



Technology for Vacuum Systems

Instructions for use



- MZ 2C EX**
- MD 4C EX**
- MV 10C EX**
- MZ 2C EX + AK + EK**
- MZ 2C EX + IK + EK**
- MD 4C EX + AK + EK**
- MV 10C EX + AK + EK**

**Chemistry diaphragm pumps
with ATEX conformity**



Dear customer,

Your VACUUBRAND diaphragm pump shall support you at your work for a long time without any trouble and with full load output. Thanks to our large practical experience we attained much information how you could add to an efficient application and to personal safety. Please read these instructions for use prior to the initial start-up of your pump.

VACUUBRAND diaphragm pumps are the result of many years of experience in construction and practical operation of these pumps combined with the latest results in material and manufacturing technology.

Our quality maxim is the "zero fault principle":

Every delivered diaphragm pump is tested extensively including an endurance run of 14 hours. Due to this endurance run, also faults, which occur rarely, are reported and can be corrected. Every single diaphragm pump is tested on achievement of the specification after the endurance run.

Every VACUUBRAND pump leaving our factory achieves the specification. We feel obliged to this high quality standard.

We are aware that the vacuum pump should not draw a part of the real work and we hope to contribute with our products to an effective and trouble-free realisation of your work.

Yours

VACUUBRAND GMBH + CO KG

After sales service: Contact your local dealer or call +49 9342 808-5500.



Attention: The manual of the offered device with ATEX approval is available in German, English and French (DVR 3: also Dutch). The user is only permitted to operate the device if he understands one of these languages or a technically correct translation of the complete manual. The manual must be completely read and understood before operation of the device. All specified measures must be applied, or else must be replaced by equivalent measures at the user's own risk.

The device has an ATEX approval according to EC-directives and standards. Users outside of the European Community must check national regulations for hazardous areas.

Trademark index:

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D, A, CH, B, L

Achtung: Die Betriebsanleitung des angebotenen Geräts mit ATEX-Zulassung ist in Deutsch, Englisch und Französisch (DVR 3: auch Niederländisch) verfügbar. Der Anwender darf das Gerät nur dann in Betrieb nehmen, wenn er eine dieser Sprachen oder eine fachlich korrekte Übersetzung der vollständigen Anleitung versteht. Die Betriebsanleitung muss vor Inbetriebnahme des Geräts vollständig gelesen und verstanden werden, und alle geforderten Maßnahmen müssen eingehalten werden. Das Gerät verfügt über eine ATEX-Zulassung gemäß EU-Richtlinien und Normen. Anwender außerhalb der EU müssen die nationalen EX-Vorschriften prüfen.

GB, IRL

Attention: The manual of the offered device with ATEX approval is available in German, English and French (DVR 3: also Dutch). The user is only permitted to operate the device if he understands one of these languages or a technically correct translation of the complete manual. The manual must be completely read and understood before operation of the device and all required measures must be applied. The device has an ATEX approval according to EC-directives and standards. Users outside of the European Community must check national regulations for hazardous areas.

F, B, L

Attention : le manuel d'utilisation de l'appareil ATEX proposé est disponible en allemand, anglais et français (en néerlandais également pour le DVR 3). L'utilisateur est autorisé à utiliser l'appareil uniquement s'il comprend l'une de ces langues ou une traduction techniquement correcte du manuel complet. Le manuel doit être lu et compris entièrement avant l'utilisation de l'appareil et toutes les mesures requises doivent être appliquées. L'appareil a une certification ATEX suivant les directives CE et les standards. Les utilisateurs en dehors de la communauté européenne doivent vérifier les normes locales pour les zones dangereuses.

BG

Внимание: Ръководството за работа с предлаганото устройство, което е с ATEX одобрение е достъпно на следните езици: немски, английски и френски език (DVR 3: също холандски). Потребителят има право да работи с устройството само ако разбира много добре един от тези езици или ползва технически правилен превод на пълното ръководство. Ръководството трябва да бъде изцяло прочетено и разбрано преди да се пристъпи към работа с устройството, а всички необходими мерки трябва да бъдат спазвани. Устройството има ATEX одобрение съгласно ЕС - директивите и стандартите. Потребители извън Европейската общност трябва да се съобразят със съответните национални разпоредби за опасни зони.

CN

注意：所提供的ATEX批准设备的操作说明书有德文版、英文版和法文版（DVR 3也有荷兰语版）。客户仅允许懂得其中一种语言或者整本说明书的正确技术翻译的情况下，才可以操作该设备。该说明书在操作前必须完全阅读且能够理解，所有需要的测试必须采用。该装置根据EC指令和标准有ATEX批准。欧盟以外区域的客户必须核查各自国家针对危险区域的国家标准。

CZ



Pozor: Příručka pro nabízené zařízení s osvědčením ATEX je k dispozici v němčině, angličtině a francouzštině (DVR 3: i v holandštině). Uživatel smí dané zařízení používat pouze, pokud zná jeden z těchto jazyků nebo má k dispozici technicky správný překlad kompletního manuálu. Příručku musí kompletně přečíst a porozumět jí před zahájením provozu zařízení a musí zajistit uplatnění všech požadovaných opatření.

Přístroj má schválení ATEX podle směrnic a norem EU. Uživatelé mimo území Evropského společenství, musí ověřit vnitrostátní předpisy pro prostředí s nebezpečím výbuchu.

DK



Bemærk: Betjeningsvejledningen til enheden "med ATEX-godkendelse" er til rådighed på Tysk, Engelsk og Fransk (DVR 3: også på Hollandsk)

Brugeren har kun tilladelse til at betjene enheden hvis, han/hun forstår et af de disse sprog eller har en teknisk korrekt oversættelse af hele manualen.

Betjeningsvejledningen skal læses og forstås før enheden kan anvendes og betjenes. Alle de krævede foranstaltninger skal overholdes.

Enheden har en ATEX godkendt certificering ifølge EF- direktiver og standarder.

Brugere uden for Det Europæiske Fællesskab skal kontrollere nationale regler for anvendelse.

EE



Tähelepanu: käsiraamat pakutud ATEX-i poolt heakskiidetud seadmele on saadaval saksa, inglise ja prantsuse keeles (DVR 3: puhul ka Hollandi keeles). Kasutajal on lubatud seda seadet kasutada ainult juhul, kui ta saab aru ühest nendest keeltest või on olemas tehniliselt korrektnete tõlge kogu juhendist. Juhend peab olema täielikult loetud ja mõistetud enne seadmega töötamist ning kõiki vajalike meetmeid tuleb rakendada. Seadmel on ATEX-i heakskiit vastavalt EÜ-direktiividele ja standarditele. Kasutajad väljaspool Euroopa Liitu peavad kontrollima riiklikuid regulatsioone ohtlike piirkondade kohta.

ES



Atención: Las instrucciones de funcionamiento del equipo ofrecido con homologación ATEX están disponibles en Alemán, Inglés y Francés (DVR 3: también en holandés). El usuario deberá poner en funcionamiento el equipo únicamente si comprende uno de estos idiomas o una correcta traducción técnica del manual completo en el idioma que comprenda. Las instrucciones deben ser leídas y entendidas antes de utilizar el equipo y deben cumplirse todas las medidas necesarias. El equipo posee una aprobación de conformidad ATEX con las directivas y normas de la UE. Los usuarios fuera de la UE deben verificar las normativas nacionales de protección contra explosiones.

FI



Huomio! Tuotteen käyttöohje, joka sisältää ATEX -todistuksen, on saatavilla saksaksi, englanniksi ja ranskaksi (DVR 3 myös hollanniksi). Laitetta saa käyttää vain henkilö, joka ymmärtää jotain em. kielistä tai hänellä on teknisesti tarkka käänös alkuperäisestä käyttöohjeesta. Käyttäjän tulee lukea ja ymmärtää käyttöohje kokonaisuudessaan sekä noudattaa siinä mainittuja toimenpiteitä ennen laitteen käyttöä.

Tuotteella on ATEX hyväksyntä EU-direktiivien ja standardien mukaisesti. Jos laitetta käytetään EU:n ulkopuolella, tulee noudattaa paikallisia määräyksiä.

GR



Προσοχή: Το εγχειρίδιο του προσφερόμενου οργάνου με πιστοποίηση ATEX είναι διαθέσιμο στα Γερμανικά, Αγγλικά, Γαλλικά (DVR3: επίσης Ολλανδικά). Ο χρήστης μπορεί να λειτουργεί το μηχάνημα εφόσον καταλαβαίνει μία από τις συγκεκριμένες γλώσσες ή μία τεχνικά σωστή μετάφραση του πλήρους εγχειριδίου. Το εγχειρίδιο θα πρέπει να αναγνωσθεί πλήρως και να γίνει κατανοητό πριν την λειτουργία του μηχανήματος και θα πρέπει να εφαρμόζονται όλα τα απαιτούμενα μέτρα. Το όργανο έχει πιστοποίηση ATEX σύμφωνα με τις οδηγίες και τα στάνταρ της Ευρωπαϊκής Ένωσης (E.E.). Χρήστες εκτός E.E. πρέπει να ελέγξουν τους εθνικούς τους κανονισμούς για τις τοποθεσίες επικινδυνότητας.

HR



Pažnja: Upute o rukovanju ponuđenih uređaja sa ATEX odobrenjem su dostupne na njemačkom, engleskom i francuskom jeziku (DVR 3: također i na holandskom). Korisniku je dopušteno rukovanje uređajem ako razumije jedan od ovih jezika ili ako ima prijevod tehničke dokumentacije. Uputa za rukovanje prije korištenja uređaja mora se pročitati, razumjeti te je potrebno primijeniti sve nužne mjere za ispravno rukovanje. Uređaji imaju ATEX odobrenje prema smjernicama Europske unije i važećim standardima. Korisnici izvan Europske unije moraju provjeriti nacionalnu regulativu vezanu uz rad sa potencijalno opasnim supstancama te uređajima koji se koriste u tom potencijalno opasnom području rada.

HU



Figyelem: a megajánlott ATEX minősítéssel rendelkező készülék kézikönyve németül, angolul és franciául érhető el (a DVR 3 hollandul is). Kérjük, csak akkor használja a berendezést, ha tökéletesen ért ezeken a nyelveken, vagy rendelkezésére áll egy technikailag megfelelő fordítás a teljes kézikönyvről. A kézikönyvet a készülék használatba vétele előtt kérjük végigolvasni, és betartani a benne foglaltakat. A készülék az EC-irányelveknek és előírásoknak megfelelő ATEX minősítéssel rendelkezik. Az Európai Közösségen kívüli vásárlók ellenőrizzék az adott országban érvényes veszélyes helyiségekre vonatkozó előírásokat.

IT



Attenzione: il manuale della strumentazione con certificazione ATEX offerta è disponibile in Tedesco, Inglese e Francese. (DVR 3: anche in Olandese). L'utilizzatore può utilizzare l'apparecchiatura solo se capisce una di queste tre lingue o una traduzione tecnicamente corretta dell'intero manuale. Prima di utilizzare l'apparecchiatura il manuale deve essere completamente letto e tutte le indicazioni devono essere seguite. La strumentazione ha un'approvazione ATEX in conformità agli standards ed alle direttive EC. Al di fuori della Comunità Europea gli utilizzatori devono controllare la regolamentazione nazionale per le aree pericolose.

JP



注意：ATEX認証された製品に付きましては、ドイツ語、英語、フランス語（DVR 3はオランダ語も）の取扱説明書がございます。ユーザーはこれらの言語が理解できるか、技術的に正しい完全なマニュアルがある場合のみ、装置を作動することが許されます。製品使用前にマニュアルは全て読み、理解しなければなりません。また、全ての要求される対策を講じなければなりません。この製品はECの指令及び規格により承認されています。EC外のユーザーに付きましては、自国の危険場所に関する規定をご確認ください。

KR



주의 : ATEX 인증을 받은 본 장비의 매뉴얼은 독어, 영어, 불어 (DVR3 는 네덜란드어도 포함) 로 되어있습니다. 이들 언어중 하나를 독해 가능하거나 혹은 이 매뉴얼을 기술적으로 완벽하게 이해한 사용자만이 이 장비를 구동해야 합니다. 장비를 구동하기 전에 매뉴얼을 모두 읽고 이해하여야 하며, 모든 필수 요건들을 지켜야합니다. 장비는 ATEX 인증을 받았으며 이 인증은 EC의 지침과 규격에 따른 것입니다. 유럽공동체 이외 지역의 사용자들은 반드시 방폭에 대한 국가규정을 확인해야 합니다.

LT



Dėmesio: Pasiūlyto prietaiso vartotojo instrukcija yra patvirtinta ATEX ir galima vokiečių, anglų bei prancūzų kalbomis (DVR3: taip pat olandų kalba). Teisę dirbti su prietaisu turi tik vartotojas, suprantantis bent vieną iš minėtų užsienio kalbų arba turintis techniškai taisyklingą vartotojo instrukciją. Prieš pradėdant dirbti su prietaisu privaloma perskaityti ir suprasti vartotojo instrukciją bei laikytis visų nurodytų reikalavimų. Prietaisas turi ATEX patvirtinimą remiantis EC-direktyvomis ir standartais. Vartotojai, nepriklausantys Europos Sąjungai, turi pasitikrinti jų šalyje galiojančius teisės aktus/reglamentus dėl pavojingų zonų.

LV



Uzmanību: Piedāvātās iekārtas ar ATEX apstiprinājumu lietošanas instrukcija ir pieejama vācu, angļu un franču valodā (DVR 3: arī holandiešu valodā). Lietotājam ir atļauts darboties ar šo iekārtu tikai tajā gadījumā, ja viņš saprot vismaz vienu no augstāk minētām valodām vai ja ir nodrošināts pilns un tehniski pareizs lietošanas instrukcijas tulkojums. Pirms iekārtas darbināšanas lietošanas instrukciju ir jāizlasa un jāizprot, kā arī jāpiemēro visas nepieciešamās darbības. Iekārta ir ATEX apstiprināta, atbilstoši EK direktīvām un standartiem. Ārpus Eiropas Kopienas valstu lietotājiem ir jāpārbauda valsts nacionālos likumus par bīstamām zonām.

NL



Attentie: de handleiding voor het geoffreerde apparaat met ATEX goedkeuring is beschikbaar in het Duits, Engels en Frans (en voor de DVR 3 ook in het Nederlands). Het is de gebruiker alleen toegestaan om het apparaat te bedienen indien hij/zij een van deze talen begrijpt of indien er een technisch correcte vertaling van de complete handleiding beschikbaar is. De handleiding dient in zijn geheel gelezen en begrepen te worden en alle nodige maatregelen dienen geregeld te zijn alvorens het apparaat bedient mag worden. Het apparaat heeft een ATEX goedkeuring conform de EG-richtlijn en standaarden. Gebruikers buiten the Europese Gemeenschap moeten de nationale richtlijnen voor gevaarlijk locaties controleren.

PL



Uwaga: Instrukcja oferowanego urządzenia z dopuszczeniem ATEX jest dostępny w języku niemieckim, angielskim i francuskim (DVR 3: również holenderskim). Użytkownik może korzystać z urządzenia tylko wtedy, gdy zapoznał się z instrukcją w jednym z podanych języków, lub poprawnym technicznym tłumaczeniem pełnej instrukcji. Przed użyciem instrukcja obsługi musi być przeczytana i zrozumiana, oraz wszystkie wymagane środki bezpieczeństwa muszą być przestrzegane. Urządzenie posiada certyfikat ATEX zgodnie z dyrektywami i normami. Użytkownicy spoza Wspólnoty Europejskiej powinni sprawdzić krajowe przepisy dla stref zagrożonych wybuchem.

