintenance or repair, lubricate the gear train with IRAX No. 67 Grease.

After every 40,000 cycles or one month, or as experience indicates, inject 2 to 4 cc of IRAX No. 67 Grease into the Grease Fitting on the Angle Attachment.



MODEL IDENTIFICATION



PERCEUSES D'ANGLE DE LA SERIE RR2

NOTE

Les perceuses d'angle de la Série RR2 sont destinées aux opérations de perçage dans les industries de l'aérospatiale, de l'automobile, des appareils ménagers, de l'électronique, de l'usinage et des meubles.

ARO 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 ARO.

ATTENTION



**D'IMPORTANTES INFORMATIONS DE SECURITE SONT JOINTES.
 LIRE CE MANUEL AVANT D'UTILISER L'OUTIL.
 L'EMPLOYEUR EST TENU A 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

- Cet outil doit toujours être exploité, inspecté et entretenu conformément à toutes les réglementations (locales, départementales, fédérales et nationales), applicables aux outils pneumatiques tenus/commandés à la main.
- 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 (620 kPa) maximum à l'entrée.
- 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 (620 kPa). 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.
- Gardez les mains, vêtements amples, cheveux longs et bijoux 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.
- Garder une position équilibrée et ferme. Ne pas se pencher trop en avant pendant l'utilisation de cet

- outil. Anticiper et prendre garde aux changements soudains de mouvement, couples de réaction ou forces lors du démarrage et de l'exploitation.
- La percussion 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 ARO.
- Cet outil n'est pas conçu pour fonctionner dans des atmosphères explosives.
- Cet outil n'est pas isolé contre les chocs électriques.
- Ne transportez pas l'outil par son flexible d'air comprimé.
- Evitez toute exposition et respiration des poussières et particules nocives créées par l'emploi de l'outil pneumatique:

Certaines poussières produites par les opérations de ponçage, sciage, meulage, perçage et autres activités de construction contiennent des produits chimiques qui sont reconnus comme pouvant causer le cancer, des infirmités de naissance ou d'autres risques à effets nocifs. Parmi ces produits chimiques on trouve:

- le plomb des peintures à base de plomb,
- les cristaux de silice contenus dans les briques, le ciment et d'autres produits de maçonnerie, et
- l'arsenic et le chrome des bois traités chimiquement.

Le risque présenté par l'exposition à ces poussières est fonction de la fréquence et du type de travail effectué. Pour réduire l'exposition à ces produits chimiques : travaillez dans une zone bien aérée, et utilisez les équipements de sécurité approuvés, tels que les masques à poussière qui sont spécialement conçus pour filtrer et arrêter les particules microscopiques.

NOTE

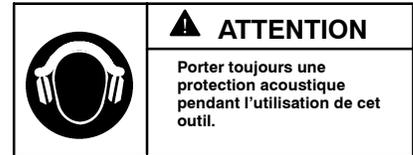
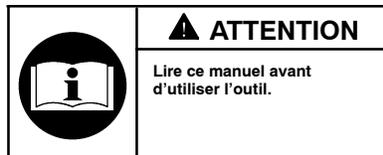
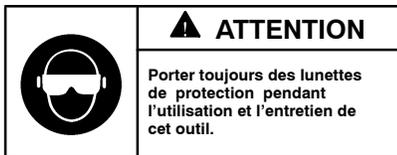
L'utilisation de rechanges autres que les pièces d'origine ARO peut causer des risques d'insécurité, réduire les performances de l'outil et augmenter l'entretien, et peut annuler toutes les garanties. Les réparations ne doivent être effectuées que par des réparateurs qualifiés autorisés. Consultez votre Centre de Service ARO le plus proche.

Pour les informations relatives aux pièces et au service, contactez votre distributeur ARO.

ARO Tool Products



SIGNIFICATION DES SYMBOLES D'AVERTISSEMENT



MISE EN SERVICE DE L'OUTIL

LUBRIFICATION



IRAX No. 10



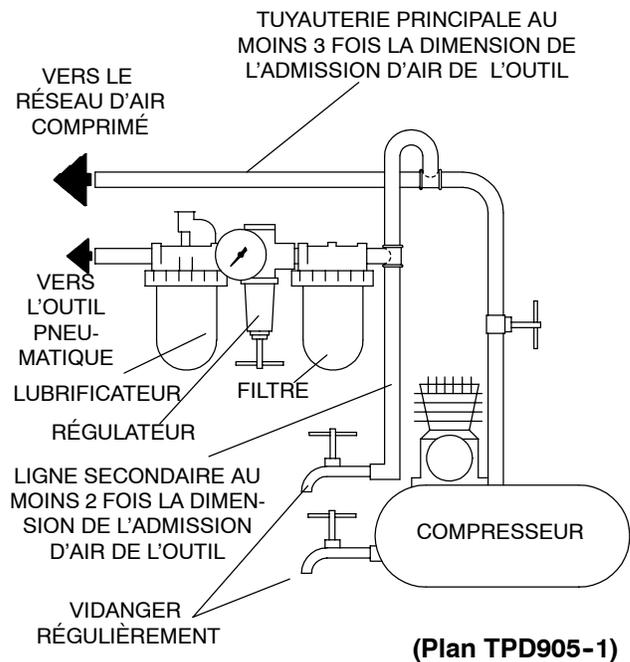
Pignonnerie:
IRAX No. 67

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

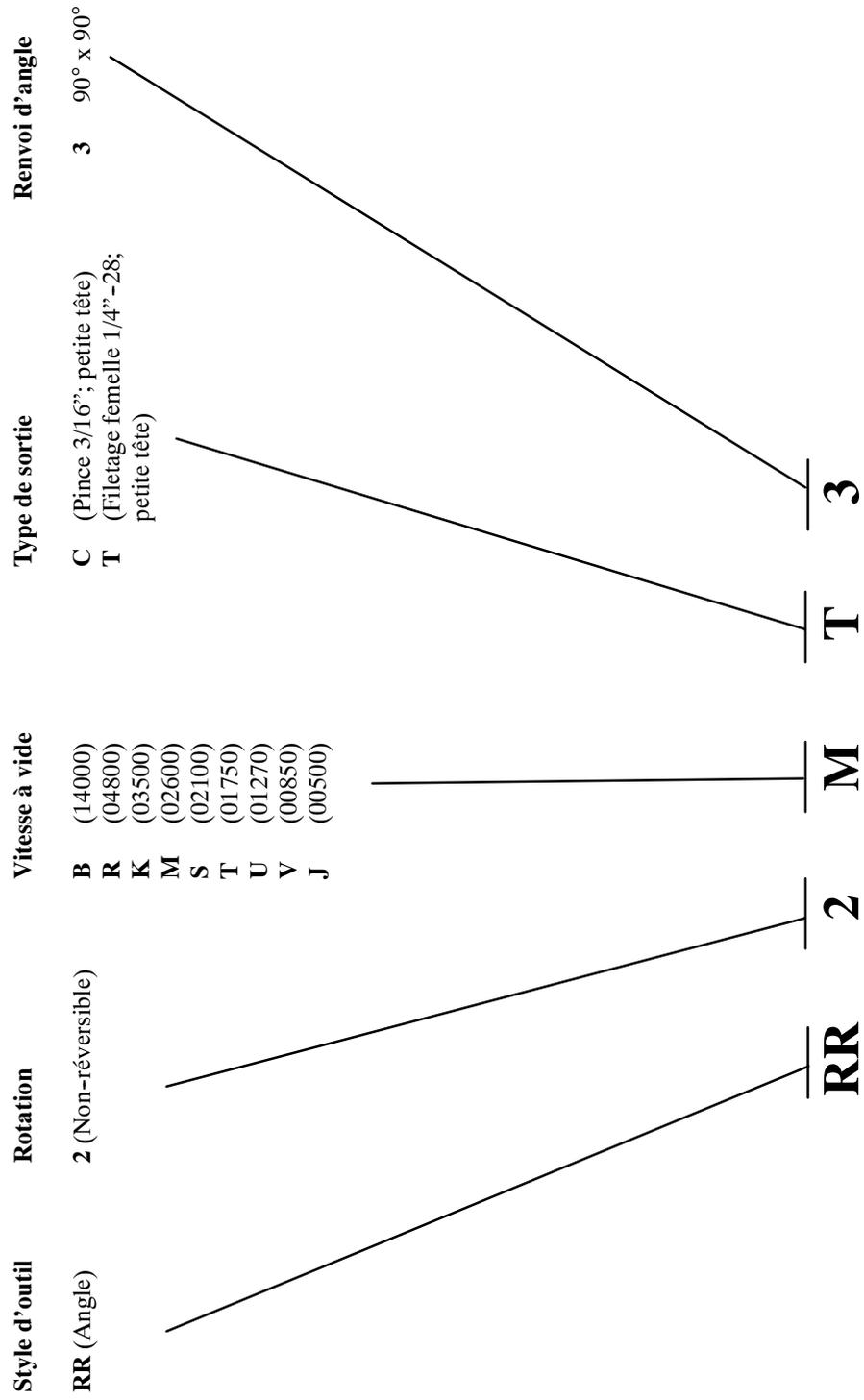
É.U. - No. C08-02-FKG0-28

Lubrifier le train d'engrenages avec de la graisse IRAX No. 67 à **chaque fois que l'outil est démonté pour entretien ou réparation.**

Tous les 40.000 cycles ou au moins tous les mois, selon le cas, injecter 2 à 4 cm³ de graisse IRAX No. 67 dans le raccord de graissage du renvoi d'angle.