PT

Atenção: O manual do dispositivo oferecido com aprovação ATEX está disponível em Alemão, Inglês e Francês (DVR 3: também em holandês). O utilizador só é autorizado a operar o dispositivo se dominar um destes idiomas ou se tiver disponível um manual de operação completo, técnica e corretamente traduzido. O manual deverá ser lido e entendido na sua totalidade antes de se iniciar o funcionamento do dispositivo e todas as medidas necessárias deverão ser aplicadas.

O dispositivo tem uma aprovação ATEX de acordo com as diretivas e normas da Comunidade Europeia. Os utilizadores fora da Comunidade Europeia deverão verificar os regulamentos nacionais relativos às áreas de risco.

RO

Atentie: Manualul aparatului este disponibil in urmatoarele limbi: germana, engleza si franceza (DVR 3: de asemenea si in olandeza).

Operatorul poate utiliza acest dispozitiv doar daca intelege una din aceste limbi sau exista o traducere tehnica corecta a manualului.

Manulul trebuie citit complet si inteles inainte de punerea in functiune a aparatului si toate cerintele solicitate trebuie aplicate.

Dispozitivul are aprobare ATEX conform cu directivele si standardele EC. Utilizatorii din afara comunitatii Europene trebuie sa verifice regulile specifice tarii lor si standardele pentru utilizarea aparatului intr-un mediu periculos.

RU

Внимание: инструкция на предложенный аппарат с сертификатом ATEX доступна на немецком, английском и французском (DVR 3: также на датском).

Пользователю разрешено работать с прибором только, если он понимает один из этих языков или технически корректный полный перевод инструкции. Инструкция должна быть полностью прочитана и понята до начала работы с прибором, должны быть выполнены необходимые требования для работы прибора.

У прибора есть сертификат ATEX согласно стандартам ЕС. Пользователи вне ЕС должны проверять требования своих стран для работы в опасных областях.

SE

Observera: Manualen om den erbjudna enheten med ATEX-godkännande finns på tyska, engelska och franska (DVR 3: även nederländska). Användaren är endast tillåten att använda enheten om han förstår något av dessa språk eller en tekniskt korrekt översättning av den fullständiga manualen. Manualen måste vara helt läsas och förstås innan drift av enheten och alla nödvändiga åtgärder måste tillämpas. Enheten har en ATEX-godkännande enligt EG-direktiv och standarder. Användare utanför Europeiska gemenskapen måste kontrollera nationella regler för farliga områden.

SI

Opomba: navodila za uporabo za ponujeno napravo z odobritvijo ATEX je na voljo v nemškem, angleškem in francoskem jeziku (DVR 3: tudi nizozemščina). Uporaba naprave je dovoljena samo uporabnikom kateri so popolnoma prebrali in razumejo navodila v enem izmed ponujenih jezikov ali tehnično pravilen prevod celotnega priročnika.

Naprava ima ATEX odobritev v skladu z EC direktivami in standardi. Uporabniki zunaj Evropske skupnosti morajo preveriti nacionalne predpise za nevarna območja.

SK

Upozornenie: Návod pre ponúknutý prístroj s ATEX schválením je dostupný v nemeckom, anglickom alebo francúzskom jazyku (DVR 3: tiež v holandskom). Užívateľ môže používať prístroj iba v prípade ak rozumie jednému z týchto jazykov alebo technicky správne prekladu celého návodu na obsluhu. Je nutné si prečítať celý návod na obsluhu a pochopiť ho pred začatím práce s prístrojom a musí pritom dodržať všetky požadované opatrenia.

Prístroj má ATEX schválenie podľa požiadaviek kladených smernicami a normami Európskej únie. Užívatelia mimo Európskej únie si musia overiť platné národné predpisy kladené na priestory s nebezpečenstvom výbuchu.

TR

Dikkat : ATEX onayı ile sunulan cihazın kullanım kitabı Almanca, İngilizce ve Fransızca dillerinde mevcuttur (DVR3: ek olarak Hollanda dilinde). Kullanıcı bu dillerden birini tam olarak anladığı yada teknik olarak bütün kullanım kitabını kendi diline çevirebildiği durumda cihazı kullanabilir. Cihazın kullanımından önce kullanım kitabının tamamı okunmuş olmalı ve gerekli ölçümler yapılmış olmalıdır.

Cihaz EC-direktifleri ve standartlarına uygun ATEX onayına sahiptir. Avrupa Topluluğu dışında bulunan kullanıcılar, tehlikeli alanlar için kendi ülkelerinin düzenlemelerini kontrol etmelidirler.

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➔ DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.



⚠ WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.



• CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.



NOTICE is used to address practices not related to personal injury.



Caution! Hot surface!



Isolate equipment from mains before removing the cover.



Electronic components must not be disposed of in the domestic waste at the end of their service life. Used electronic devices contain harmful substances that can cause damage to the environment or human health. End users are legally obliged to take used electric and electronic devices to a licensed collection point.

Safety information!

General information

NOTICE

☞ **Read and comply with this manual before installing or operating the equipment.**

☞ Transport the pump at the provided handle.

Remove all packing material, remove the product from its packing-box, remove the protective covers from the inlet and outlet ports and keep, inspect the equipment.

If the equipment is damaged, notify the supplier and the carrier in writing within three days; state the item number of the product together with the order number and the supplier's invoice number. Retain all packing material for inspection.

Do not use the equipment if it is damaged.

If the equipment is not used immediately, replace the protective covers. Store the equipment in suitable conditions.

Intended use

WARNING

☞ Use the equipment for the intended use only according to the ATEX conformity, e. g. for pumping gas atmosphere without aerosol in a range from 0.1 to 1000 mbar and a maximum inlet pressure (dynamic pressure) and outlet pressure of 1100 mbar (absolute).

☞ The pump and all system parts must not be used on humans or animals.

☞ Prevent any part of the human body from coming into contact with vacuum.

☞ Ensure that the individual components are only connected, combined and operated according to their design and as indicated in the instructions for use.

☞ Comply with notes on correct vacuum and electrical connections, see section "Use and operation".

The pumps are marked with "X" (according to DIN EN ISO 80079-36:2016), i. e. restrictions of the operation conditions:

CAUTION

- The pumps are designated for a low degree of mechanical stress and have to be installed in a way so that they can not be damaged from outside.

Pumping units have to be installed protected against shocks from the outside and against glass splinters in the event of breaking (implosion).

- The pumps are designated for an ambient and gas inlet temperature during operation of +10 to +40°C. Never exceed these ambient and gas inlet temperatures.

NOTICE

Use the equipment **for the intended use only**, i.e. for generation of vacuum in vessels designed for that purpose.

Setting up and installing the equipment

NOTICE

Before system start-up of the pump or the complete system the user has to evaluate in its entirety the explosion risks and takes adequate measures in application of the principle of risk assessment.

The evaluation and the measures have to be laid down in an explosion protection document before system start-up.

The pump/system must not be operated until operation without danger in explosive atmosphere is ensured. **Provide suitable control, protection and warning systems even in the event of failure.**

The inner (pumped media) and outer part of the pump have to be evaluated separately because of their different conformity (see also section "Technical data" and "Notes regarding devices with ATEX conformity").

The pumps are not suitable for pumping dust and have no approval for operation below ground.

The pumps are not suitable for pumping self inflammable substances, for substances which are inflammable without air and explosive substances.

WARNING

- ☞ **Electrical and vacuum components might require a separate approval.**
- ☞ Include the components in the recurrent tests of tightness for pressure vessels, in the case of hits and beats an intermediate leak test is required.
- ☞ Due to the high compression ratio of the pumps, pressure at the outlet port might be generated being higher than the max. permitted pressure compatible with the mechanical stability of the system.
- ☞ Always provide a free and pressureless exhaust pipeline.
- ☞ Do not permit any **uncontrolled pressurizing** (e.g. make sure that the exhaust pipeline cannot become blocked). If there is an exhaust isolation valve, make sure that you cannot operate the equipment with the valve closed. **Risk of bursting!**

CAUTION

- Secure coolant hoses at the hose nozzles (e.g. with hose clip) to prevent their accidental slipping.
- Comply with **maximum permissible pressures** at inlet and outlet and pressure differences, see section "Technical data". Do not operate the pump with overpressure at the inlet.
- **Attention:** Flexible elements tend to shrink when evacuated.

NOTICE

Provide a firm level platform for the equipment and check that the system to be evacuated is mechanically stable and that all fittings are secure. Ensure a stable position of the pump without any mechanical contact except of the pump feet. Comply with all applicable safety regulations.

Pumping units (pumps with vapour condenser) have to be installed protected against hits from outside and protected against splinters (against implosion). Adopt suitable measures prior to the first use.

Obey all relevant requirements (regulations and guidelines) and adopt suitable safety measures.

WARNING

- ☞ **Pay attention to the max. permitted ambient temperature and make sure ventilation is adequate especially if pump is installed in a housing or if ambient temperature is elevated, install an external automatic ventilation system if necessary.**
If pumping hot process gases make sure that the maximum permitted gas inlet temperature is not exceeded.
- ☞ If the equipment is brought from cold environment into a room for operation, allow the equipment to warm up (pay attention to water condensation on cold surfaces).
- ☞ The work clothing of the user must not lead to electrostatic discharge which may ignite the explosive atmosphere.

! WARNING**Inlet**

- ☞ Connection lines at the pump inlet have to be performed conductive grounded and gas tight (designation of the pump connections see figures).
- ☞ The diameter of the inlet pipeline should be at the least as large as the diameter of the pump connection pipelines.
- ☞ Obey max. inlet pressure (see "Technical data").
- ☞ If there is a risk of ignition of gases or gas mixtures before or behind the pump the user has to provide suitable safety devices against incoming of flames according to EN 12874. The user must ensure the suitability concerning gas flow, chemical resistance and safeness against clogging prior to use.

! WARNING**Outlet**

- ☞ Connection lines at the pump outlet (small flange) have to be performed conductive grounded and gas tight (designation of the pump connections see figures).
- ☞ The diameter of the inlet pipeline should be at the least as large as the diameter of the pump connection pipelines.
- ☞ Obey max. inlet pressure (see "Technical data").

Due to the high compression ratio of the pumps, pressure at the outlet port might be generated being higher than the max. permitted pressure compatible with the mechanical stability of the system.

! WARNING

- ☞ Obey maximum permitted pressures and pressure differences, see section "Technical data". Do not operate the pump with overpressure at the inlet.
- ☞ Do not permit any uncontrolled pressurizing (e. g. make sure that the exhaust pipeline cannot become blocked). If you have an exhaust-isolation valve, make sure that you cannot operate the equipment with the valve closed. Risk of bursting!
- ☞ Ensure that the system design does not allow the exhaust pipeline to become blocked. Lead away exhaust gas or condensate at the outlet of the pump and the overpressure safety valve under consideration of all applicable safety measures. Avoid backflow of gases or condensate definitely.
- ☞ Ensure that the system design does not allow the coolant outlet pipeline to become blocked.
- ☞ Escaped and/or intentional or unintentional released inflammable gases or vapours which may lead to danger of explosion have to be lead away safely or lead to an appropriate place. If not possible enclose the gasses, vapours or mist safely or dispose in an other way. In case of mixtures or different gases the measures must consider the highest risk.
- ☞ If there is a risk of ignition of gases or gas mixtures before or behind the pump the user has to provide suitable safety devices against incoming of flames according to EN 12874. The user must ensure the suitability concerning gas flow, chemical resistance and safeness against clogging prior to use.

Check the overpressure safety valve at the outlet regularly.

! WARNING

- ☞ Attention: If the exhaust pipeline is blocked the pumped gases may escape into the environment through the overpressure safety valve. If necessary take appropriate measures.

If pumping dangerous gases install a second completely independent exhaust pipeline instead of the overpressure safety valve. If necessary assemble a hose nozzle instead of the overpressure safety valve to lead away the gases through a second exhaust pipeline. Attention: Never combine the exhaust pipelines, i. e. provide a sperate line for each exhaust.

! WARNING**Inert gas purge**

- ☞ The user must take suitable precautions to prevent any formation of explosive mixtures in the expansion chamber using inert gas to purge the housing. Otherwise in case of a diaphragm crack, mechanically generated sparks, hot surfaces or static electricity may ignite these mixtures.
- ☞ Inert gas connection lines (inlet and outlet) have to be performed conductive grounded and gas tight (designation of the pump connections see figures).
- ☞ Connect the inert gas connections at the crankcase not serial but parallel.
- ☞ We recommend an inert gas purge of ≥ 1 l per minute.
- ☞ Provide an external pressure limitation to a pressure of 1.1 bar absolute if inert gas is connected to the pump or at an air admittance valve. The inert gas has to be dry and pure. It could be recommendable to provide an appropriate control system to supervise the inert gas flow which switches off the pump in case of failure (e. g. absence of inert gas) if necessary.
- ☞ To control the faultless function of the diaphragm it could be recommendable install a gas specific detector at the outlet of the inert gas purge. A signal from the detector indicates a diaphragm crack. Switch off the pump immediately and check diaphragms.

! WARNING

- ☞ It is possible to leave out the inert gas purge if the surrounding of the pump is zone 2 or not an explosive atmosphere.
- ☞ Without inert gas purge the pump outer part has the specification II 3G Ex h IIB T4 Gc X.

! WARNING**Gas ballast**

- ☞ Use only inert gas for gas ballast.
- ☞ We recommend the use of gas ballast when pumping condensable media.
- ☞ Gas ballast connection lines (inlet and outlet) have to be performed conductive grounded and gas tight (designation of the pump connections see figures).
- ☞ Connect the inert gas connections at the gas ballast and the crankcase not serial but parallel.
- ☞ Provide an external pressure limitation to a pressure of 1.1 bar absolute if inert gas is connected to the pump or at an air admittance valve. The inert gas has to be dry and pure. It could be recommendable to provide an appropriate control system to supervise the inert gas flow which switches off the pump in case of failure (e. g. absence of inert gas) if necessary.

! WARNING

- ☞ Pumping at high inlet pressure may lead to overpressure at the gas ballast valve.
- ☞ Pumped gases or condensate might be pushed out in case the valve is open.
- ☞ The inert gas lines have to be chemical resistant due to possible backflow.

! WARNING**Electrical connection**

- ☞ Electrical connection of the pump must be performed only by a suitable trained and supervised personnel.
- ☞ The motor cable for pumps in 230V version contains wires colour coded as follows: green or green and yellow: earth; blue or white: neutral; brown or black: live.
- ☞ The earth connection of the device (potential equalization) has to be performed only using the green or green/yellow earth connection wire. Connect the earth connection wire of the device to the earth connection of the power supply line and the potential equalization point of the environment of the device.
- ☞ When using pumps with two motors absolutely connect both motors as described above. Ensure that always both motors are running.

Attention: Never use the antistatic connection at the housing of the device to connect the device to ground, use only the green or green and yellow connection wire of the motor. Use the antistatic connection at the housing only to perform an antistatic connection of other non-electronic devices and components, e. g. inlet and outlet vacuum hoses or something similar. Never lead away short-circuit currents using this connection. External electric devices have to be connected at the potential equalization point of the environment separately and independent of this device.

WARNING

- ☞ Equipment must be connected only to a suitable fused and protected electrical supply and a suitable earth point by suitable trained personnel. Failure to connect the motor to ground may result in deadly electrical shock.
- ☞ Check that mains voltage and current conform with the equipment (see rating plate).
- ☞ **Obey notes regarding the motor in section "Instructions manual: Explosion proof motors", see below.**

The motor is protected by a **thermal cutout with manual reset combined with an overcurrent protection.**

WARNING

- ☞ Avoid reliable high heat supply (e. g. due to hot process gases). Maximum permitted gas and ambient temperature see "Technical data".
- ☞ Make sure ventilation is adequate especially if pump is installed in a housing or if ambient temperature is elevated, install an external automatic ventilation system if necessary.
- ☞ Ensure that in case of **pumps with two motors** both motors are switched on at the same time, if not possible switch on the motor of the pump at the outlet first.

Ambient conditions

To the best of our knowledge the equipment is in compliance with the requirements of the applicable EC-directives and harmonized standards (see "Declaration of conformity") with regard to design, type and model, especially directive EN 61010-1. This directive gives in detail conditions, under which the equipment can be operated safely (see also IP degree of protection).

Adopt suitable measures in case of differences, e. g. using the equipment outdoors, installation in altitudes of more than 1000 m above mean sea level, conductive pollution or dewiness.

Pay attention to the **permissible maximum ambient and gas inlet temperatures** (see "Technical data").

Operating conditions

The pumps have a conformity according to their specification to be installed in areas and to pump out of areas which contain under normal operation conditions occasionally a potential explosive atmosphere as a mixture of air with inflammable gases or vapours (**category 2**). **Class of ignition and temperature see "Technical data".**

The specification for category 2 for the outer part of the pump is only valid when purging the crankcase with inert gas. Without inert gas purging the pump has the specification II 3G Ex h IIB T4 Gc X for the outer part.

Ensure that the materials of the wetted parts are compatible with the pumped substances, see section "Technical data".

WARNING

- ☞ Adopt suitable measures to prevent the release of dangerous, explosive, corrosive or polluting fluids.
- ☞ If pumping **different substances**, it is recommended to purge the pump with air or inert gas prior to changing the pumped media in order to pump out residues and to avoid reactions of the pumped substances with each other and with the pump materials.
Take into consideration interactions and chemical reactions of the pumped media. Ensure that the materials of the wetted parts are compatible with the pumped substances, see section "Technical data".
- ☞ The valves and the diaphragms are wear parts. Replace the diaphragms and valves at the latest at 90% of the typical lifetime or immediately at higher noise level. The typical lifetime of a diaphragm is 15000 operation hours when pumping non-corrosive or non-condensable gases, if necessary provide an operation time counter.
- ☞ Check the overpressure safety valve between the pump stages (only pumps with four cylinders) regularly and replace at the latest at 90% of the typical lifetime (typical lifetime: 15000 operation hours).
- ☞ Take adequate precautions to protect people from the effects of dangerous substances (chemicals, thermal decomposition products of fluoroelastomers), wear appropriate safety-clothing and safety glasses.
- ☞ Obey applicable regulations when disposing of chemicals. Take into consideration that chemicals may be polluted.
- ☞ Adopt suitable measures to prevent contamination of the pumped substances or the environment.

Electronic equipment is never 100% fail-safe. This may lead to an indefinite status of the equipment. Provide protective measures against malfunction and failure.

WARNING

- ☞ Operating the pump, stand still of the pump or operating the air admittance valve must not lead to a critical dangerous situation under any circumstances.

Ensure that in case of failure the pump and the vacuum system always will turn into a safe status.

WARNING

- ☞ In case of leaks in the manifold or diaphragm cracks pumped substances might be released into the environment or into the pump housing. To reduce the risk of leaks, ask for a diaphragm pump with additional safety diaphragm.
- ☞ Obey especially notes on operation and use and maintenance.
- ☞ Failure of the pump (e. g. by power failure) or connected components, parts of the supply (e. g. coolant) or change of parameters (e. g. increase of pressure in the coolant system) must not lead to a critical dangerous situation under any circumstances.

Safety during operation

DANGER

- ➔ Adopt suitable measures to prevent the release of dangerous, toxic, explosive, corrosive, noxious or polluting fluids, vapours and gases. In case install an appropriate collecting and disposal system and take protective action for pump and environment.
- ➔ Prevent any part of the human body from coming into contact with vacuum.
- ➔ Potentially explosive mixtures at the outlet of the pump have to be drained appropriately, sucked off or diluted with inert gas to non-explosive mixtures.



WARNING

- ☞ Pay attention to the symbol "hot surfaces" on the equipment. Adopt suitable measures to prevent any danger arising from the formation of hot surfaces or electric sparks. Provide a suitable protection against contact if necessary.
- ☞ Always provide free and pressureless exhaust pipelines.
- ☞ Ensure that the **coolant outlet pipeline** is always free and that it cannot get blocked.
- ☞ Check liquid level in both catchpots regularly and drain condensate in time.

WARNING

- ☞ Pumping at **high inlet pressure** may lead to overpressure at the gas ballast valve. Pumped gases or condensate might be pushed out in case the valve is open. If an inert gas supply is connected, ensure that the inlet pipeline is not contaminated.

CAUTION

- Comply with applicable regulations when disposing of chemicals. Take into consideration that chemicals may be polluted. Take adequate precautions to protect people from the effects of dangerous substances (chemicals, thermal decomposition products of fluoroelastomers), wear appropriate safety-clothing and safety glasses.

WARNING

- ☞ Use only **genuine spare parts and accessories**. Otherwise safety and performance of the equipment as well as the electromagnetic compatibility of the equipment might be reduced.
- ☞ If not using genuine spare parts the ATEX conformity becomes invalid.

Do not start the pump if the pressure difference between inlet and outlet port exceeds 1.1 bar at maximum.

Prevent the backpressure of gases and the backflow of condensates.

Never suck liquids or dust into the pump.

Ensure that in case of failure the pump and the vacuum system always will turn into a safe status.

Provide appropriate protective measures (i.e. precautions which allow for the requirements of the respective application) even for the case of failure and **malfunction**.

Failure of the pump (e.g. due to power failure) or of connected components, parts of the supply or change of parameters must not lead to a critical dangerous situation under any circumstances. In case of diaphragm cracks or leaks in the manifold pumped substances might be released into the environment or into the pump housing or motor. Comply especially with notes on operation and use and maintenance.

CAUTION

- Due to the residual **leak rate of the equipment**, there might be an exchange of gas, albeit extremely slight, between the environment and the vacuum system. Adopt suitable measures to prevent contamination of the pumped substances or the environment.

Maintenance and repair

Wear parts have to be replaced regularly. In normal use, the lifetime of the diaphragms and valves is typically 15,000 operating hours. Bearings have a typical durability of 40000 h.

CAUTION

- The motor capacitors have to be replaced after 200000 start/stop cycles at the latest. If an overaged motor capacitor fails it might get hot and even melt and may cause a flame to form which could be **dangerous for persons and equipment in the vicinity**. The capacitors have to be replaced only at the factory.

Use only genuine spare parts and accessories.

WARNING

- ☞ Otherwise safety and performance of the equipment as well as the electromagnetic compatibility of the equipment might be reduced.
- ☞ If not using genuine spare parts the ATEX conformity becomes invalid.



Ensure that maintenance is done only by suitable trained and supervised technicians.

- **Isolate equipment from mains and wait two minutes** before starting maintenance to allow the capacitors to discharge.
- Before starting maintenance vent the pump, isolate the pump and other components from the vacuum system. Allow sufficient cooling of the pump. Drain condensate, if applicable.

WARNING

- ☞ **Ensure that the pump cannot be operated accidentally. Never operate the pump if covers or other parts of the pump are disassembled. Never operate a defective or damaged pump.**

- ☞ **Attention:** The pump might be contaminated with process chemicals which have been pumped during operation. Ensure that the pump is decontaminated before maintenance and take adequate precautions to protect people from the effects of dangerous substances if contamination has occurred.

- ☞ Take adequate precautions to protect people from the effects of dangerous substances (chemicals, thermal decomposition products of fluoroelastomers), wear appropriate safety-clothing and safety glasses.

- ☞ To avoid danger due to electrostatic ignition wipe the device or parts of the device only with a humid cloth.

In order to comply with law (occupational, health and safety regulations, safety at work law and regulations for environmental protection) vacuum pumps, components and measuring instruments returned to the manufacturer can be repaired only when certain procedures (see section "**Repair - Maintenance - Return - Calibration**") are followed.

Notes regarding devices with ATEX conformity

This information sheet does not replace the instructions for use!

In directive 89/391/EEC the European Union has defined requirements for safety at work, which later have been detailed for explosive atmospheres in the directive 1999/92/EC.

The requirements to equipment for operation in explosive atmospheres have been defined in the directive 94/9/EC, since April 20th 2016 in directive 2014/34/EU (also known as ATEX 100a or ATEX 95).

Concerning technology these directives only state general requirements. Technical details and test procedures are "recommended" in European standards (e.g. for equipment with ATEX conformity: EN 1127, E50014ff, EN 60079, DIN EN ISO 80079-36:2016).

Since July 1st 2003 equipment intended for use in potentially explosive atmospheres shall only be sold if the equipment is in accordance with directive 94/9/EG (ATEX), since April 20th 2016 in accordance with directive 2014/34/EU. This applies only to new equipment. The repair of equipment sold prior to July 1st, 2003 is not affected. EX approvals according to directive 94/9/EC remain valid under 2014/34/EU.

Requirements to users and manufacturers of equipment according to ATEX:

The **user of a system according to ATEX** has to analyse the overall explosion risks according to directive 1999/92/EC and has to take adequate measures by means of a risk assessment. The evaluation and validation of measures has to be documented in an explosion protection document, specifying among other things the areas classified as potentially explosive (see below). The inner part of the pump (pumped gases) and the environment of the pump (outer explosion protection) have to be evaluated separately. Often the requirements will be different.

The responsibility for the classification of areas with potentially explosive atmospheres into zones and for the specification of requirements to the equipment (category of equipment, class of ignition, temperature class etc.) is accountable strictly to the operator of the system. The equipment used has to comply with these requirements. VACUUBRAND does not advise customers concerning requirements to the equipment under the specific aspects of the customer's applications.

Equipment with ATEX-conformity is to be used by appropriately instructed personnel only.

ATEX marking, intended use:

The marking of the equipment corresponding with the standards (see above) gives the areas in which the equipment may be used according to its intended use.

**Technical data, safety notes and intended use:
See instructions for use!**

The equipment must not be used if the instructions for use are not read, fully understood and obeyed.

Clean, check and maintain equipment regularly.

Do never operate a defective equipment.

Electrical connection:

VACUUBRAND diaphragm pumps with ATEX-conformity (device cat. 2) are equipped with a 230 V / 50 Hz single-phase motor and are protected by a thermal cutout with manual reset combined with an overcurrent protection.

See instructions for use concerning notes on electrical connection.

Where applicable the motors can be connected directly to an appropriate power supply by suitably trained and authorised personnel (electrician). It is the responsibility of the user to meet the requirements of explosion protection in the power supply and connection area.

For operation of VACUUBRAND ATEX VARIO pumps a motor speed control signal (4 – 20 mA) is required.

Vacuum and outlet connections:

See instructions for use: Make sure that all mechanical connections are always gas tight and electrically conducting.

The exhaust pipeline must be designed in a way that it cannot become blocked.

If the exhaust pipeline becomes blocked, the overpressure safety device at the pump releases potentially dangerous gases into the environment. Take appropriate safety measures (see instructions for use).

Evaluate the risk of explosion for the release of pumped gases at the outlet of the pump.

Use and connection of inert gas supply:

For external ATEX equipment category 2G (e.g. for use in Ex-zone 1) the crank case of the pump has to be flushed with inert gas (e.g., nitrogen). A flow of approx. 1 l/min (at atmospheric pressure up to max. 0.1 bar over pressure) is sufficient. If necessary the flow should be monitored using a flow meter. Without inert gas purge the pump has external equipment category 3G. This means the pump has to be used in this case only in a surrounding with Ex - zone 2 (or no Ex-zone).

It is recommended to install a gas detector (specific to the pumped gas) at the outlet of the inert gas tubing. The maximum permitted overpressure at the inert gas outlet is 0.1 bar (check the flow rate through the gas detector!). A positive signal from the detector indicates a diaphragm failure. In this event switch off the pump immediately and check the pump.

In the case of pumping condensable vapours, use gas ballast. Connect inert gas with maximum overpressure of 0.1 bar to the gas ballast inlet (see instructions for use).

**Inlet of air into the gas ballast must never lead to formation of an explosive mixture inside the pump
or at the outlet of the pump!**

Technical data

Type		MZ 2C EX MZ 2C EX + AK + EK MZ 2C EX + IK + EK	MD 4C EX MD 4C EX + AK + EK	MV 10C EX MV 10C EX + AK + EK
ATEX approval Inner part (pumped gases) Outer part Surrounding of the pump with inert gas purge Surrounding of the pump without inert gas purge		II 2G Ex h IIC T3 Gb X II 2G Ex h IIB T4 Gb X II 3G Ex h IIB T4 Gc X		
ATEX approval Motor		II 2G Ex db IIB T4 Gb		
Max. pumping speed* according to ISO 21360	m ³ /h	1.9	3.7	8.1
Ultimate vacuum* (absolute) without gas ballast	mbar	12	3	2
Ultimate vacuum* (absolute) with gas ballast	mbar	18	10	10
Max. permitted pressure at the inlet and the outlet (absolute)	bar	1.1		
Max. permitted pressure difference between inlet and outlet	bar	1.1		
Max. permitted pressure at inert gas connection (absolute)	bar	1.1		
Max. permitted ambient temperature during operation	°C	+10 to +40		
Max. permitted ambient temperature during storage	°C	-10 to +60		
Permitted gas inlet temperature	°C	+10 to +40		
Max. surface temperature of the pump (outer part)	°C	110		
Max. permitted atmospheric moisture during operation (no condensation)	%	30 to 85		
Degree of protection of the pump IEC 529 Pump Pump + AK + EK / Pump + IK + EK		IP 54** IP 52**	IP 54** IP 54**	IP 54** IP 54**
Nominal current draw	A	1.2	2	2 x 2
Maximum start-up current / Start-up duration		5.5 A / 125 ms	10.2 A / 125 ms	2 x 10.2 A / 125 ms

* Technical data according to EN 61010-1 and EN 1012-2 recommendation. The pump achieves its ultimate pumping speed and ultimate vacuum only at operating temperature (after approx. 15 min.).

** Only when positioning the pump horizontal.

We reserve the right for technical modifications without prior notice!