IDENTIFICATION DES MODÈLES

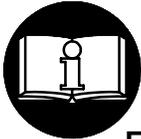


TALADROS ANGULARES DE LA SERIE RR2

NOTA

Los taladros angulares de la serie RR2 están diseñados para las operaciones de taladrado de las industrias aeroespacial, del automóvil, de electrodomésticos, electrónica, mecánica y del mueble.

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



⚠ 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**

- Use, inspeccione y mantenga esta herramienta siempre de acuerdo a todas las normativas (locales, estatales, federales, nacionales), que apliquen a las herramientas neumáticas de operación y agarre manual.
- 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.
- 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. TPD905-1 para un típico arreglo de tuberías.
- Use siempre aire limpio y seco a una máxima presión de 90 psig (6,2 bar/620kPa). 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.

- herramienta. Anticipe y esté atento a los cambios repentinos en el movimiento, pares de reacción u otras fuerzas durante la puesta en marcha y utilización.
- El accesorio de herramienta podría 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 ARO recomendados.
- Esta herramienta no ha sido diseñada para trabajar en ambientes explosivos.
- Esta herramienta no está aislada contra descargas eléctricas.
- No lleve ni arrastre la herramienta sujetándola por la manguera.
- Evite respirar el polvo y partículas nocivos que se producen al utilizar la herramienta, así como exponerse a ellos:

Ciertos tipos de polvo que se producen al lijar, serruchar, rectificar o taladrar y durante otras actividades de la construcción contienen sustancias químicas que son conocidas como causantes de cáncer, defectos de nacimiento y otros daños reproductivos. Algunos ejemplos de estas sustancias químicas:

- el plomo de las pinturas con base de plomo,
- la sílice cristalina de ladrillos y hormigón y otros productos asociados con la albañilería, y
- el arsénico y el cromo que produce la madera sometida a tratamientos químicos.

El riesgo a la persona que presenta una exposición de este tipo varía en función de la frecuencia con que se realiza esta clase de trabajo. Para reducir la exposición a estas sustancias químicas: trabaje en una zona bien ventilada y utilice equipo de protección homologado, por ejemplo una mascarilla especialmente diseñada para filtrar partículas microscópicas.

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, el cabello largo y las alhajas apartados del extremo de trabajo 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.
- Mantenga una postura del cuerpo equilibrada y firme. No estire demasiado los brazos al manejar la

NOTA

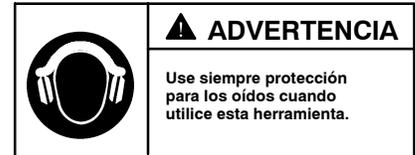
El uso de piezas de recambio que no sean las auténticas piezas ARO podría poner en peligro la seguridad, reducir el rendimiento de la herramienta y aumentar los cuidados de mantenimiento necesarios, así como invalidar toda garantía.

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

Pour les informations relatives aux pièces et au service, contactez votre distributeur ARO.

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IDENTIFICACIÓN DE SÍMBOLOS DE AVISO



PARA PONER LA HERRAMIENTA EN SERVICIO

LUBRICACION



IRAX N° 10



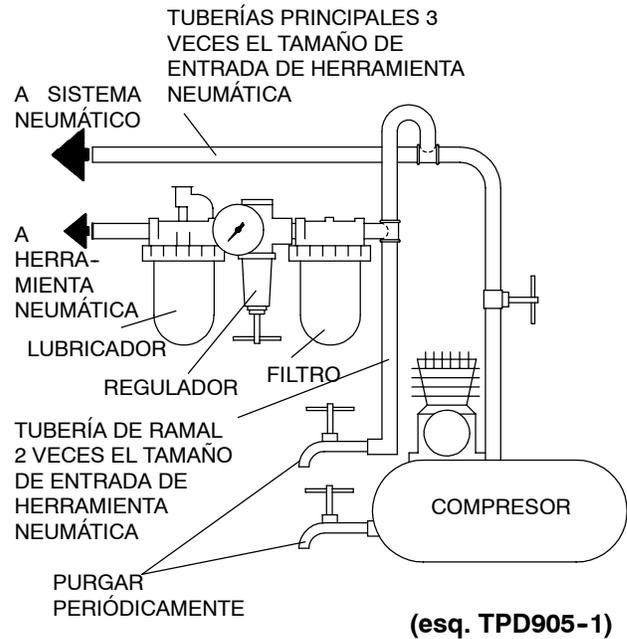
**Engranajes:
IRAX N° 67**

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

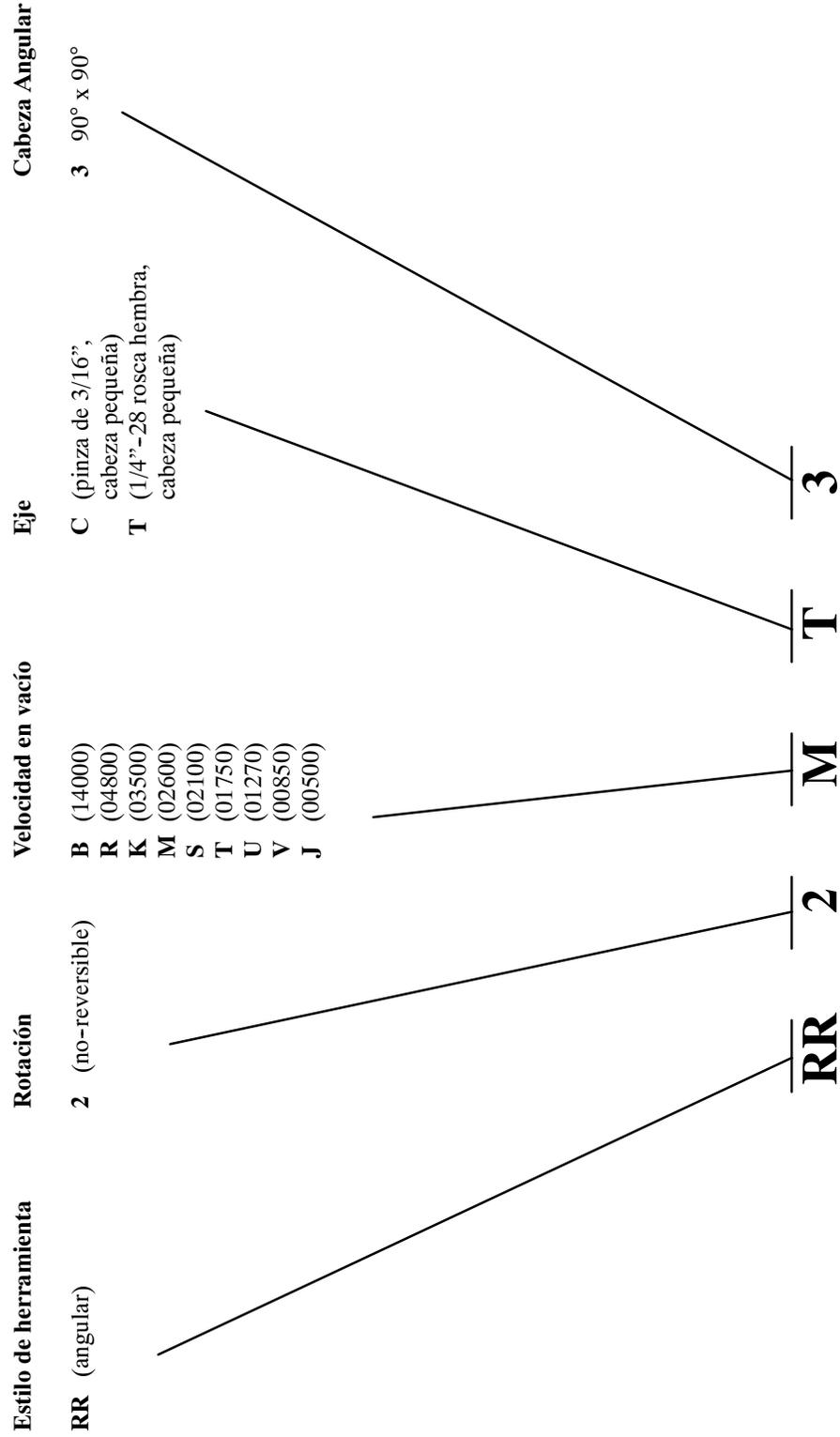
EE.UU. - N° C08-02-FKG0-28

Cada vez que se desarme la herramienta para realizarle trabajos de mantenimiento o reparación, lubrique el tren de engranajes con grasa IRAX N° 67.

Después de cada 40,000 ciclos o un mes de uso, o según indique la experiencia, inyecte 2-4 cc de grasa IRAX N° 67 en el engrasador de la cabeza angular.



IDENTIFICACIÓN DE MODELOS



BERBEQUINS EM ÂNGULO SÉRIE RR2



AVISO

Os Berbequins em Ângulo Série RR2 são concebidos para operações de perfuração nas indústrias aeroespacial, automóvel, de aparelhos, electrónica, de maquinagem e de mobiliário. A ARO não é responsável por modificações, feitas pelo cliente em ferramentas, nas quais a ARO 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 DESTES MANUAIS NAS MÃOS DO OPERADOR.**

**O NÃO CUMPRIMENTO DAS SEGUINTE ADVERTÊNCIAS PODE RESULTAR EM FERIMENTOS.
COLOCANDO A FERRAMENTA
EM FUNCIONAMENTO**

- Opere, inspecione e mantenha sempre esta ferramenta de acordo com todas regulamentações (local, estadual, federal e do país), que possam ser aplicadas às ferramentas pneumáticas operadas manualmente ou seguras com as mãos.
- 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.
- 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 6,2 bar/620 kPa (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, roupas soltas, cabelos longos e jóias afastados da extremidade de trabalho da ferramenta.
- 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.

- Mantenha o corpo numa posição equilibrada e firme. Não estique o corpo ao operar esta ferramenta. Esteja preparado e alerta para mudanças súbitas no movimento, binários ou forças de reacção durante o arranque e o funcionamento.
- 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 ARO.
- Esta Ferramenta não foi concebida para trabalhos em atmosferas explosivas.
- Esta Ferramenta não está isolada contra choques eléctricos.
- Não transporte ou arraste a ferramenta pela mangueira.
- Evite expor-se e respirar as poeiras e partículas nocivas criadas pela utilização de ferramentas motorizadas:

Algumas poeiras criadas por operações motorizadas de lixar, serrar, rectificar, perfurar e outras actividades de construção contêm produtos químicos conhecidos por causarem cancro, malformações congénitas e terem efeitos nocivos na reprodução. Alguns exemplos desses produtos químicos são:

- chumbo de tintas à base de chumbo,
- sílica cristalina de tijolos e cimento e outros produtos de alvenaria e
- arsénico e crómio de madeira tratada quimicamente

Os riscos dessas exposições varia, dependendo de com que frequência faz esse tipo de trabalho. Para reduzir a sua exposição a esses produtos químicos: trabalhe numa área bem ventilada e com equipamento de segurança aprovado, como as máscaras contra a poeira que são especialmente projectadas para filtrar partículas microscópicas.

AVISO

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

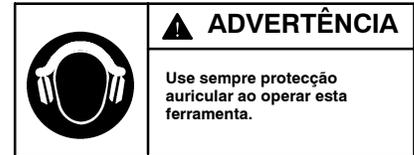
As reparações devem ser feitas somente por pessoal treinado autorizado. Consulte o Centro de Serviços da ARO mais próximo.

Para obter informações sobre peças e assistência, contacte o seu distribuidor local ARO.

ARO Tool Products



IDENTIFICAÇÃO DO SÍMBOLO DE AVISO



COLOCANDO A FERRAMENTA EM FUNCIONAMENTO

LUBRIFICAÇÃO



IRAX. 10



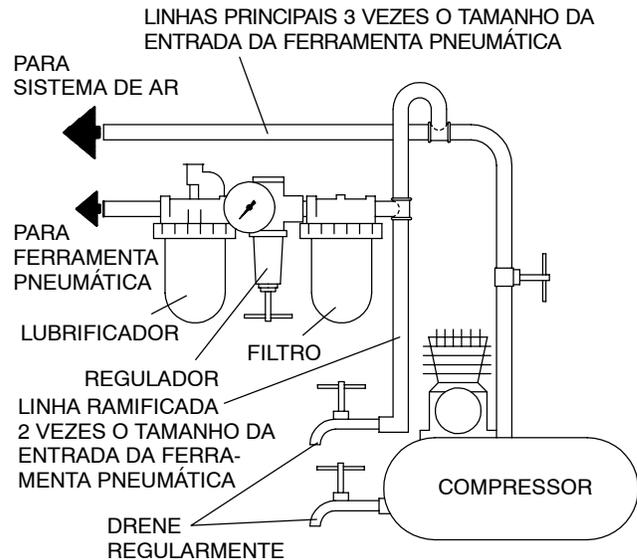
Engrenagem:
IRAX No. 67

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

Para E.U.A. - No. C08-02-FKG0-28

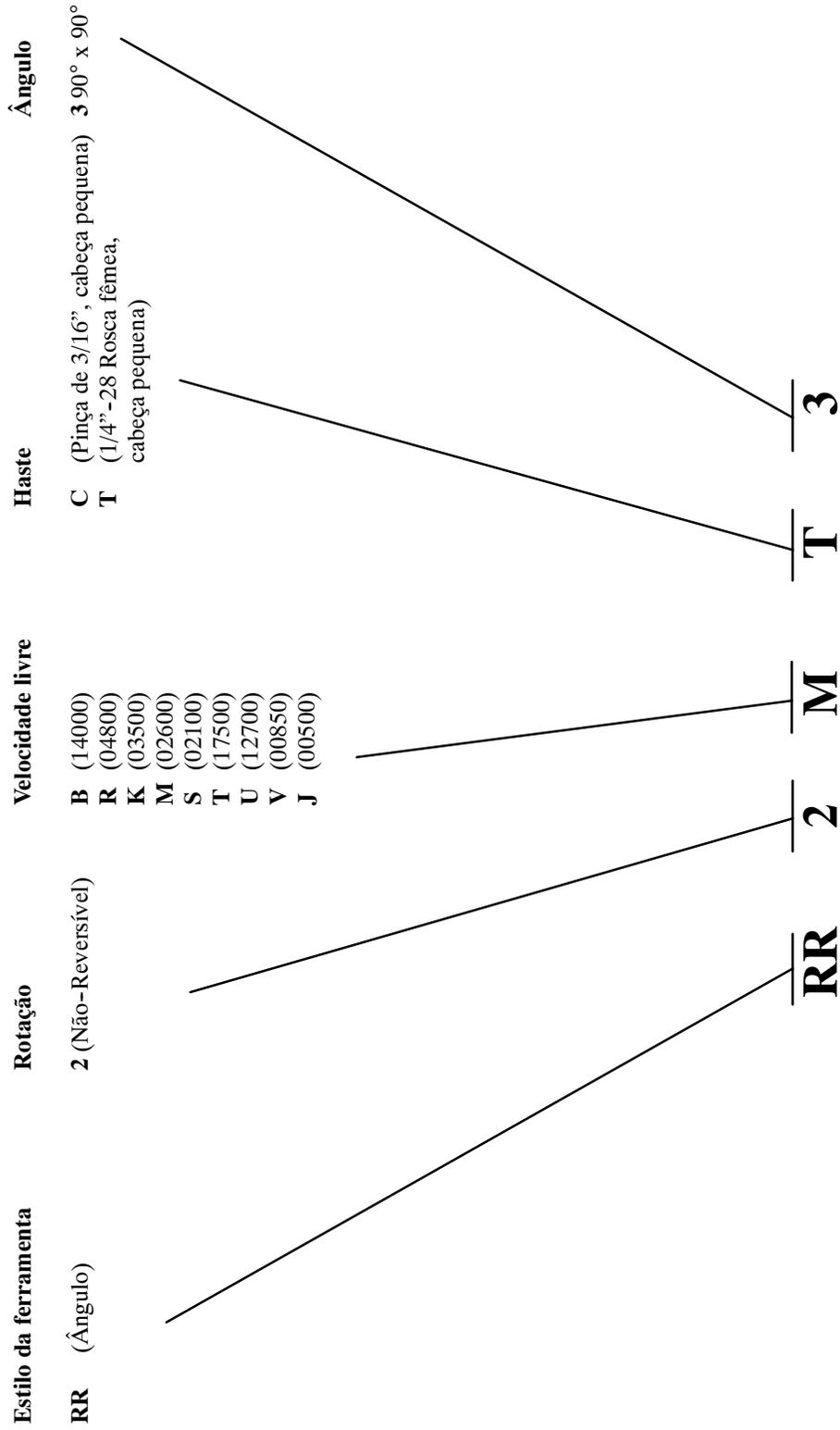
Sempre que a ferramenta for desmontada para manutenção ou reparação, lubrifique o trem de engrenagens com Massa IRAX Nº 67.