Type		MZ 2C EX MZ 2C EX + AK + EK MZ 2C EX + IK + EK	MD 4C EX MD 4C EX + AK + EK	MV 10C EX MV 10C EX + AK + EK
Max. permitted range of voltage supply / frequency		230V ± 10% / 50 Hz		
Integral leak rate	mbar ³ /s	0.1		
Motor power	kW	0.15	0.25	2 x 0.25
No-load speed	min ⁻¹	1500		
A-weighted emission sound pressure level ^{***} (uncertainty K _{pA} : 3 dB(A))	dB(A)	50	53	53
Inlet Pump Pump + IK + EK		KF 16 hose nozzle DN 13 mm	KF 25 -	KF 25 -
Outlet Pump Pump + AK + EK / Pump + IK + EK		KF 16 hose nozzle 10 mm		
Gas ballast connection		hose nozzle 10 mm		
Inert gas purge connection		hose nozzle 8 mm		
Recommended flow of inert gas	l/min	≥ 1		
Overall dimensions L x B x H, approx.				
Pump	mm	340 x 290 x 250	440 x 265 x 305	560 x 430 x 410
Pump + AK + EK	mm	357 x 308 x 470	600 x 365 x 420	on request
Pump + IK + EK	mm	357 x 308 x 470	-	-
Mass, approx.				
Pump	kg	21.6	29.3	63.2
Pump + AK + EK	kg	25.4	37.4	on request
Pump + IK + EK	kg	on request	-	-

*** Measurement according to EN ISO 2151:2004 and EN ISO 3744:1995 at 230V/50Hz and ultimate vacuum with exhaust tube at outlet.

We reserve the right for technical modifications without prior notice!

Wetted parts

Components	Wetted parts
Inlet	stainless steel*
Outlet Pump Pump + AK + EK	stainless steel** PBT
Hoses	PTFE, antistatic
Fittings	ETFE / stainless steel*
Housing cover insert	PTFE, carbon reinforced
Head cover	ETFE, carbon reinforced
O-ring in head cover	FPM
Diaphragm clamping disc	ETFE, carbon reinforced
Valve	FFKM or PTFE
Diaphragm	PTFE
Overpressure safety relief device	stainless steel***, PTFE, carbon reinforced, FFKM
Separator cover plate	PTFE, carbon reinforced
Catchpot, collecting flask, vapour condenser	borsilicate glass

* stainless steel 1.4404

** stainless steel 1.4541

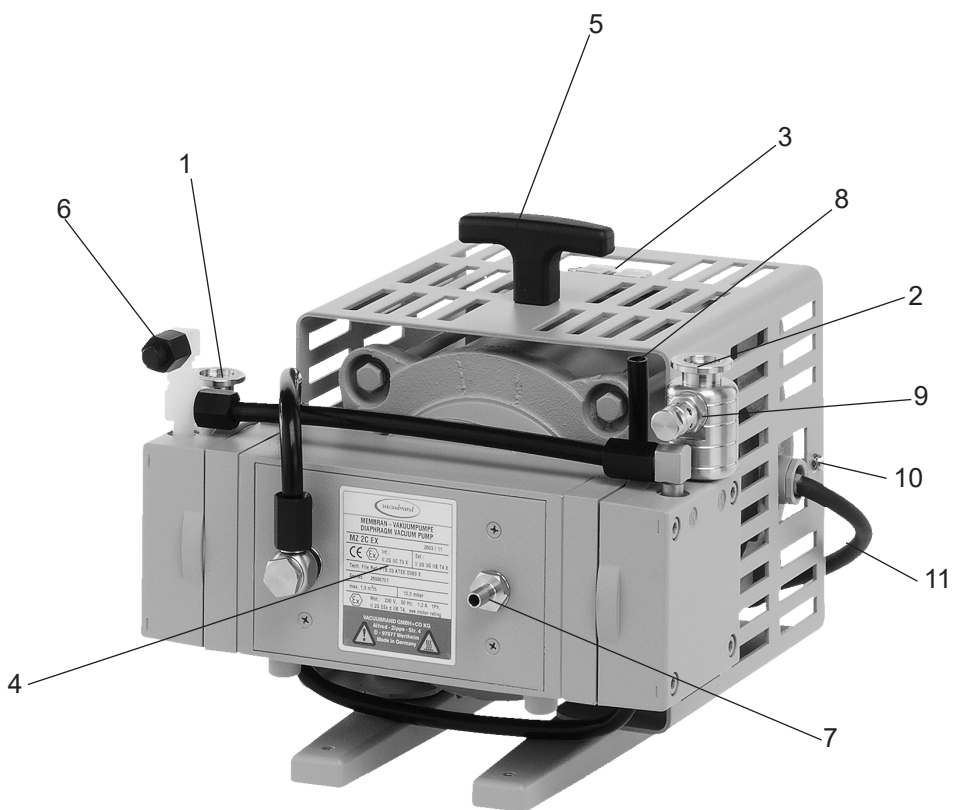
*** stainless steel 1.4404 and 1.4310

Pump parts

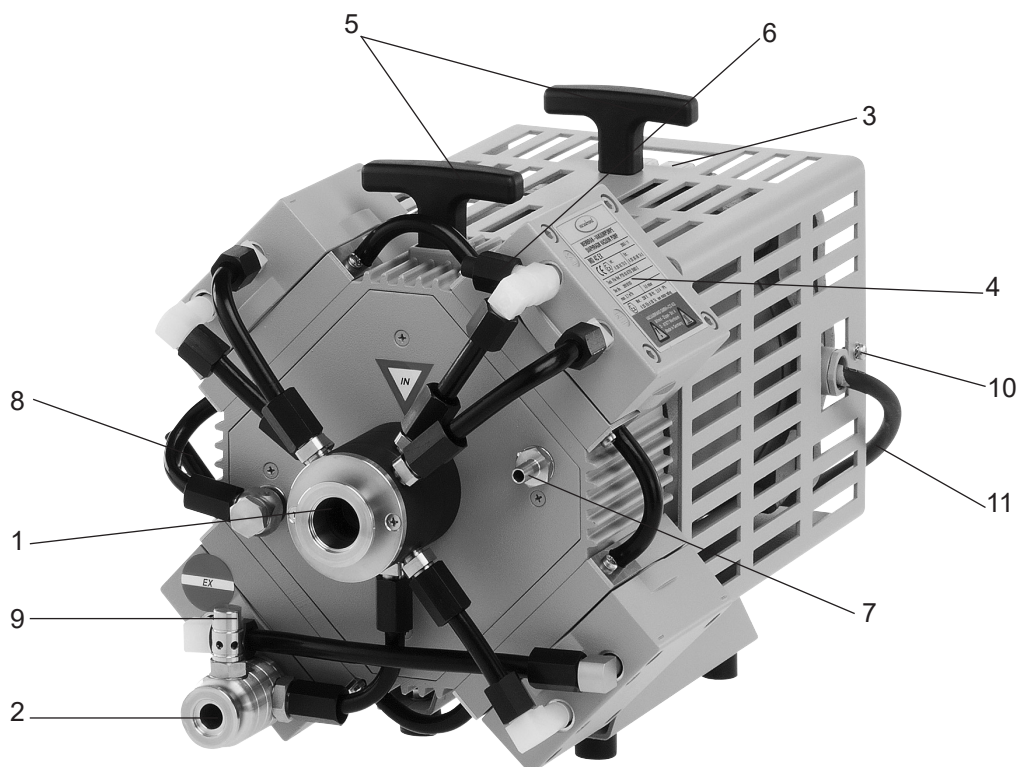
Position	Component	Position	Component
1	inlet (vacuum connection)	12	exhaust waste vapour condenser
2	outlet (gas!)	13	coolant inlet (hose nozzle 6 mm)
3	on/off switch (0: off, 1: on)	14	coolant outlet (hose nozzle 6 mm)
4	rating plate	15	catchpot
5	handle	16	cover plate
6	gas ballast connection (only inert gas)	17	collecting flask
7	inlet inert gas purge	18	immission condenser
8	outlet inert gas purge		
9	overpressure valve		
10	antistatic connection		
11	mains cable		

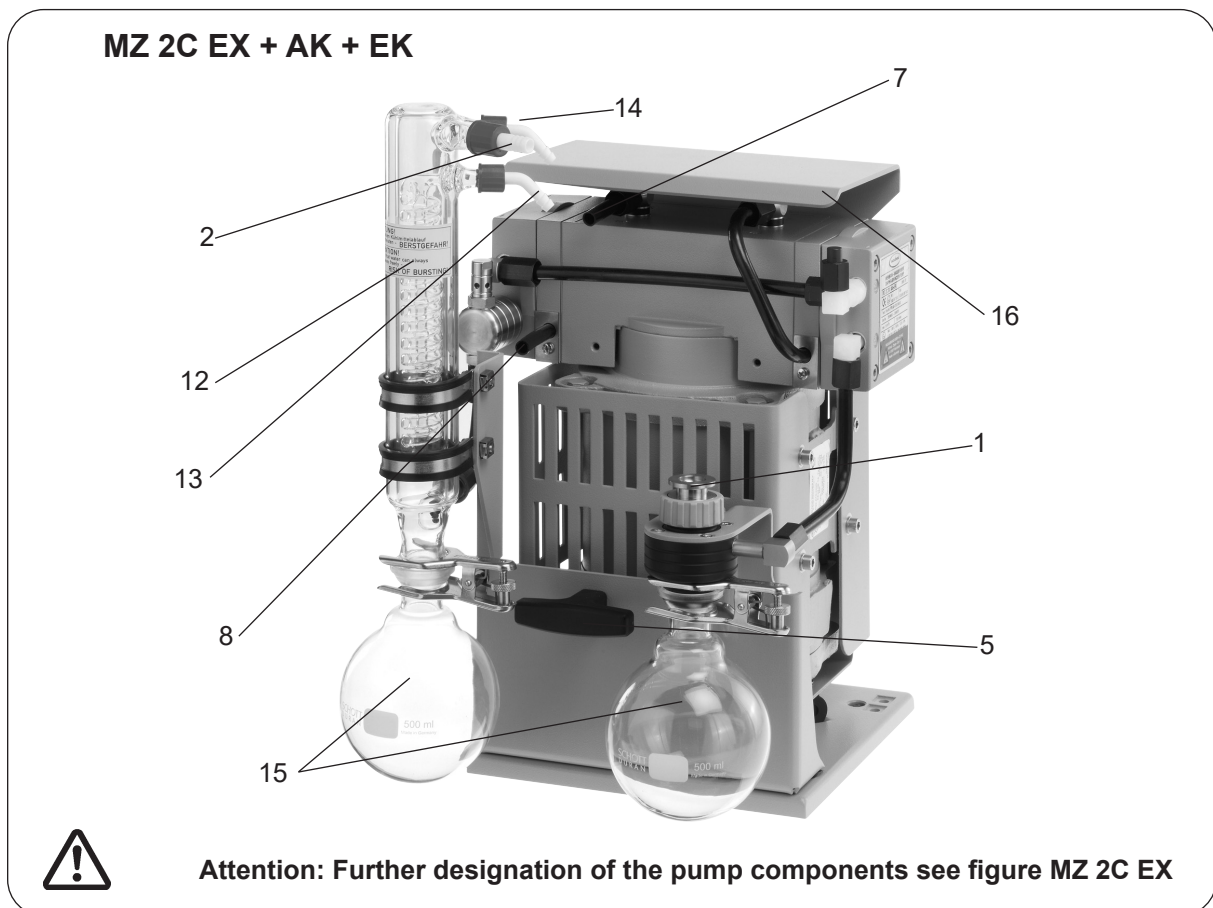
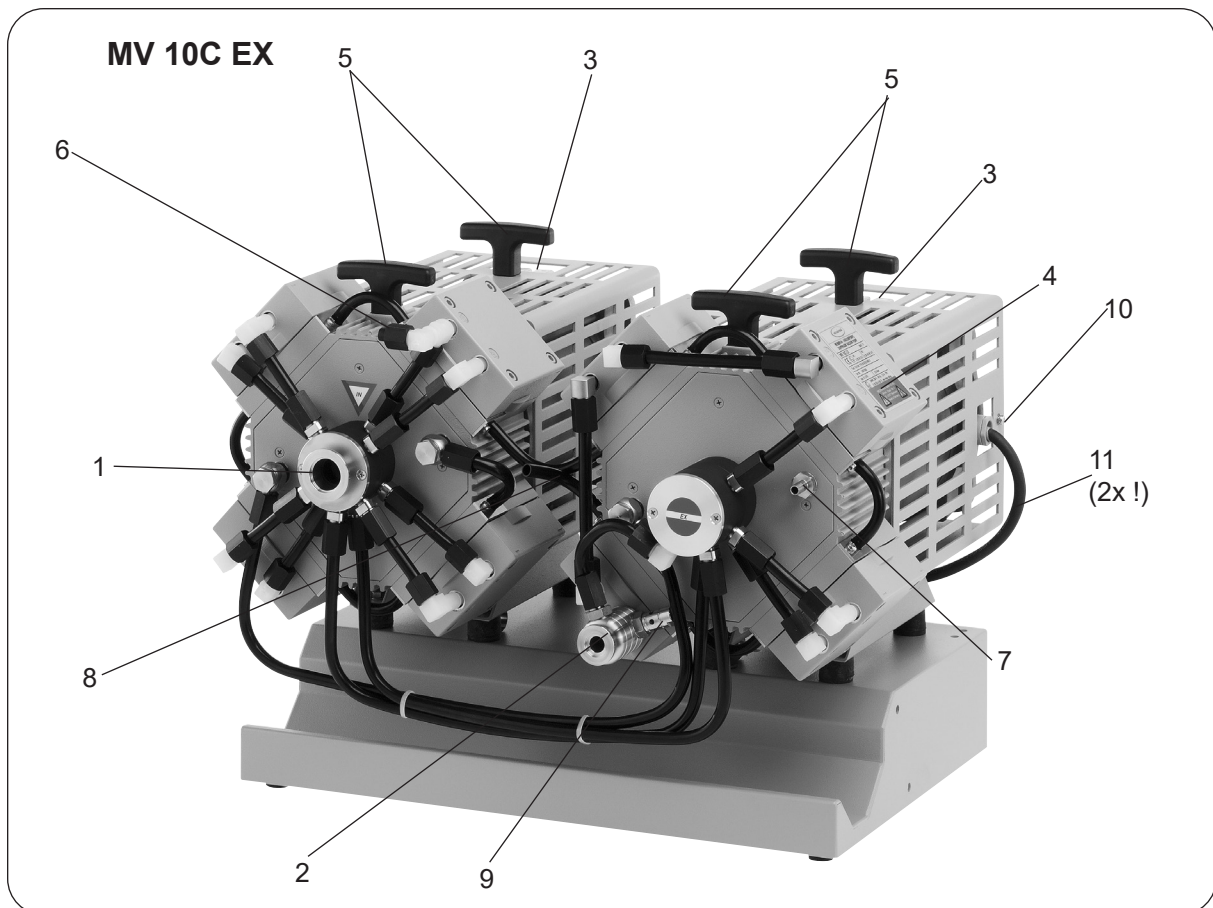
We reserve the right for technical modifications without prior notice!