Após cada 40 000 ciclos ou um mês, ou conforme a experiência indicar, injecte 2 a 4 cc de Massa Lubrificante IRAX Nº 67 no copo de lubrificação do acessório em ângulo.

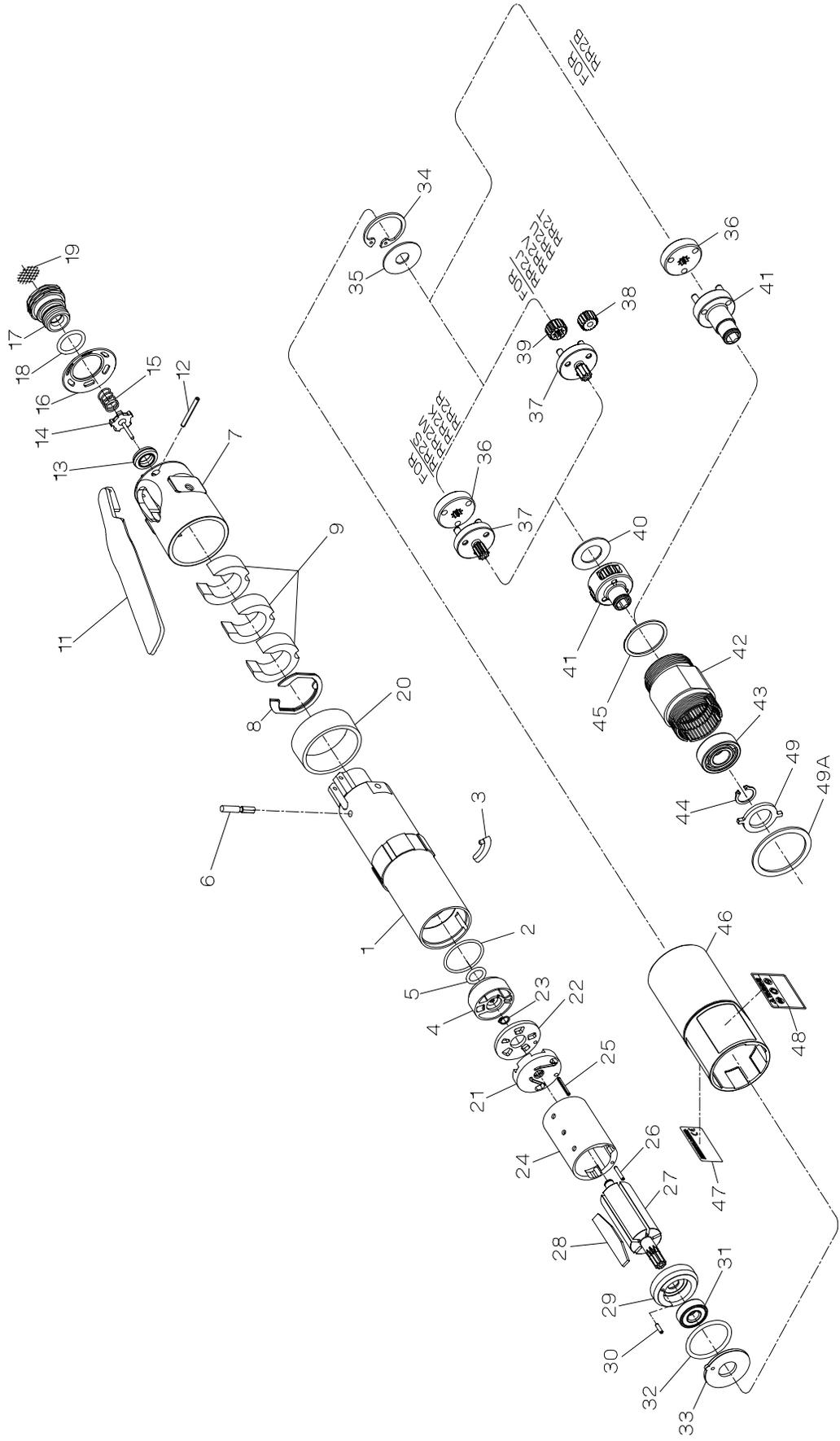


(Desenho TPD905-1)

MODEL IDENTIFICATION



MOTOR AND GEARING FOR SERIES RR2 90 X 90 ANGLE DRILLS



(Dwg. ATP77)

MOTOR AND GEARING FOR SERIES RR2 90 X 90 ANGLE DRILLS

PART NUMBER FOR ORDERING

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1	Motor Housing	TRL-40	30	End Plate Alignment Pin	TRH-98-2
2	Housing O-ring	TRH-104	31	Front Rotor Bearing	TRH-24
3	Housing Plug	TRD-982	32	Motor Seal	TRH-211
4	Reverse Valve Assembly	TRH-A3291	33	Motor Clamp Washer	TRH-207
5	Reverse Valve Seal	R1A-159	34	Gear Retainer	TRH-28
6	Throttle Plunger	TRL-302	35	Gear Head Spacer	TRH-81
7	Back Cap	TAL-231	36	Planet Gear Head Drive Plate (for Series RR2S, RR2M, RR2K, RR2R and RR2B)	TRH-17
8	Back Cap Gasket	TRL-A283	37	Planet Gear Head Assembly (includes gear shaft) for Series RR2S, RR2K and RR2R	TRH-A2169-16
9	Muffler Element (3)	TRL-311		for Series RR2V	TRH-A21612-12
11	Throttle Lever	TRL-273		for Series RR2J and RR2M	TRH-A216-12
12	Throttle Lever Pin	TRL-98		for Series RR2U	TRH-A2169-12
13	Throttle Valve Seat	TRH-303		for Series RR2T	TRH-A2169-10
14	Throttle Valve	TRD-A302		Planet Gear (3 for each Gear Head)	TRH-10-16
15	Throttle Valve Spring	TRL-51	38	for Series RR2J	TRH-10-12
16	Exhaust Diffuser	TAH-123		for Series RR2V and RR2U	TRH-10-10
17	Inlet Bushing Assembly	TRH-A465		for Series RR2T	TRH-17-21
18	Inlet Bushing Seal	AF120-290		for Series RR2V and RR2U	TRH-17-18
19	Inlet Screen	TRH-61		for Series RR2T	TRH-82
20	Housing Plug Cover	TRD-981	39	Gear Head Pinion	TRH-A8-16
21	Rear End Plate Assembly (includes rear rotor bearing)			for Series RR2T	TRH-A8-15
22	Rear End Plate Face Plate	TRH-A12-1	40	for Series RR2V and RR2U	TRH-A8-12
23	Rear End Plate Assembly Retainer	TRH-12-2	41	Planet Gear Head Spacer	TRH-A8-10
24	Cylinder Assembly	8SL-305		Spindle Assembly (includes all spindle gearing) for Series RR2S	TRH-A8-DL
25	Cylinder Rear Alignment Pin	THD-A3-D		for Series RR2S	TAL-37
26	Cylinder Front Alignment Pin	TRH-98		for Series RR2J, RR2V and RR2M	
27	Rotor	TRH-98-1		for Series RR2U and RR2K	
28	Vane Packet (set of 5 Vanes)	TRD-53		for Series RR2T and RR2R	
29	Front End Plate Assembly	TRH-42-5	42	for Series RR2B	
		TRH-A11		Gear Case	

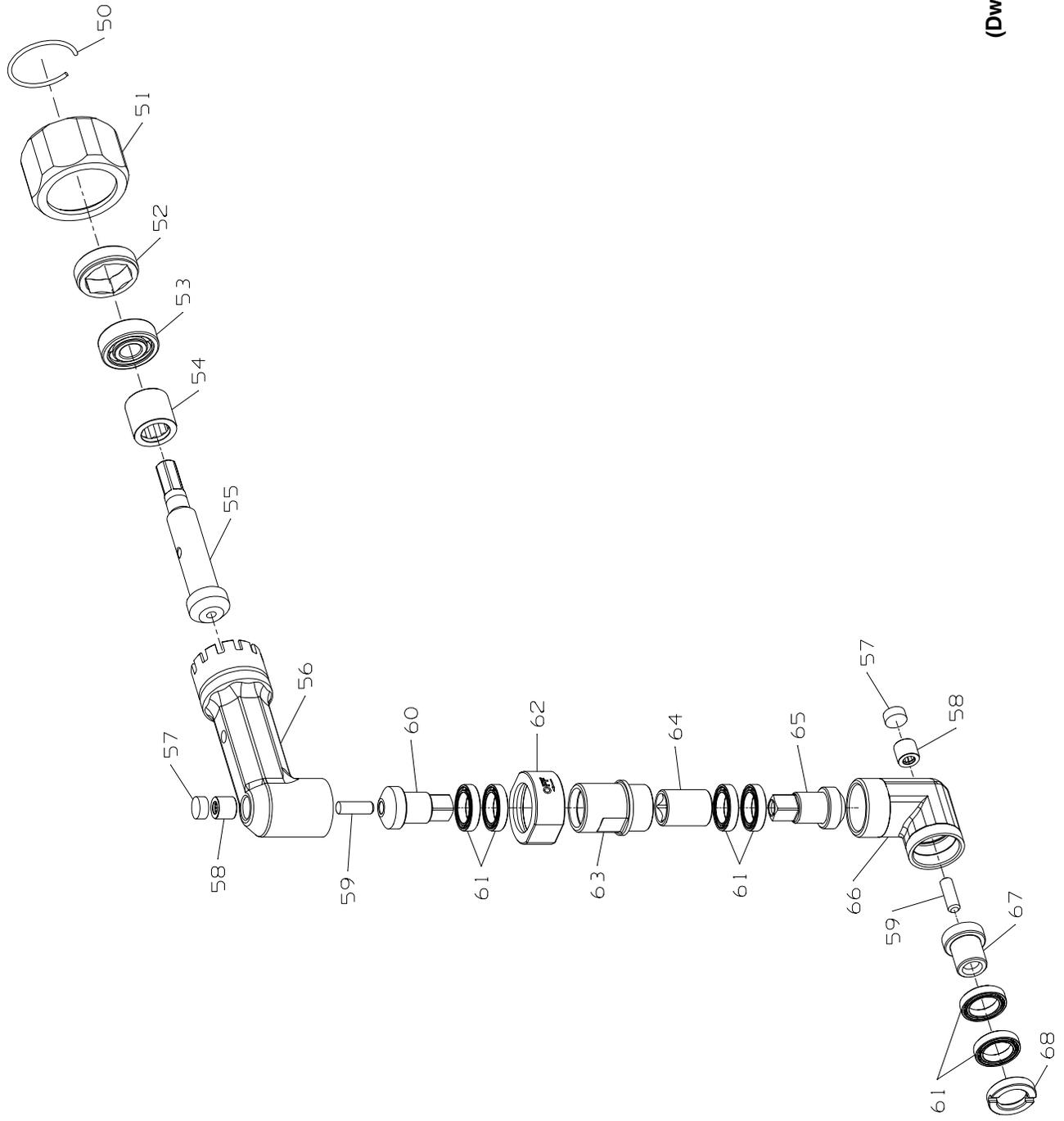
PART NUMBER FOR ORDERING

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43	Spindle Bearing	TRH-510	55	Bevel Pinion	TRL1-552
44	Spindle Bearing Retaining Ring	4E-6	56	Upper Angle Housing	TRL1-550
45	Spindle Bearing Seat	TRH-208	57	Spindle Upper Bearing Cap (2)	TRL2-531
46	Housing Grip	TAH-40-A136	58	Spindle Upper Bearing (2)	W22-654
47	Nameplate	TAH-301	59	Spindle Upper Bearing Shaft (2)	TRL1-110
48	Warning Label	TRH-99	60	Bevel Gear (1/4" Sq. Drive)	TRL1-551-S4
49	Housing Lock Spacer	TRL-682	61	Spindle Bearing (6)	TRL1-593
49A	Grip Spacer	TRL-504	62	Coupling Nut (lower housing)	TRL5-27
	90° x 90° Angle Head Assembly for Models with 9/32"-40 female thread for 3/16" Collet (Collet not included in Assembly)	TRL5F40	63	Coupler	TRL5-304
	for Models with 1/4"-28 female thread Spindle	TRL5F28	64	Adaptor	TRL5-212
50	Coupling Nut Retainer	TRL-29	65	Pinion (lower housing)	TRL5-552-S4
51	Coupling Nut (upper housing)	TRL-27	66	Lower Angle Housing	TRL5-550
52	Angle Head Plug	TRL1-532	67	Bevel Gear for TRL5F40 Angle Head Assembly for TRL5F28 Angle Head Assembly	TRL1-551-F40 TRL1-551-F28
53	Pinion Rear Bearing	TRL-514	68	Spindle Bearing Cap	TRL1-531
54	Pinion Front Bearing	TRL-654	*	Suspension Bail	7L-365
			*	Piped-Away Exhaust Kit (optional)	LG1-K284

* Not illustrated.

ANGLE HEAD FOR SERIES RR2 90 X 90 ANGLE DRILLS



(Dwg. ATP78)

MAINTENANCE SECTION

WARNING

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

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.

LUBRICATION

Each time a Series RR2 90 x 90 Angle Drill is disassembled for maintenance and repair or replacement of parts, lubricate the tool as follows:

1. Coat all exposed gears with IRAX No. 67 Grease and work some of the Grease into the gearing of the Spindle Assembly (41) and Angle Head Assembly (56 and 66).
2. Use IRAX No. 10 Oil to lubricate the motor. Inject approximately 1 to 2 cc of oil into the air inlet before attaching the air hose to the tool.

SPEED ADJUSTMENT

Series RR2 90 x 90 Angle Drills are furnished with the ability to precisely control speed, within certain ranges. Setting the speed requires a tachometer. Although the adjustment is simple, only a competent technician using the proper equipment should attempt it.

The Back Cap (7) has a small, molded stud on the end face of the Cap nearest the Exhaust Diffuser (16). Take an initial reading of the tool speed by applying a tachometer to the end of the Spindle (60) without a drill bit and with the Lever (11) completely depressed.

After determining the actual velocity, shut off the air supply and disconnect the airline. Use a 3/4" wrench to loosen the Inlet Bushing (17). The longest slot in the Exhaust Diffuser will contain the molded stud on the Back Cap. Rotate the Diffuser to open the exhaust ports to increase speed or rotate it to restrict the exhaust to reduce speed. Being careful not to allow the Diffuser to damage the molded stud, tighten the Inlet Bushing to 15 ft-lbs. (20 Nm) torque. Connect the airline and restore the air supply and check the velocity again. Determine which direction you need to rotate the Diffuser to obtain the desired speed and then rotate it accordingly. Best results are achieved by using gradual increments and frequent tachometer readings. Be sure to turn off the air supply and disconnect the line when making adjustments.

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 vice 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 that 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 gaskets and o-rings for replacement.

Disassembly of the Tool

Each Series RR2 90 x 90 Angle Drill is composed of four modules including a housing and throttle unit, a motor unit, a combined gearing with spindle unit and an angle head unit. The tool can be disassembled for repairs to each individual unit without disturbing the other units. To separate the modules, proceed as follows:

1. Lightly grasp the body portion of the Angle Head (56) in copper-covered or leather-covered vise jaws in a manner that provides access to the Coupling Nut (51).

NOTICE

The Coupling Nut has a left-hand thread. Rotate the Nut clockwise to loosen it.

2. Using a wrench on the flats of the Coupling Nut, loosen the Coupling Nut and then remove the tool from the vise jaws.
3. With the Angle Head upward, unscrew the Coupling Nut and pull the assembled Angle Head off the front end of the tool. Remove the Housing Lock Spacer (49) from the Angle Head or Gear Case (42).
4. Remove the Grip Spacer (49A) and pull the Grip Assembly (46) off the Gear Case.
5. Lightly grasp the flats of the Motor Housing in leather-covered or copper-covered vise jaws with the Inlet Bushing (17) upward.

MAINTENANCE SECTION

6. Place a 1-3/16" wrench on the flats of the Back Cap (7) to prevent it from rotating, and use a 3/4" wrench to unscrew and remove the Inlet Bushing.
7. Lift the Exhaust Diffuser (16) off the Back Cap.
8. If the Throttle Valve Spring (15) did not come out of the tool with the Inlet Bushing, use needle nose pliers to remove it and the Throttle Valve (14) from the Motor Housing.
9. If the Throttle Valve Seat (13) is damaged and must be replaced, insert a hooked tool through the central opening of the Seat and pull it from the Motor Housing.
10. Using a 1/16" pilot punch, tap the Throttle Lever Pin (12) out of the Back Cap and remove the Throttle Lever (11).
11. Pull the Throttle Plunger (6) out of the Motor Housing and remove the assembly from the vise.
12. Holding the assembly horizontally, remove the Back Cap and the Back Cap Gasket (8).
13. If the Muffler Elements (9) need to be cleaned or replaced, pull them out of the Back Cap.
14. Grasp the flats at the inlet end of the Motor Housing in leather-covered or copper-covered vise jaws, and using a 1-1/16" wrench on the flats of the Gear Case, unscrew and remove the Gear case from the Motor Housing.
15. Set the assembled Gear Case on the workbench.
16. Remove the Motor Clamp Washer (33) and the Motor Seal (32) from the assembled motor in the Housing.
17. Tap the Motor Housing on a block of wood to remove the motor assembly from the Motor Housing.