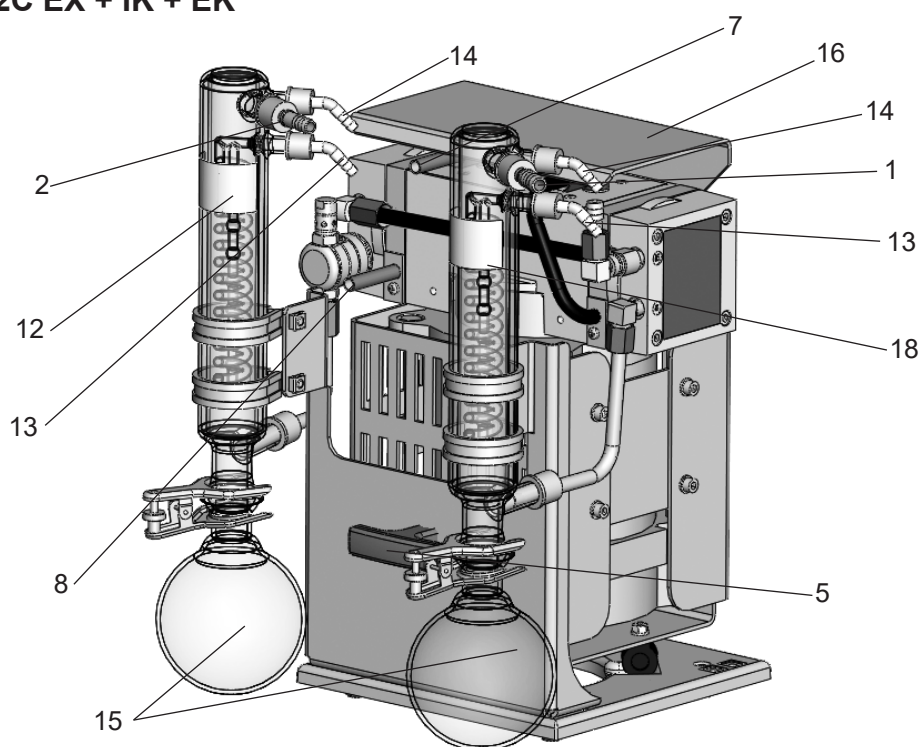
MZ 2C EX



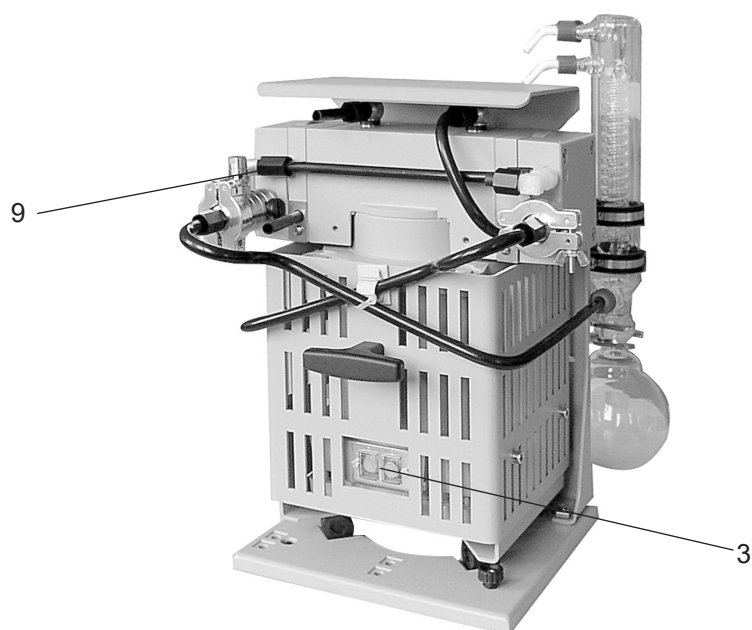
MD 4C EX





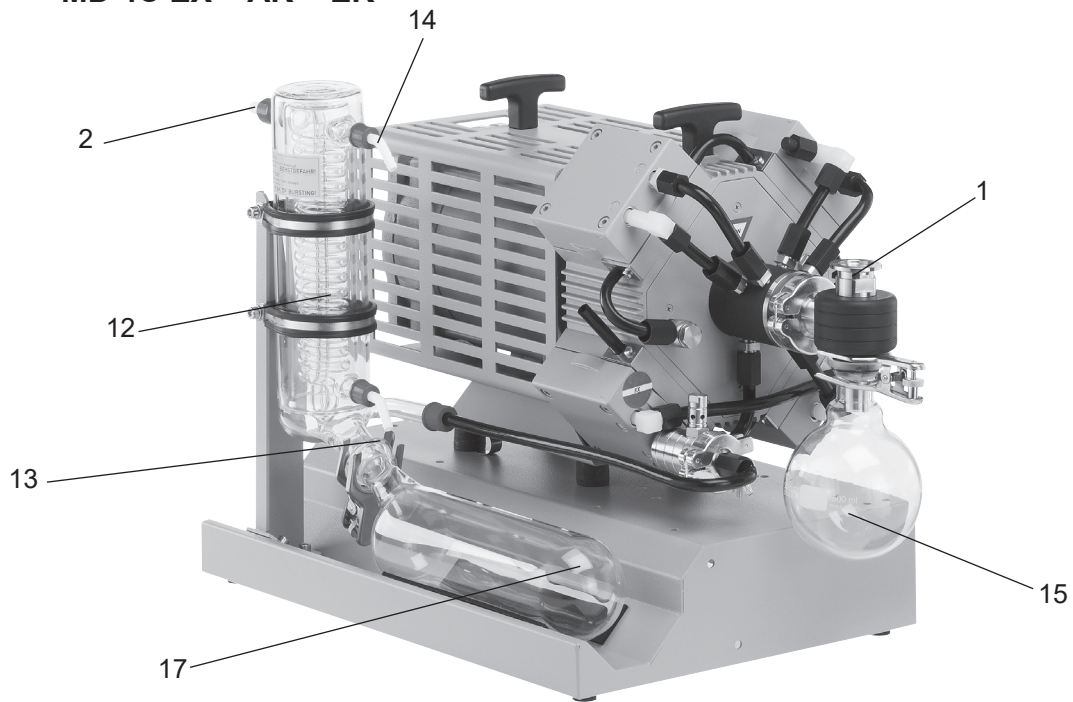
MZ 2C EX + IK + EK

Attention: Further designation of the pump components see figure MZ 2C EX

MZ 2C EX + AK + EK / MZ 2C EX + IK + EK (rear side)

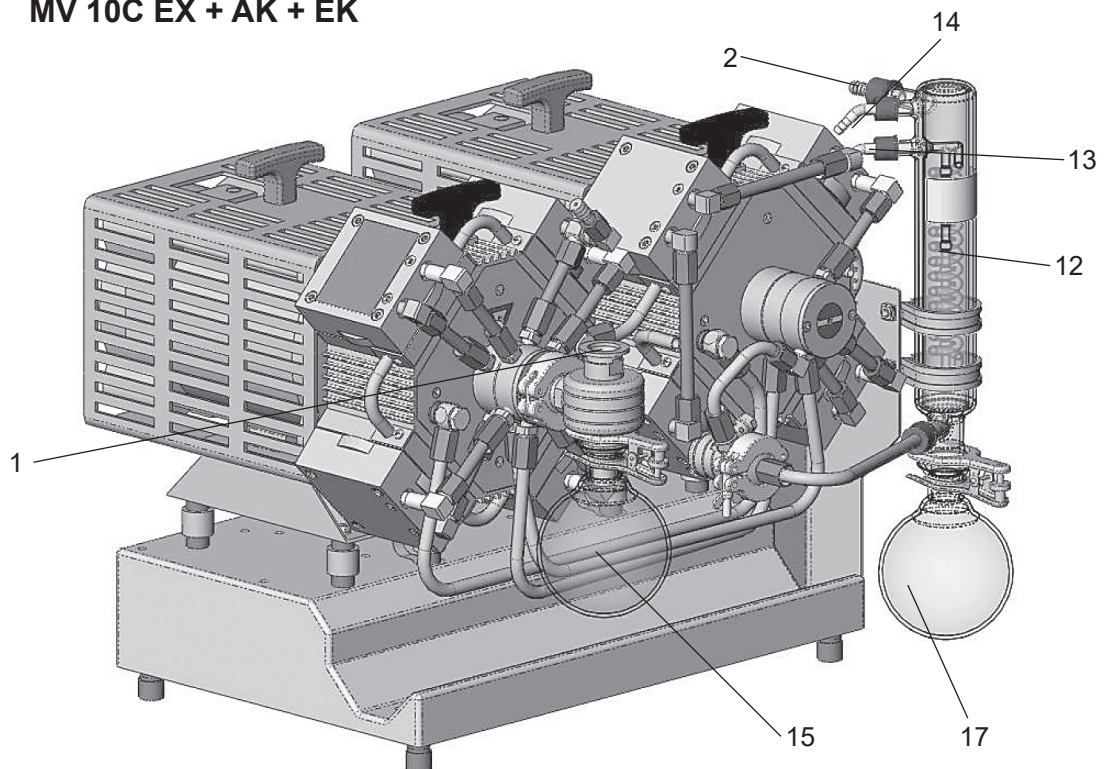
Attention: Further designation of the pump components see figure MZ 2C EX

MD 4C EX + AK + EK



Attention: Further designation of the pump components see figure MD 4C EX

MV 10C EX + AK + EK



Attention: Further designation of the pump components see figure MV 10C EX

Use and operation

Installing in a vacuum system

CAUTION

- All connection lines at the pump (e. g. inlet, outlet, gas ballast connection, inert gas connection) have to be performed conductive grounded.
- Connect pump and all connected components to ground.
- Avoid contact of the pump with rusty metal parts, e. g. by positioning the pump with sufficient distance to surrounding parts.
- The pump is designated for a low degree of mechanical stress. Protect the pump from damage and beats. In case of damage switch off the pump immediately, check leak rate if necessary.
- Connection lines at the pump inlet have to be gas tight. Particles and dust must not be aspirated, the user has to provide appropriate filters if necessary. The user must ensure their suitability concerning gas flow, chemical resistance and safety against clogging prior to use.
- Connect an exhaust line gas tight at the pump outlet if necessary. Always dispose of exhaust gases appropriately (e.g. into a fume hood). If there is risk of release of dangerous or polluting fluids, install an appropriate system to catch and dispose of those fluids.
- Reduce the transmission of vibration and prevent mechanical load due to rigid pipelines. Insert elastic hoses or flexible elements as couplings between the pump and rigid pipes. **Attention:** Flexible elements tend to shrink when evacuated.
- Use of a suitable valve to isolate the pump from the vacuum system is recommended to allow the pump to warm up before pumping condensable vapours or to clean the pump before it is switched off.
- The gas outlet must never be blocked. The exhaust line has always to be free (pressureless) to ensure an unimpeded discharge of gas.
- Especially if the gas ballast valve is open, a power failure may cause accidental ventilation of the pump. In case this constitutes a potential source of danger, take appropriate safety measures.
- Make sure ventilation is adequate especially if the pump is installed in a housing or if the ambient temperature is elevated. Provide external ventilation if necessary. Keep a distance of minimum 20 cm between fan and ambient parts.

NOTICE

Avoid throttling losses by using connecting pipes with large diameter and by keeping them as short as possible.
In case of perturbing exhaust noise connect an exhaust hose. Install outlet pipelines always falling to avoid backflow of condensate towards the pump.
When assembling, ensure **vacuum-tightness**. After assembly, check the whole system for leaks. Secure hose connections at the pump appropriately against accidental detaching.

NOTICE

Attach the pipelines of the coolant circuit to the respective hose nozzles (hose nozzles 6-8 mm, see image) at the vapour condenser. Check hose connections prior to starting operation of the cooling system.
Secure coolant hoses at the hose nozzles (e.g. with hose clip) to prevent their accidental slipping.

CAUTION

- The gas outlet must not be blocked. The exhaust pipeline has always to be free and pressureless to enable an unhindered discharge of gases.
- If necessary connect the exhaust to a suitable treatment plant to prevent the discharge of dangerous gases and vapours to the surrounding atmosphere.
- **Attention:** Install hoses of the cooling system in a way to avoid flow / dropping of condensed water onto the pumping unit (especially cables and electronic parts).
- Ensure that the **coolant outlet pipeline** is always free and that it cannot get blocked.
- Install an optional coolant valve always in the supply line of the vapour condenser only.

Connection of the mains cable**WARNING**

- ⓘ Electrical connection of the pump must be performed only by a suitable trained and supervised personnel.
- ⓘ The motor cable for pumps in 230V version contains wires colour coded as follows: green or green and yellow: earth; blue or white: neutral (N); brown or black: live (L).
- ⓘ Provide a fuse for the mains cable (L and N) according to the current draw of the motor, see "Technical data".
- ⓘ The earth connection of the device (potential equalization) has to be performed only using the green or green/yellow earth connection wire. Connect the earth connection wire of the device to the earth connection of the power supply line and the potential equalization point of the environment of the device.
Attention: Never use the antistatic connection at the housing of the device to connect the device to ground, use only the green or green and yellow connection wire of the motor. Use the antistatic connection at the housing only to perform an antistatic connection of other non-electronic devices and components, e. g. inlet and outlet vacuum hoses or something similar. Never lead away short-circuit currents using this connection. External electric devices have to be connected at the potential equalization point of the environment separately and independent of this device.
- ⓘ In case of power failure unintentional venting of the system is possible. Adopt suitable measures if this might lead to a dangerous situation.

Inlet**WARNING**

- ⓘ Connection lines at the pump inlet have to be performed conductive grounded and gas tight (designation of the pump connections see figures).
- ⓘ Particles and dust must not be aspirated, the user has to provide appropriate filters if necessary. The user must ensure the suitability concerning gas flow, chemical resistance and safeness against clogging prior to use.
- ⓘ If there is a danger of deposits in the pump chamber (check inlet and outlet of the pump) control the pump chamber regularly and clean if necessary.
- ⓘ If there is a risk of ignition of gases or gas mixtures before or behind the pump the user has to provide suitable safety devices against incoming of flames according to EN 12874. The user must ensure the suitability concerning gas flow, chemical resistance and safeness against clogging prior to use.

Connection of the inert gas purge**WARNING**

- ⓘ Connect the inert gas connections at the gas ballast and the crankcase not serial but parallel.
- ⓘ Inert gas connection lines (inlet and outlet) have to be performed conductive grounded and gas tight (designation of the pump connections see figures).
- ⓘ We recommend an inert gas purge of ≥ 1 l per minute.

WARNING

- ☞ To control the faultless function of the diaphragm it could be recommendable to install a gas specific detector at the outlet of the inert gas purge. A signal from the detector indicates a diaphragm crack. Switch off the pump immediately and check diaphragms.
- ☞ If the surrounding of the pump is not an explosive atmosphere it is possible to leave out the inert gas purge.

WARNING**Connection of the inert gas ballast**

- ☞ Connect the inert gas connections at the gas ballast and the crankcase not serial but parallel.
- ☞ Use only inert gas at the gas ballast connection. Therefore replace the blind cap at the gas ballast connection by the hose nozzle enclosed.
- ☞ Gas ballast connection lines (inlet and outlet) have to be performed conductive grounded and gas tight (designation of the pump connections see figures).
- ☞ Provide an external pressure limitation to a pressure of 1.1 bar absolute if inert gas is connected to the pump or at an air admittance valve. The inert gas has to be dry and pure. Provide an appropriate control system to supervise the inert gas flow which switches off the pump in case of failure (e. g. absence of inert gas) if necessary.

Attention: Important notes regarding the use of gas ballast

- ☞ When using air rather than inert gas, risk of significant damage to equipment and/or facilities, risk of personal injury or even loss of life exists due to the formation of hazardous and/or explosive mixtures if air and pumped media react inside or at the outlet of the pump.

WARNING**Outlet of the pump**

- ☞ Always connect an exhaust line at the pump outlet (small flange or hose nozzle 10 mm). Perform the outlet line conductive grounded and gas tight (designation of the pump connections see figures). Always connect the exhaust to a suitable treatment plant (e. g. hood).
- ☞ Potential explosive mixtures at the outlet of the pump have to be drained appropriately, sucked off or diluted with inert gas not explosive mixtures.
- ☞ If there is a danger of deposits in the pump chamber (check inlet and outlet of the pump) control the pump chamber regularly and clean if necessary.
- ☞ If there is a risk of ignition of gases or gas mixtures before or behind the pump the user has to provide suitable safety devices against incoming of flames according to EN 12874. The user must ensure the suitability concerning gas flow, chemical resistance and safeness against clogging prior to use.