Disassembly of the TRL5F28 and TRL5F40

Angle Heads

1. Carefully grasp the assembled Angle Head in leather-covered or copper-covered vise jaws with the input end of the Angle Head in a downward position.

NOTICE

The thread in the following step is a left-hand thread. Rotate the Coupling Nut (62) in the indicated direction to loosen it.

2. Remove assembled Lower Angle Head (66) from assembled Upper Angle Head (56). Pinion (65) and Bearings (61) can be removed from assembled Lower Angle Head (66), and Adaptor (64) can be removed from assembled Angle Head (56.)
3. Grasp the assembled Lower Angle Head (66) lightly in copper-covered or leather-covered vise jaws with the output upward.

NOTICE

The thread in the following step is a left-hand thread. Rotate the wrench clockwise to remove the Bearing Cap (68).

4. Use a fixed or adjustable face spanner wrench to unscrew and remove the Spindle Bearing Cap (68).
5. Pull the assembled Spindle (67) out of the Angle Head.
6. Slide the two Spindle Bearings (61) off the Spindle.
7. To remove the Spindle Upper Bearing Shaft (59), stand the gear end of the Spindle on a block with clearance for the Shaft. Insert a 1/8" round rod into the opening in the output end of the Spindle and using an arbor press, press the Shaft out of the Spindle.
8. If the Spindle Upper Bearing (58) must be replaced, press the Bearing and Spindle Upper Bearing Cap (57) out the end of the Angle Housing opposite the spindle end.
9. Reposition assembled Upper Angle Head (56) with input upward.
10. Slide the Upper Housing Coupling Nut (51) toward the output end of the assembled Upper Angle Head (56) and using a thin blade screwdriver, work the Coupling Nut Retaining Ring (50) out of the groove in the Angle Head. Slide the Coupling Nut off the Angle Head.
11. Using a piece of 9/16" hexagon bar stock with a 1/4" hole drilled 3/4" deep in the center to clear the hex of the Bevel Pinion (55) and a 9/16" wrench, unscrew and remove the Angle Housing Plug (52).
12. To pull the assembled Bevel Pinion out of the Angle Head, proceed as follows:
 - a) Gather together a 1/2" square drive socket that would be used for a nut that is larger than 1" and an 8-32 UNC socket head cap screw that is 1/2" longer than the socket. In addition, a nut for the Screw and a flat washer that is larger than the socket with a hole that is smaller than the nut, yet is thick enough to withstand some pressure, are also necessary. A wrench for the nut and a hex wrench for the screw are also required.
 - b) Thread the nut onto the cap screw until it stops against the screw head.
 - c) To restrict the rotation of the small Angle Head Spindle (60), thread a 1/4"-28 thread bolt into the Spindle or insert a rod into the collet and clamp the bolt or rod into a vise with the motor end upward.

MAINTENANCE SECTION

- d) Place the square drive end of the socket against the notched end of the Angle Head.
 - e) With the cap screw and nut inserted through the flat washer, thread the cap screw through the square drive opening into the end of the Bevel Pinion until it bottoms out.
 - f) Thread the nut along the cap screw until it contacts and holds the flat washer against the Angle Head.
 - g) Use a hex wrench to hold the cap screw in position while turning the nut with a wrench to jack the assembled Bevel Pinion out of the Angle Head. Unscrew the cap screw from the Bevel Pinion.
13. Slide the Pinion Rear Bearing (53) and Pinion Front Bearing (54) off the Bevel Pinion.
 14. Reposition assembled Upper Angle Head (56) in vise with the input end downward. Pull Lower Housing Coupling Nut (62) over so that flats of Coupler (63) are exposed. Grip on flats and unscrew.
 15. Remove Spindle Bearings (61) and Bevel Gear (60) from the assembled Upper Angle Head (56).
 16. To remove the Spindle Upper Bearing Shaft (59), stand the gear end of the spindle on a block with clearance for the Shaft. Insert a 1/8" round rod into the opening in the output end of the Spindle and using an arbor press, press the Shaft out of the Spindle.
 17. If the Spindle Upper Bearing (58) must be replaced, press the Bearing and Spindle Upper Bearing Cap (57) out the end of the Angle Housing opposite the Spindle end.

Disassembly of the Gearing

1. Using snap ring pliers, remove the Gear Retainer (34) from inside the Gear Case (42) and remove the Gear Head Spacer (35).
2. **For Series RR2B**, lightly rap the motor end of the Gear Case on a wooden work bench top to remove the Planet Gear Head Drive Plate (36).
For Series RR2S, RR2M, RR2K and RR2R, lightly rap the motor end of the Gear Case on a wooden work bench top to remove the Planet Gear Head Drive Plate (36), Planet Gear Head Assembly (37) and the Planet Gear Head Spacer (40).
For Series RR2J, RR2V, RR2U and RR2T, lightly rap the motor end of the gear case on a wooden work bench top to remove the three Planet Gears (38), the Planet Gear Head Assembly (37) and the Planet Gear Head Spacer (40).
For Series RR2U, lightly rap the motor end of the Gear Case on a wooden work bench top to remove the three Planet Gears (38), the Gear Head Pinion (39), the Planet Gear Head Assembly (37) and the Planet Gear Head Spacer (40).

3. Using snap ring pliers, remove the Spindle Bearing Retaining Ring (44).
4. Stand the Gear Case on the table of an arbor press with the output spindle upward. Using a rod that neatly fits inside the internal hex of the Spindle (41), press the Spindle Assembly out of the Spindle Bearing (43).

CAUTION

Do not remove the Bearing in the following step unless you have a new replacement available for installation. The Bearing will be damaged as a result of the removal process.

5. Invert the Gear Case on the table of an arbor press so that the end face having the four notches makes contact with the table. Using a rod against the inner race of the Spindle Bearing, press the Bearing from the Gear Case.
6. If the Spindle Bearing Seat (45) must be replaced, use a small, thin blade screwdriver to spiral it out of the groove in the Gear Case.

Disassembly of the Motor

1. If the motor was not removed from the Housing (1) when the tool was disassembled, slide the Motor Clamp Washer (33) off the shaft of the Rotor (27) and remove the Motor Seal (32).
2. Tap the Motor Housing on a block of wood to remove the motor assembly from the Motor Housing.
3. Using snap ring pliers, remove the Rear End Plate Assembly Retainer (23) from the shaft of the Rotor.
4. Pull the Rear End Plate Face Plate (22) and Rear End Plate Assembly (21) off the hub of the Rotor.
5. Using a piece of leather or other type of protective material, grasp the shaft of the Rotor and pull the Rotor out of the Cylinder (24).
6. Remove the Vanes (28) from the Rotor.
7. Support the Front End Plate Assembly (29), as near the rotor body as possible, on the table of an arbor press and press the Rotor from the Front Rotor Bearing (31). Remove the Bearing from the Front End Plate.

Disassembly of the Housing

1. Pull the Housing Plug Cover (20) off the inlet end of the Motor Housing (1).
2. If the Housing Plug (3) does not drop out of the Housing when the Cover is removed, tap the inlet end of the Housing on a block of wood to dislodge the Plug from the Housing.
3. Insert a 5/16" wooden dowel between 6 and 8 inches long, into the inlet end of the Motor Housing and push the Reverse Valve Assembly (4) out the motor end of the Housing.

MAINTENANCE SECTION

4. Use a hooked tool to pull the Housing O-ring (2) out of the Motor Housing.

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 to protect the surface of the part and help prevent distortion. This is particularly true of threaded members and housings.
4. Except for bearings, always clean every part and wipe every part with a thin film of oil before installation.
5. Apply o-ring lubricant to all o-rings before final assembly.
6. 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 never be cleaned.** Lubricate all open bearings with grease before installation.

Assembly of the Housing

1. Lubricate the Housing O-ring (2) with o-ring lubricant and install it at the bottom of the cylinder bore in the Motor Housing (1).
2. Inspect the face and Reverse Valve Seal (5) on the hub of the Reverse Valve Assembly (4) for nicks or damage. Replace the Reverse Valve Assembly or Seal if any damage is evident.
3. Lubricate the Reverse Valve Seal with o-ring lubricant and insert the Assembly, seal end leading, into the cylinder bore of the Motor Housing. Push the Assembly toward the bottom of the cylinder bore until it "snaps" into its proper location.
4. Rotate the Valve inside the Housing until the threaded hole in the side of the Valve aligns with the hole for the Housing Plug (3) in the side of the Motor Housing.
5. Insert the pin end of the Housing Plug into the hole in the Reverse Valve and fit the remainder of the Plug into the recess in the Motor Housing.
6. While holding the Plug in position, from the inlet end of the Housing, slide the Housing Plug Cover (20) onto the Housing. Make certain it captures the Plug when it moves along the Housing and stops against the housing shoulder.

Assembly of the Motor

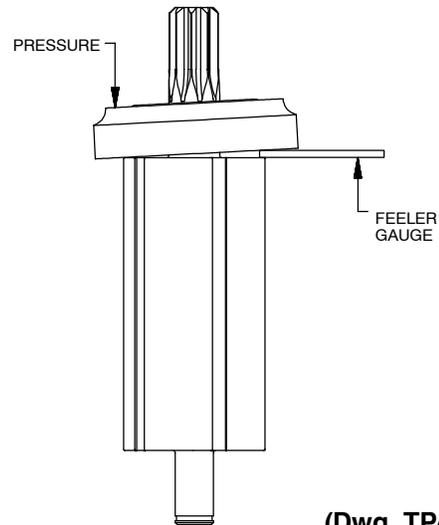
1. Place the Front End Plate (29) on the splined shaft of the Rotor (27) with the bearing recess away from the rotor body.
2. Place the Front Rotor Bearing (31) onto the shaft and using a sleeve or piece of tubing that makes contact with the inner race of the Bearing, press the Bearing onto the shaft until the Front End Plate nearly contacts the rotor body.

NOTICE

In the following step, the measurement must be made at the end corner of the large rotor body.

3. The clearance between the Front End Plate and Rotor is critical. While pressing downward with your finger on the outer edge of the Front End Plate on the bearing side of the End Plate, insert a 0.004" (0.1 mm) feeler gauge between the face of the rotor body and the face of the End Plate at a point that is 180 degrees away from where the pressure is applied. Refer to Dwg. TPA1740. To increase the gap, support the End Plate and lightly tap the rotor shaft with a plastic hammer; to decrease the gap, press the Bearing farther onto the rotor shaft.

Measurement of Front End Plate Clearance



4. Wipe each Vane (28) with a light film of IRAX No.10 Oil and place a Vane in each slot in the Rotor.
5. One end of the Cylinder Assembly (24) has a notch that breaks the outer wall and end face of the Cylinder. With that end trailing, install the Cylinder Assembly over the Rotor and Vanes against the Front End Plate. Make certain the Cylinder Front Alignment Pin (26) enters the hole in the Front End Plate.

MAINTENANCE SECTION

6. Install the Rear End Plate Assembly (21), flat face leading, on the rear hub of the Rotor. Make certain the Cylinder Rear Alignment Pin (25) enters the hole in the Rear End Plate.
7. Examine the Rear End Plate Face Plate (22) for scratches. If it is scratched, replace it. If it is not, slide it onto the rear hub of the Rotor and onto the Cylinder Rear Alignment Pin against the Rear End Plate. Some pressure may be required to fit the hole in the Plate onto the Alignment Pin.
8. Using snap ring pliers, install the Rear End Plate Assembly Retainer (23) in the annular groove on the rear rotor hub to secure the assembly in position.
9. Set the assembled motor aside.

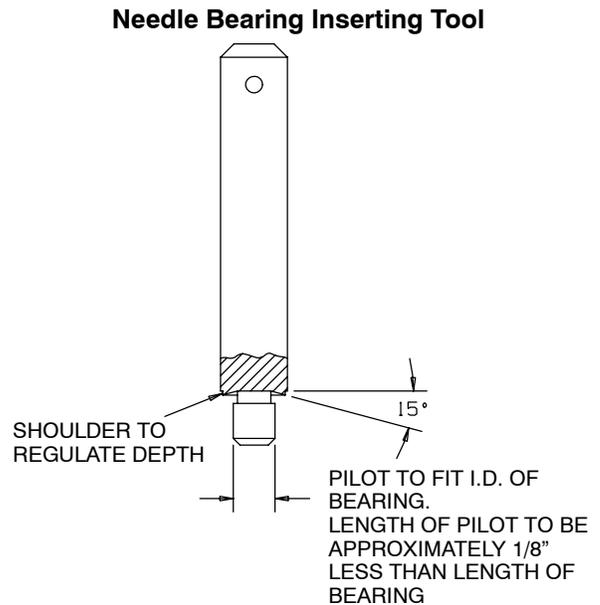
Assembly of the Gearing

1. Using a small screwdriver, work the Spindle Bearing Seat (45) into the internal groove nearest the notched end of the Gear Case (42).
2. Stand the Gear Case, notched end upward, on the table of an arbor press. Using a piece of tubing that contacts the outer race of the Spindle Bearing (43), press a new Bearing into the Gear Case against the Seat.
3. Lubricate the gears in the Spindle Assembly (41) with IRAX No. 67 Grease.
4. Invert the Gear Case and using another piece of tubing that supports the inner race of the Bearing and clears the output end of the Spindle Assembly, press the Spindle Assembly into the Bearing from the motor end of the Gear Case.
5. Using snap ring pliers, install the Spindle Bearing Retainer (44) in the external groove near the drive end of the spindle.
6. **For all tools except Series RR2B**, apply some IRAX No. 67 Grease to the Planet Gear Head Spacer (40) and the shafts of the Planet Gear Head Assembly (37).
7. **For all tools except Series RR2B**, insert the Planet Gear Head Spacer (40) and Planet Gear Head Assembly (37), spline hub leading, into the open end of the Gear Case.
8. **For Series RR2J, RR2V, RR2U and RR2T**, apply IRAX No. 67 Grease to the three Planet Gears (38) and install them on the shafts of the Planet Gear Head Assembly.
9. **For Series RR2U**, apply IRAX No. 67 Grease to the Gear Head Pinion (39) and while meshing the gear teeth, insert it in the opening between the three Planet Gears.
10. **For Series RR2S, RR2M, RR2K and RR2R**, install the Planet Gear Head Drive Plate (36) on the shafts of the Planet Gear Head Assembly.

11. Place the Gear Head Spacer (35) in the Gear Case and secure the assembly by using snap ring pliers to install the Gear Retainer (34) in the angular groove inside the Gear Case.

Assembly of the TRL5F28 and TRL5F40 Angle Heads

1. If the Spindle Upper Bearing (58) was removed, stand the output end of the Lower Angle Head (56) on the table of an arbor press. Using a Needle Bearing Inserting Tool as shown in Dwg. TPD786, press the Bearing into the small opening at the top of the Angle Head. Press Plug (57) until top is flush with Upper Angle Head (56) surface.



(Dwg. TPD786)

2. Apply a light film of Ingersoll-Rand No. 67 Grease to the shaft of the Bevel Pinion (55) and to the inside of the Pinion Front Bearing (54).
3. Slide the Pinion Front Bearing, stamped end trailing, onto the shaft until it stops against the back of the gear.
4. Without distorting the Angle Head, support the hex flats of the Angle Head in a machine vise on the table of an arbor press with the notched end upward and the head resting on a solid stop. Apply 2 to 4 cc of Ingersoll-Rand No. 67 Grease to the gear on the end of the Bevel Pinion.

MAINTENANCE SECTION

5. Insert the gear end of the Bevel Pinion into the notched end of the Angle Head while aligning the Pinion Front Bearing with the central opening.
6. Use a piece of tubing that clears the shaft of the Bevel Pinion and the inner wall of the Angle Head and is between 1.455" and 1.465" (36.95 and 37.21 mm) long to press the Bearing into the Angle Head. Press the Bearing until the trailing end of the pressing tube is flush with the notched end of the Angle Head.
7. Apply some IRAX No. 67 Grease to the Pinion Rear Bearing (53) and slide it onto the shaft of the Bevel Pinion and into the Angle Head recess.
8. Use the 9/16" hex stock with clearance for the bevel pinion shaft that was used during disassembly to screw the Angle Head Plug (52) into the Angle Head against Pinion Rear Bearing. Tighten the Plug between 10 and 15 ft-lbs. (13.5 and 20.3 Nm) torque.
9. Remove the assembly from the machine vise and position it in leather-covered or copper-covered vise jaws with the opening for the output spindle upward.
10. If the Spindle Upper Bearing Shaft (59) was removed, stand the output end of the Spindle (60) on the table of an arbor press. One end of the Shaft has a bevel and the other end is rounded. Press the Shaft, bevel leading, into the gear end of the Spindle until rounded end extends above the shoulder of the gear 0.551" to 0.554" (14.0 to 14.1 mm).
11. Slide the Spindle Bearings (61) onto the shaft of the Spindle against the gear and insert the assembled Spindle, gear end leading, into the Angle Head. Push the Bearing into the housing below the threads.

NOTICE

The thread in the following step is a left-hand thread. Rotate the Coupling Nut (62) in the indicated direction to tighten it.