WARNING**Overpressure safety valve at the outlet of the pump**

- ☞ The overpressure safety valve at the outlet prevents reliable high pressures in the system. Check overpressure safety valve regularly and replace if necessary.
- ☞ Attention: If the exhaust pipeline is blocked the pumped gases may escape into the environment through the overpressure safety valve. If necessary take appropriate measures.

If pumping dangerous gases install a second completely independent exhaust pipeline instead of the overpressure safety valve. If necessary assemble a hose nozzle (thread G 1/4) instead of the overpressure safety valve to lead away the gases or condensate through a second exhaust pipeline. Attention: Never combine the exhaust pipelines, i. e. provide a separate line for each exhaust.

DANGER

Attention: Deposits and condensate may lead to increased temperature and to excess of the max. permitted temperatures! Increased temperatures possibly may lead to ignition of flammable mixtures inside the pump.
Use inert gas ballast if necessary and check pump regularly for deposits.
Install a gas washing bottle, condenser, filter, separator, etc. at the inlet of the pump if necessary.

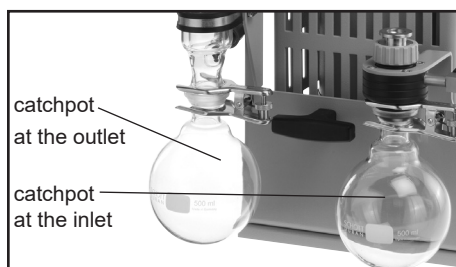
Pumps with two motors

- ☞ Ensure that in case of pumps with two motors both motors are switched on at the same time, if not possible switch on the motor of the pump at the outlet first.
- ☞ Connect the inert gas connections at the crankcase not serial but parallel.

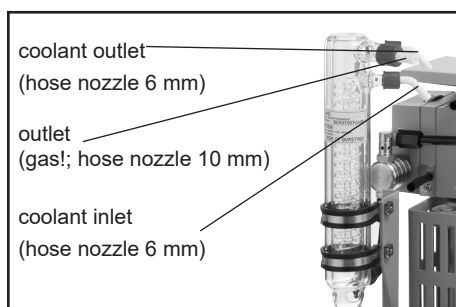


Attention: Glass parts (flasks and condensers) of pumping units (pumps with AK (IK) and EK) have no protection against splinters (against implosion) or against leakage in case of mechanical damage or hits from outside.

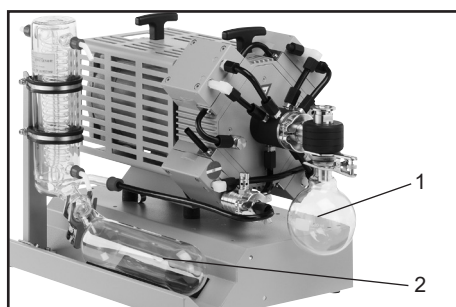
The user must ensure an appropriate protection against splinters / implosion or leakage prior to the first use.

MZ 2C EX + AK + EK / MZ 2C EX + IK + EK

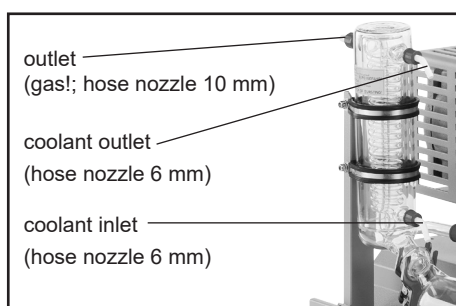
- ➔ Assemble catchpot at the inlet and at the outlet using joint clips (fig.: MZ 2C EX + AK + EK)



- ➔ Assemble hose nozzles for cooling water inlet and outlet at the vapour condenser.

MD 4C EX + AK + EK / MV 10C EX + AK + EK

- ➔ Assemble catchpot at the inlet (1) using joint clips.
- ☞ The collecting flask at the outlet (2) is already assembled.



- ➔ Assemble hose nozzles for cooling water inlet and outlet at the vapour condenser.

Separation of condensate:

Attention: Due to electrostatics reasons the vapour condenser has no protective layer to avoid separation of condensed water! Risk of bursting!


CAUTION

- Maximum permissible coolant pressure at the vapour condenser: 6 bar (absolute). Backflow always pressureless.
- Comply with the maximum permissible coolant pressures of additional components in the coolant circuit (e.g. coolant valve).
- Avoid overpressure in the coolant circuit (e.g. caused by blocked or squeezed coolant hoses).
- Install an optional coolant valve always in the supply line of the vapour condenser only.

Permissible range of coolant temperature at the vapour condenser:
-15°C to +20°C

Check hose connections prior to starting operation of the cooling system.
Check coolant hoses regularly during operation.

Do not allow the catchpots to get overfilled. Maximum liquid level approx. 80% to avoid problems when removing the catchpots.
Check liquid level in both catchpots regularly and drain catchpots in time.

Removing the catchpots:

Catchpot / collecting flask at outlet:

Remove joint clip, remove catchpot and drain condensate.

Catchpot at inlet:

Admit air or inert gas (via pump inlet) to atmospheric pressure. Remove joint clip, remove catchpot and drain condensate.

- Reassemble drained catchpots.

Important: Comply with regulations when disposing of solvents/condensates. Re-use if possible, purify if contaminated.


WARNING

For condensable vapours (water vapour, solvents, ...):

- ☞ Do not pump vapour before pump has reached its operating temperature and without inert gas ballast.
- ☞ Use inert gas at the gas ballast to avoid the formation of explosive mixtures.
- ☞ With gas ballast ultimate vacuum will be reduced
- ☞ Do not pump vapour before pump has reached its operating temperature

In case of low boiling solvents when the formation of condensate is unlikely, the use of gas ballast might be unnecessary.

- ☞ Operating the pump without gas ballast increases the solvent recovery rates at the vapour condenser.

The exhaust waste vapour condenser enables an efficient condensation of the pumped vapours at the outlet.


WARNING

- ☞ Next to 100% solvent recovery.
- ☞ Install hoses for cooling water at the inlet and outlet (hose nozzle 6 mm), secure hose connections against gliding down.
- ☞ Ensure that the system design does not allow the coolant outlet pipeline to become blocked.

WARNING

- ☞ Ensure that the system design does not allow the exhaust pipeline to be blocked (hose nozzle 10 mm), do not permit uncontrolled pressurizing.
- ☞ Connect the exhaust to a suitable treatment plant to prevent the discharge of dangerous gases and vapours to the surrounding atmosphere.
- ☞ The pumped gases at the outlet of the pump or at the exhaust waste vapour condenser have to be drained under consideration of all applicable safety regulations.

The user has to check the possibility of an explosive atmosphere at the outlet of the pump or the exhaust waste vapour condenser. Therefore for example calculate the solvent partial pressure at the present cooling water temperature at the exhaust waste vapour condenser and compare with the explosion limits of the pumped solvent. If there is an explosive mixture, drain the gas at the outlet in antistatic lines according to the valid explosion protection guidelines.

During operation**CAUTION**

- **Maximum ambient temperature:** 40 °C
- Make sure ventilation is adequate especially if the pump is installed in a housing or if the ambient temperature is elevated. Install an external automatic ventilation system if necessary.
- If the pump is installed in altitudes of more than 1000 m above mean sea level check compatibility with applicable safety requirements, especially IEC 60034 (motor might overheat due to insufficient cooling).
- ☞ **If the pump has been exposed to increased ambient temperature (> 40°C) check the pump for damage and perform a leak test if necessary (integral leak rate < 0.1 mbar*l/s).**
- Potentially explosive mixtures at the outlet of the pump have to be drained appropriately.
- Due to the high compression ratio of the pumps, pressure at the outlet port might be generated being higher than the max. permitted pressure compatible with the mechanical stability of the system.

WARNING

- ☞ Check compatibility with max. permitted pressure at the inlet and the outlet and max. pressure difference between inlet and outlet ports. Ensure that the pump outlet is not blocked or restricted.

Do not start pump if pressure difference between inlet and outlet port exceeds max. 1 bar. Attempts to start pump at higher difference may cause blockade and damage of the motor. Check compatibility with **maximally permitted pressure** at inlet and outlet.

Check the pump regularly at the outside for pollution or deposits, clean the pump if necessary to avoid increase of the operation temperature of the pump.

If pumping different substances purge the pump with inert gas prior to change the pumped media to pump out residues and to avoid reactions of the pumped substances with each other and the pump material.

Take into considerations interactions and chemical reactions of the pumped media.

The pump achieves its pumping speed, ultimate total vacuum and vapour pumping rate only at operating temperature (after approx. 15 minutes).

⚠ WARNING

- ☞ Prevent internal condensation, transfer of liquids or dust. The diaphragm and valves will be damaged, if liquids are pumped in significant amounts.
- ☞ Let the pump run with gas ballast to reduce condensation of pumped substances (water vapour, solvents,) in the pump.

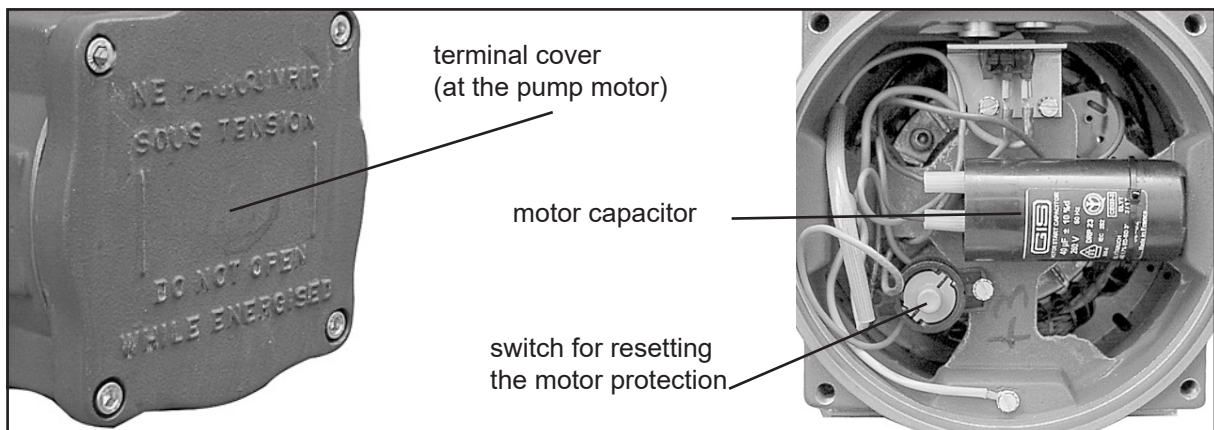
The motor is protected by a thermal cutout with manual reset combined with an overcurrent protection.

⚠ WARNING

- ☞ Attention: Only manual reset is possible. Determine cause of switching off and eliminate. Allow sufficient cooling of the pump prior to switching on again (approx. 5 minutes).
- ☞ Reset of the pump must be performed only by a suitably trained technician!
- Separate the pump from mains and wait two minutes before opening the terminal until hot parts have discharged.
Attention: Open the terminal only outside of explosive atmospheres and only by suitably trained personnel.
- Unscrew the terminal cover from the pump motor.
- Push the switch inside the terminal.
- Screw the terminal cover correctly, screw tightening torque: 23 Nm.



Attention:
Absolutely check the motor capacitor for leaks and capacity if the motor protection has been activated.
Check the complete pump for leaks in the gas line (integral leak rate <math>< 0.1 \text{ mbar l / s}</math>!



Shutdown**NOTICE****Short-term:**

Has the pump been exposed to condensate?

Allow the pump to continue to run at atmospheric pressure for a few minutes.

Has the pump been exposed to media which may damage the pump materials or form **deposits**?

Check and clean pump heads if necessary.

Long-term:

Take measures as described in section short-term shutdown.

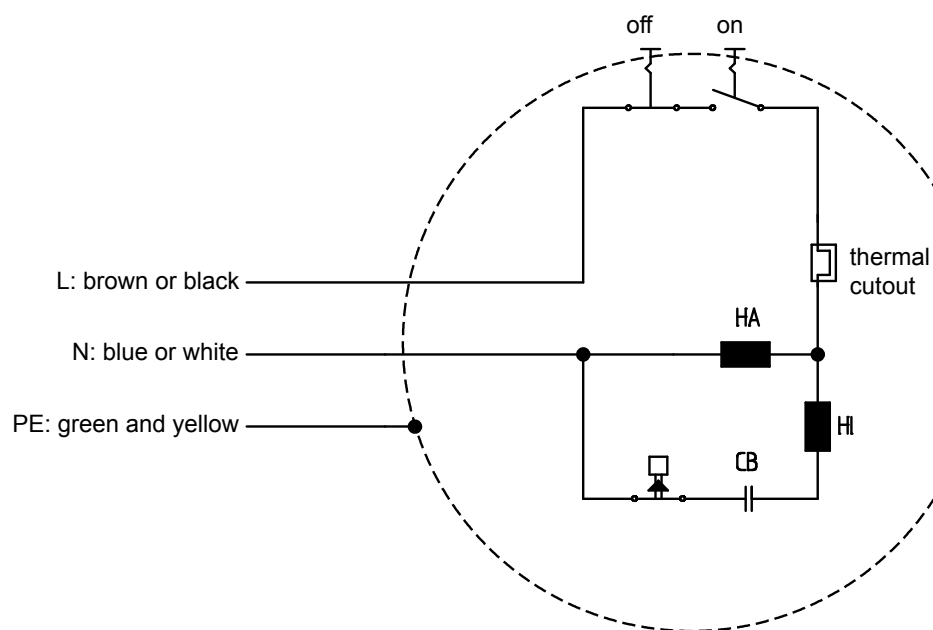
Separate pump from the apparatus.

Close inlet and outlet port (e. g. with transport caps).

Close the gas ballast valve.

Store the pump in dry condition

Circuit diagram



Motor cable

Cable length: 2 m

Cable diameter: 9.2 mm - 11.9 mm

Cable type: H07RN-F-255-3G

Wire size: 1.5 mm²

Troubleshooting

**Never operate a defective pump!
Read and obey the instructions for use!**

Fault	Possible cause	Remedy
<input type="checkbox"/> Pump does not start or stops immediately.	<ul style="list-style-type: none"> ➔ Mains not plugged in, electrical supply failure? ➔ Pressure in outlet pipeline too high? ➔ Motor overloaded? 	<ul style="list-style-type: none"> ✓ Check power supply and fuse in the building installation. ✓ Remove blockade in line, open valve. ✓ Allow the motor to cool down, identify cause of failure and eliminate. Reset the motor protection and switch on the pump, see section above.
<input type="checkbox"/> Pump does not achieve its ultimate vacuum or usual pumping speed.	<ul style="list-style-type: none"> ➔ Centring ring at small flange connection not correctly positioned or leak in the pipeline or vacuum system? ➔ Long, narrow line? ➔ Pump has been exposed to condensate? ➔ Deposits have been formed inside the pump? ➔ Diaphragms or valves damaged? ➔ Outgassing substances or vapour generated in the process? 	<ul style="list-style-type: none"> ✓ Check pump directly - connect vacuum gauge directly at pump inlet - then check connection, pipeline and vacuum system if necessary. ✓ Use lines with larger diameter, length as short as possible. ✓ Allow pump to run for some minutes with atmospheric pressure at the inlet. ✓ Clean and inspect the pump heads. ✓ Replace diaphragms and/or valves. ✓ Check process parameters.
<input type="checkbox"/> Pump too noisy. Attention: Switch off pump immediately and inspect!	<ul style="list-style-type: none"> ➔ Loud exhaust noise? ➔ Diaphragm crack or diaphragm clamping disc loose? ➔ Motor bearing defective? ➔ Deposits have been formed inside the pump? ➔ Diaphragms or valves defective? ➔ Other than above mentioned causes? 	<ul style="list-style-type: none"> ✓ Connect hose or silencer to pump outlet. ✓ Perform maintenance. ✓ Contact local distributor. ✓ Clean and inspect pump heads. ✓ Replace diaphragms and/or valves. ✓ Contact local distributor.
<input type="checkbox"/> Pump seized.		<ul style="list-style-type: none"> ✓ Contact local distributor.