12. Slide Lower Housing Coupling Nut (62) onto Coupler (63) so Coupling Nut rests on flange. Grip on flats of Coupler and thread into Upper Angle Head housing (56). Tighten the Coupler between 5 and 10 ft-lbs. (6.8 and 13.5 Nm).
13. If the Spindle Upper Bearing (58) was removed, stand the output end of the Lower Angle Head (66) on the table of an arbor press. Using a Needle Bearing Inserting Tool as shown in Dwg. TPD786 on the previous page, press the Bearing into the small opening at the top of the Angle Head. Press Plug (57) until top is flush with Lower Angle Head (66) surface.
14. If the Spindle Upper Bearing Shaft (59) was removed, stand the output end of the Spindle (67) on the table of an arbor press. One end of the Shaft has a bevel and the other end is rounded. Press the shaft,

bevel leading, into the gear end of the Spindle until rounded end extends above the shoulder of the gear 0.551" to 0.554" (14.0 to 14.1 mm).

15. Grasp the Lower Angle Head (66) in leather-covered or copper-covered vise jaws with output end upward.
16. Slide the Bevel Gear (67) and Spindle Upper Bearing Shaft (59) assembly into output end of Lower Angle Head housing (66). Slide the Bearings (61) onto the Bevel Gear Shaft.

NOTICE

The thread in the following step is a left-hand thread. Rotate the wrench counterclockwise to tighten the Bearing Cap (68).

17. Thread the Spindle Bearing Cap (68) into the Lower Angle Head (66) and using a spanner wrench, tighten the Cap between 5 and 10 ft-lbs. (6.8 and 13.5 Nm) torque.
18. Reposition Lower Angle Head (66) with input end upward. Slide Lower Housing Pinion (65) into Angle Head and slide Bearings (61) onto Pinion Shaft.
19. Slide Adaptor (64) onto Lower Housing Pinion (65).
20. Take assembled Upper Angle Head (56) and connect output end with input end of assembled Lower Angle Head (66). Adaptor (64) connects Bevel Gear (60) to Lower Housing Pinion (65). Thread Lower Housing Coupling Nut (62) onto assembled Lower Angle Head (66). Torque between 5 and 10 ft-lbs. (6.8 and 13.5 Nm).
21. Remove the assembly from the vise jaws and slide the Upper Housing Coupling Nut (51), threaded end trailing, onto the notched end of Upper Angle Head (56). Move the Nut far enough onto the housing to install the Coupling Nut Retainer (50) in the angular groove at the notched end of the Upper Angle Head (56).

Assembly of the Tool

1. Lightly grasp the flats on the Motor Housing (1) in leather-covered or copper-covered vise jaws with the inlet end of the tool upward.
2. Insert a 5/8" dowel through the opening in the Back Cap (7), and using the dowel as an alignment device, install the three Muffler Elements (9) in the cavity of the Back Cap. Make certain the notches in the outer edge of the Elements fit over the small pocket in the bottom of the Cap.
3. Make certain the tab on the inside edge of the Back Cap Gasket (8) is aligned with the pocket and install the Gasket, metal face leading, in the recess of the Back Cap against the face with the cavity containing the Muffler Elements.

MAINTENANCE SECTION

4. Position the gasket end of the alignment dowel against the inlet hub on the Motor Housing. Align the flats on the Cap with the flats on the Housing. Orient the Back Cap and slide the Back Cap Assembly off the alignment dowel and onto the Motor Housing.
5. The Exhaust Diffuser (16) has one slot that is longer than the other five slots. The Back Cap has a short, molded stud projecting from inlet end. Place the Exhaust Diffuser against the Back Cap with the long slot encircling the molded stud. Rotate the Diffuser counterclockwise until the wall of the slot stops against the stud. The exhaust ports are now in the full open position and will provide maximum free speed.
6. Being careful not to damage it, insert the Throttle Valve Seat (13) into the central opening at the inlet end of the Motor Housing at an angle until it clears the threads in the Housing. Using a rod with a flat end and no sharp edges, push the Seat to the bottom of the opening until it seats flush.
7. Using needle nose pliers, insert the Throttle Valve (14), long stem leading, into the opening against the Seat. Center the Valve in the Seat.
8. Install the Throttle Valve Spring (15) in the opening so that it encircles the Valve.
9. If the Inlet Screen (19) required replacement, use a wooden dowel to carefully push a new one into the Inlet Bushing (17).
10. If the Inlet Bushing Seal (18) is nicked or damaged, carefully install a new one over the threads of the Inlet Bushing.
11. Thread the Inlet Bushing Assembly through the Diffuser and Back Cap into the Motor Housing. Using a 1-3/16" wrench on the flats of the Back Cap to keep it from turning, tighten the Inlet Bushing between 15 and 20 ft-lbs. (20 and 27 Nm) torque.
12. The Throttle Plunger (6) has a lengthwise flat on the outer edge at one end of the Plunger. Insert the Plunger, flat end first, into the cross-hole in the Housing. Push on the end of the Plunger to make certain it springs back from contact with the stem of the Throttle Valve.
13. Position the Throttle Lever (11) in the slot in the Back Cap and Motor Housing and using a 1/16" diameter rod, align the holes through the Back Cap, Motor Housing and Throttle Lever. While maintaining alignment, install the Throttle Lever Pin (12) in place of the rod by tapping it through all three pieces.
14. Remove the assembled Housing from the vise jaws.
15. Lightly grasp the flats of the Motor Housing in leather-covered or copper-covered vise jaws with the motor bore upward.
16. Grasp the spline of the Rotor (27) in the assembled motor and after aligning the End Plate Alignment Pin (30) with the internal notch in the motor end of the housing bore, insert the assembled motor into the Motor Housing. Make certain the motor is far enough into the Housing to have the undercut below the internal housing thread visible.
17. Lubricate the Motor Seal (32) with o-ring lubricant and install it around the Front End Plate (29) and into the undercut in the Housing.
18. Align the tab of the Motor Clamp Washer (33) with the internal notch in the Housing and install it over the rotor hub and End Plate Alignment Pin against the Motor Seal. Make certain the Pin enters the hole in the Washer and the Washer is flat against the Seal.
19. Apply some IRAX No. 67 Grease to the spline on the rotor shaft.
20. Thread the assembled Gear Case (42) and Spindle Assembly (41), gear case end leading, into the Motor Housing and using a 1-1/16" wrench, tighten the joint between 15 and 20 ft-lbs. (20 and 27 Nm) torque.
21. Install the Housing Grip (46), internal slotted end leading, over the motor and Housing and engage the slots in the Grip with the projections on the Housing.
22. Position the Housing Lock Spacer (49) in the Gear Case with the tabs of the Spacer going into the notch openings.

NOTICE

The thread in the following step has a left-hand thread. Rotate the Nut counterclockwise to tighten it.

23. Orient the assembled Angle Head to the desired position and insert the notched end of the Angle Head into the Gear Case to engage the tabs of the Spacers. Make certain the external hex of the Bevel Pinion (55) enters the hex recess of the Spindle Assembly (41). Thread the Coupling Nut (51) onto the Gear Case and tighten it between 2 and 5 ft-lbs. (2.7 and 6.8 Nm) torque.
24. Remove the tool from the vise jaws.
25. Check the free speed of the tool using a tachometer and following the instructions in the **SPEED ADJUSTMENT** section of this manual.

TROUBLESHOOTING GUIDE

Trouble	Probable Cause	Solution
Loss of Power	Low air pressure	Check air supply. For top performance, the air pressure must be 90 psig (6.2 bar/620 kPa) at the inlet.
	Plugged Inlet Bushing Screen	Clean the Inlet Bushing Screen using a clean, suitable cleaning solution. If the Screen cannot be cleaned, replace it.
	Worn or broken Vanes	Replace a complete set of Vanes.
	Worn or broken Cylinder	Replace the Cylinder if it is cracked or if the bore appears wavy or scored.
	Exhaust control restricted	Make certain the Exhaust Diffuser is in the fully open position.
Motor won't run	Motor Clamp Washer binding	Remove the Gear Case make certain the Washer is flat and the Motor Seal is properly positioned.
	Gears binding	Clean and inspect all gearing. Replace any worn or damaged gearing.
Leaky Throttle Valve	Worn Throttle Valve and/or Throttle Valve Seat	Install a new Valve and/or Seat.
	Dirt accumulation on Throttle Valve and/or Throttle Valve Seat	Clean or replace the Throttle Valve and/or Throttle Valve Seat.
Gear Case gets hot	Excessive grease	Clean and inspect Gear Case and gearing parts and lubricate as instructed.
	Worn or damaged parts	Clean and inspect the Gear Case and gearing. Replace worn or broken components.

NOTICE

SAVE THESE INSTRUCTIONS. DO NOT DESTROY.