Replacing diaphragms and valves

NOTICE

All bearings are encapsulated and are filled with long-life lubricant and run under normal operating conditions maintenance free. Replacement of the bearing must be performed at the latest at 90% of the nominal lifetime of the bearing (nominal lifetime of the bearing: 40000 operation hours, if necessary provide an operation time counter). If the noise level is enhanced switch off the pump immediately and inspect. Replacement of the bearing must only performed at the factory. Never operate a defective pump.

NOTICE

The motor capacitors are wear parts. The motor capacitors have to be replaced after 200000 start/stop cycles at the latest. The capacitors have to be replaced only at the factory.

NOTICE

The valves and the diaphragms are wear parts. Replace the diaphragms at the latest at 90% of the typical lifetime or immediately at higher noise level. The typical lifetime of a diaphragm is 15000 operation hours when pumping non-corrosive or non-condensable gases, if necessary provide an operation time counter. Pumping condensable media, operation at high temperature, great gas flow or deposits reduce the lifetime of a diaphragm significantly. Therefore check the diaphragm regularly for faultless condition.

- ☞ Prevent internal condensation, transfer of liquids or dust. The diaphragm and valves will be damaged, if liquids are pumped in significant amount.

NOTICE

To control the faultless function of the diaphragm install a gas specific detector at the outlet of the inert gas flush. A signal from the detector indicates a diaphragm crack. Switch off the pump immediately and check diaphragms. If the rated ultimate vacuum is no longer achieved, the pump interior, the hose connections, the diaphragms and the valves must be cleaned and the diaphragms and valves must be checked for cracks or other damage. Replace defective parts immediately.

NOTICE

Inspect the fittings of the pump regularly, the maximum permitted leak rate is 0.1 mbar l / s.

When replacing diaphragms and valves check the overpressure safety valve at the outlet of the pump.

Remove possible deposits in the crank chamber of the pump when replacing diaphragms and valves.

If the pump is exposed to corrosive gases or gases and vapours which may form deposits (e. g. crystallisation) or deposits due to pumped particles, maintenance should be carried out frequently (according to the experience of the user).

- ☞ Regular maintenance will improve the lifetime of the pump and also protect both man and environment.



WARNING

Before starting maintenance vent the system, isolate the pump and other components from the vacuum system and the electrical supply. Drain condensate if applicable, avoid the release of pollutants. Allow sufficient cooling of the pump. Before starting maintenance, wait two minutes after isolating the equipment from mains to allow the capacitors to discharge.

CAUTION

Never operate the pump if covers or other parts of the pump are disassembled. Ensure that the pump cannot be operated accidentally. Never operate a defective or damaged pump.

Ensure that the maintenance technician is familiar with the safety procedures which relate to the products processed by the pumping system.

Attention: The pump might be contaminated with the process chemicals that have been pumped during operation. Ensure that the pump is decontaminated before maintenance and take adequate precautions to protect people from the effects of dangerous substances if contamination has occurred.

☞ Wear appropriate safety-clothing when you come in contact with contaminated components.

NOTICE

☞ **Please read section "Replacing diaphragms and valves" completely before starting maintenance.**

Partially the pictures show pumps in other versions. This doesn't influence replacing diaphragms and valves of the pump.

NOTICE

Attention:

The pump heads of VACUUBRAND ATEX diaphragm pumps are assembled in two different versions. This is only visible after disassembling the pump heads.

Replacing diaphragms and valves is described for both versions separately.

NOTICE

If not using genuine spare parts the ATEX conformity becomes invalid.

Attention: Open the pump only outside of explosive atmospheres and only by suitably trained personnel.

Always replace both diaphragms of a pump head!

Always disassemble and assemble only one pump head before opening the next pump head. The single parts of a pump head are measured in a way so to avoid that the diaphragm clamping disc hits the head cover. Never mix parts of different pump heads or add or leave out washers.

We recommend to replace all diaphragms and valves of a pump at the same time.

Spare parts

Set of seals (diaphragms, valves, O-rings)

MZ 2C EX / MZ 2C EX + AK + EK / MZ 2C EX + IK + EK..... 1 x 20696837

MD 4C EX / MD 4C EX + AK + EK..... 2 x 20696837

MV 10C EX / MV 10C EX + AK + EK 4 x 20696837

Sealing bond (PTFE) 20637514

Valve (one piece)..... 20637225

(internal overpressure valve in MD 4C EX, MD 4C EX + AK + EK, MV 10C EX, MV 10C EX + AK + EK)

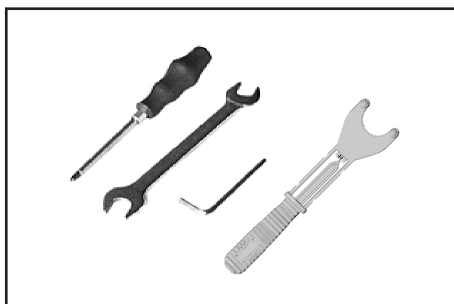
O-Ring 28 x 2.5 20635628

at the spherical ground joint of the catchpot at the inlet

Flat seal (overpressure safety valve at the outlet)..... 20637081

Spring (overpressure safety valve at the outlet)..... 20637065

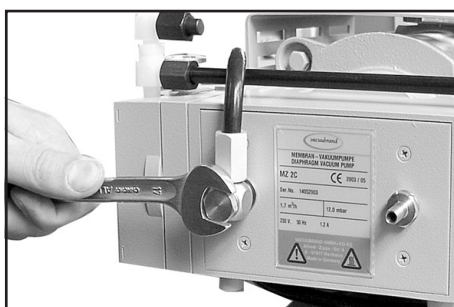
Version 1



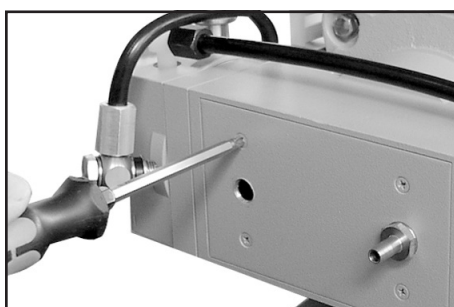
Tools required (metric):

- Phillips screw driver size 2
- Open-ended wrench size 10/15/17
- Hex key size 5
- Face wrench with torque indicator
(fig. VACUUBRAND face wrench cat. no.: 20637580)

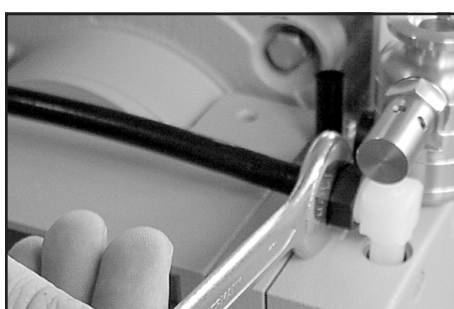
Cleaning and inspecting the pump heads



- ➔ Use open-ended wrench to unscrew the inert gas fitting at the housing cover.



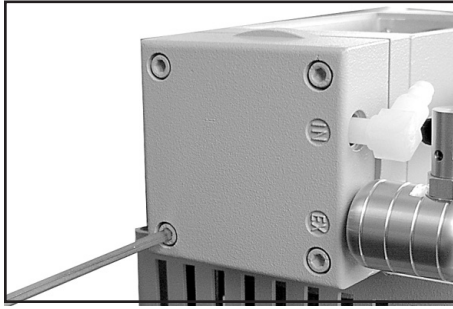
- ➔ Unscrew the housing plate from the pump.



- ➔ Unscrew the union nut at the elbow fitting of the pump head and remove hose.
- ⚠ Turn the fittings as little as possible and do not remove the fittings from the pump head.
Through reassembly a leak may result.



- ➔ Position the pump on the motor.
Unscrew the locking plate at the inert gas connection and remove hose.



- ➔ Use hex key to remove four socket head screws from pump head and remove upper housing (housing cover with housing cover insert and head cover).
- ⚠ Never remove parts by using a spiky or sharp-edged tool (e. g. screw driver), we recommend to use a rubber mallet or compressed air (to be blown carefully into port).
- ➔ Carefully remove head cover from housing cover insert and check valves. Note position of valves and remove.
- ⚠ Replace valves if necessary.
- ⚠ Use petroleum ether or industrial solvent to remove deposits. Do not inhale.

Replacing the diaphragm



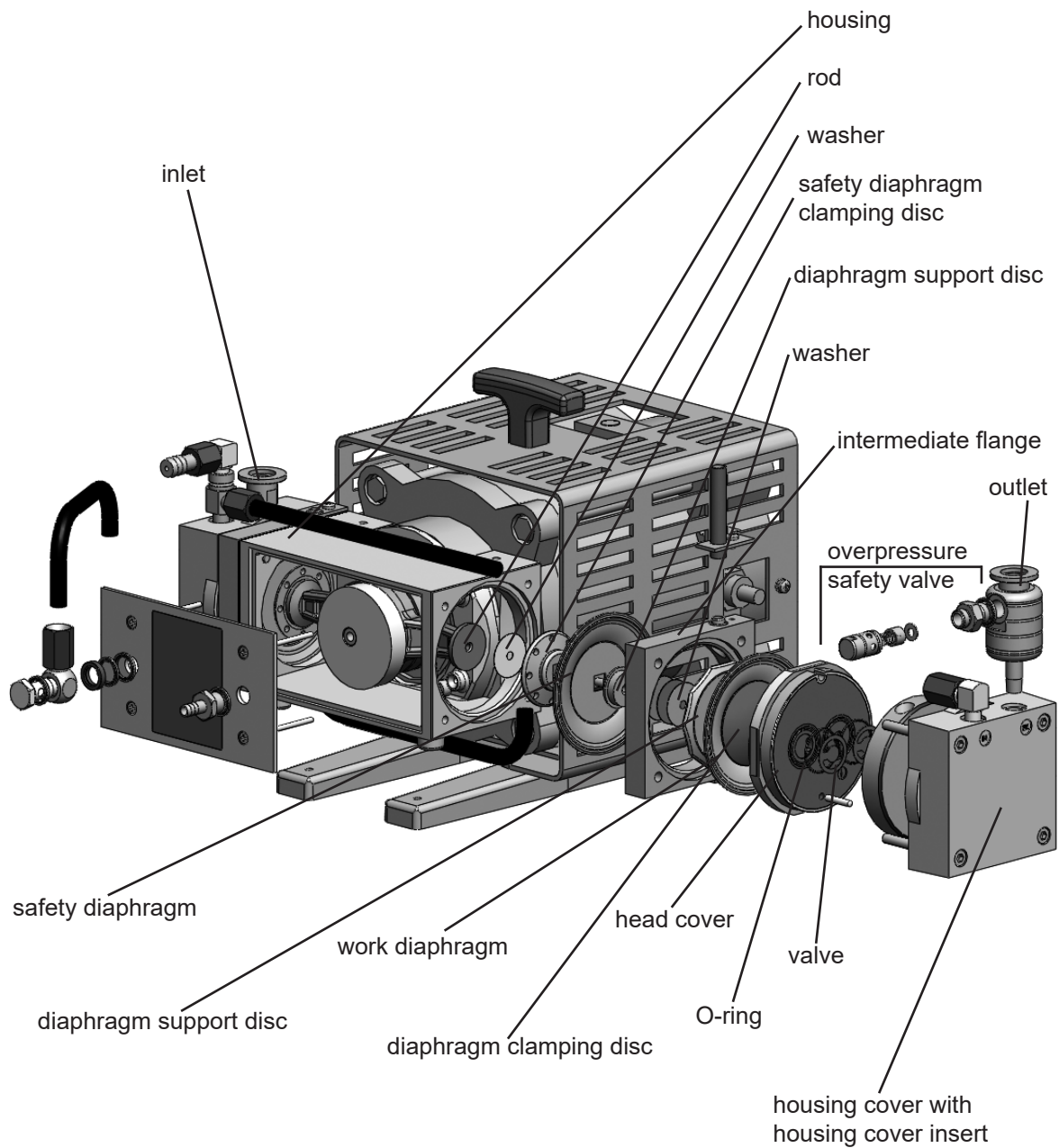
- ➔ Use a face wrench to remove diaphragm support disc.
- ➔ Check for washers under clamping disc. Do not mix the washers from the different heads. Make sure that the original number and thickness of washers is reassembled at the individual pump head.
- ➔ Never increase the amount of washers. **⚠ DANGER**
Risk of temperature increase!
Risk of explosion!



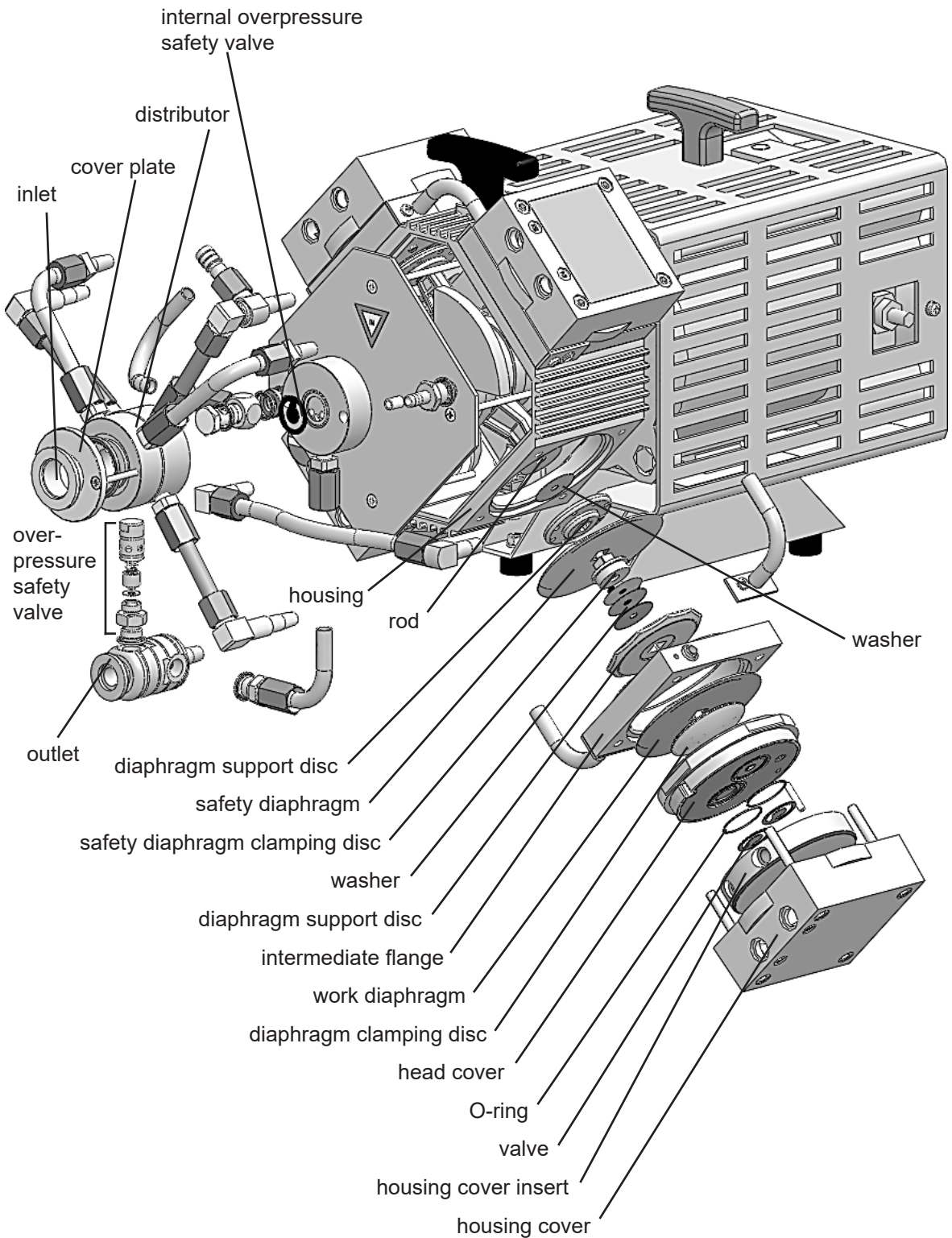
- ➔ Remove the intermediate flange with clamping discs, diaphragms and diaphragm support discs from the pump housing.

Remove the diaphragm support disc of the safety diaphragm and safety diaphragm.

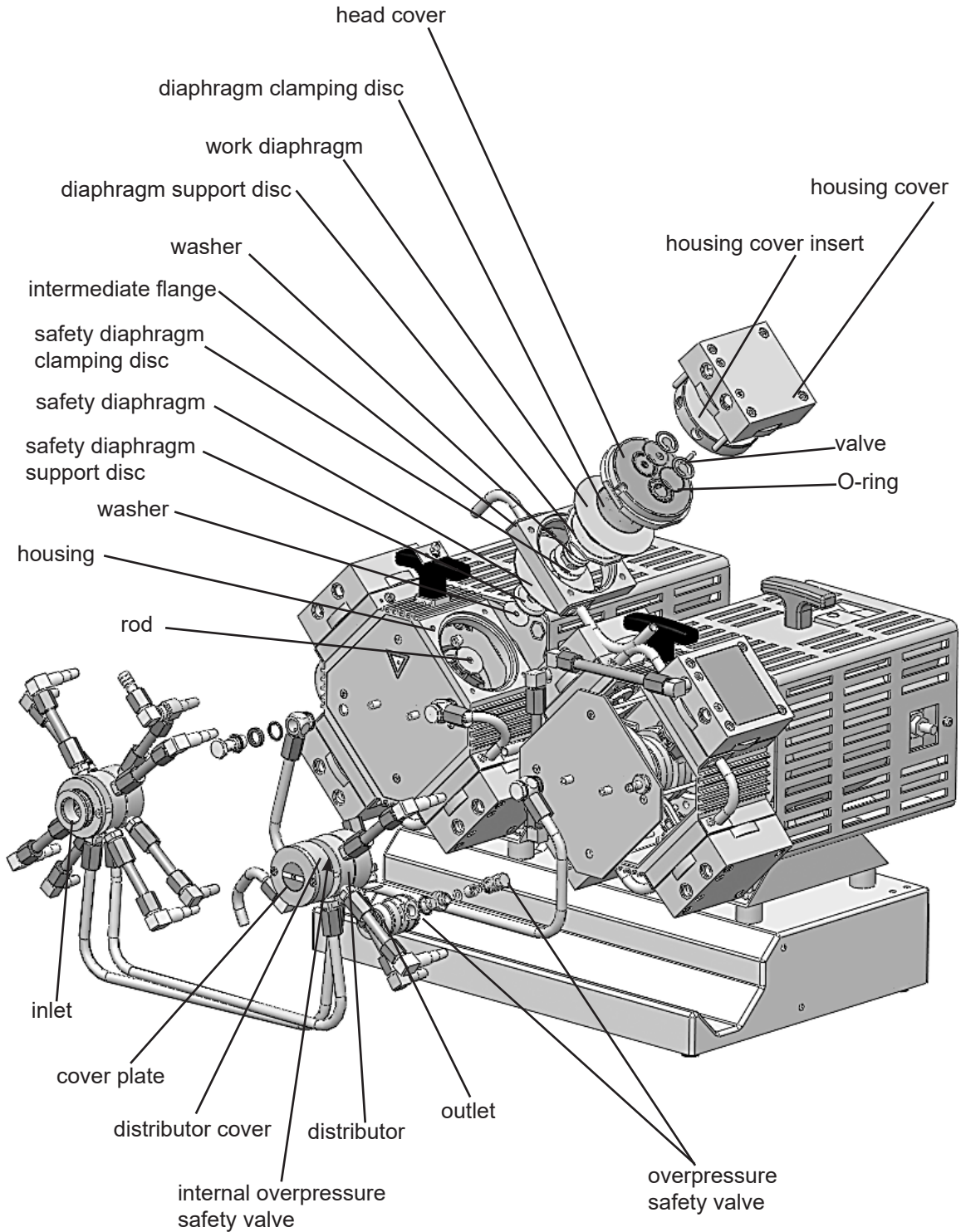
View of the disassembled pump head parts (fig. MZ 2C EX)

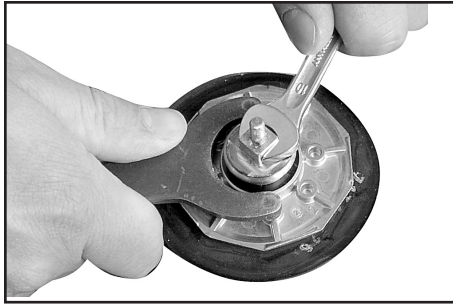


View of the disassembled pump head parts (fig. MD 4C EX)



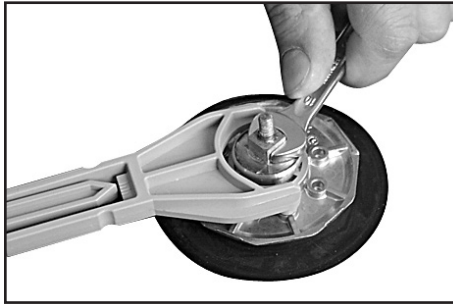
View of the disassembled pump head parts (fig. MV 10C EX)





- ➔ Use the metal face wrench to disassemble diaphragm clamping disc, diaphragm and diaphragm support disc (use a open-ended wrench to fix the components).

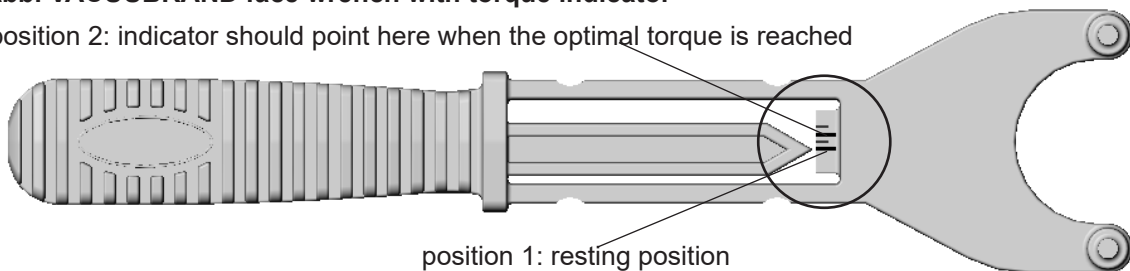
Before reassembling ensure that all parts are clean, dry and lint free, especially the valve seat. Remove residual adhesive.



- ➔ Position new diaphragm between diaphragm clamping disc with square head screw and diaphragm support disc.
 - ⚠ Attention: Position diaphragm with white PTFE side to diaphragm clamping disc (to pump chamber).
 - ⚠ Make sure that the square head screw of the diaphragm clamping disc is correctly seated in the guide hole of the diaphragm support disc.
 - ➔ Use a face wrench with torque indicator to assemble diaphragm clamping disc, diaphragm and diaphragm support disc with safety diaphragm clamping disc (use a open-ended wrench to fix the components).
 - ⚠ Make sure that the square head screw of the diaphragm clamping disc is correctly seated in the guide hole of the diaphragm support disc.
- Optimum torque for the diaphragm support disc: 6 Nm.
- ⚠ The optimum torque is reached when the pointer in the handle of the VACUUBRAND face wrench points to position 2 which is the long line between the two shorter lines. Do not tighten over 6 Nm!
 - ⚠ Ensure conductance of the connection.

Abb. VACUUBRAND face wrench with torque indicator

position 2: indicator should point here when the optimal torque is reached



position 1: resting position

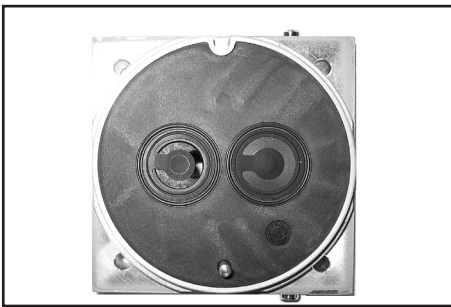


- ➔ Position diaphragm clamping disc, diaphragm and diaphragm support disc with safety diaphragm clamping disc in the intermediate flange from the side which has a deepening as guidance for the diaphragm. Position safety diaphragm and safety diaphragm support disc from the other side.
 - ⚠ Attention: Position diaphragm with the light side towards the pump chamber.
- Ensure correct position of the diaphragm support disc (see also exploded drawing). Assemble the side with the smaller bearing surface towards the diaphragm.



- ➔ Use a face wrench with torque indicator to assemble safety diaphragm support disc under the safety diaphragm with rod.
- ⚠ **Attention: Absolutely assemble all washers correct if available (between safety diaphragm support disc and rod). Never assemble more washers!**
- ⚠ **DANGER**
- ⚠ Make sure that the square head screw of the diaphragm clamping disc is correctly seated in the guide hole of the diaphragm support discs.
Optimum torque for the diaphragm support disc: 6 Nm.
- ⚠ The optimum torque is achieved if the pointer in the handle of the VACUUBRAND face wrench shows to the longer marking line (see above).
- ⚠ Ensure conductance of the connection.

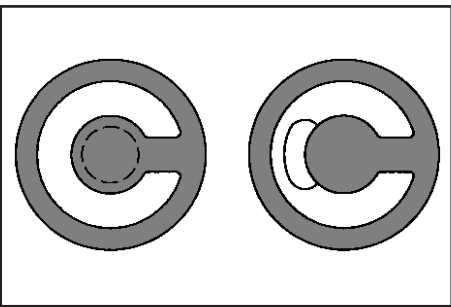
Assembling the pump head



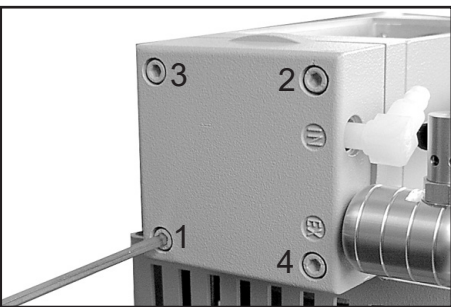
- ➔ Position pump in a way so that the disassembled pump head is above, support if necessary.
- ➔ By turning eccentric bushing (front of connecting rod), bring connecting rod into a position in which diaphragm is in contact with housing and centred with respect to bore.

Reassemble in reverse order.

- ➔ Install head cover with O-ring, valves and housing cover with housing cover insert.

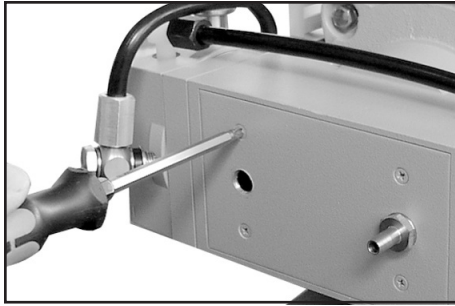


- ⚠ Make sure that the valves are correctly seated: Valves at the outlet with round centred opening under valve, valves at the inlet with kidney-shaped opening beside valve.
- ⚠ Ensure that the diaphragm is positioned centrally so that it will become clamped uniformly between housing and head cover.



- ➔ Screw in four socket head screws fixing housing cover crosswise (e. g. in the sequence 1,2,3,4) first slightly, then tighten.
- ⚠ Do not tighten until head cover is in contact with housing, torque 12 Nm.
Attention: Ensure that the diaphragm clamping disc never hits the head cover! In case of loud knocking switch off the pump immediately.

Inspect pump or replace diaphragms and valves at the other pump heads analogue.



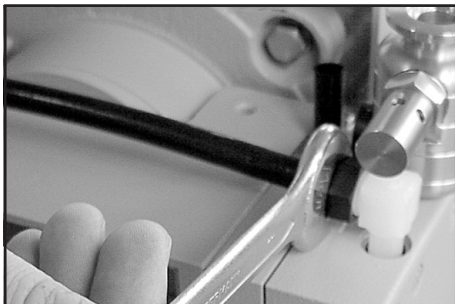
- ➔ Screw housing plate to pump.

Individual performance check of a pump head



- ➔ Measure the pressure at the inlet port of the individual head: Use a suitable vacuum gauge (e. g. DVR 2pro, cat. no.: 20682906), make sure that it is correctly calibrated, and measure the pressure at the inlet port. A vacuum of less than 120 mbar should be indicated.
- ⚠ If the reading is higher, recheck the pump chamber and make sure that the valves and the diaphragms are correctly seated (diaphragms concentric with bore).

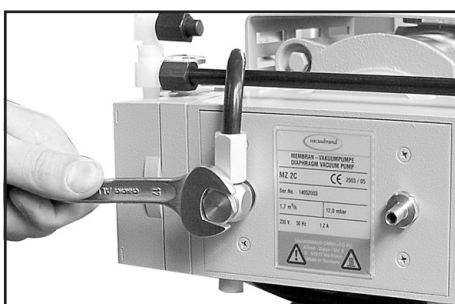
Assembling fittings



- ➔ Position pump on pump feet.
- ➔ Connect hose to elbow fitting.
- ➔ Tighten union nuts first by hand and then tighten one full turn using open ended wrench.



- ➔ Position the pump on the motor.
Attach hose to the inert gas connection and screw the locking plate.



- ➔ Use open-ended wrench to screw the inert gas fitting at the housing cover.



Attention: Perform a leak test always after opening the pump by using an appropriate leak detector (e. g. helium leak detector)!

Ensure that the diaphragm clamping disc never hits the head cover while pump is running! Noise check!

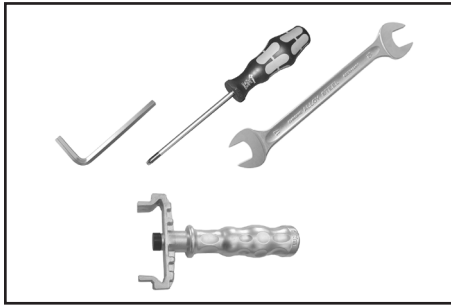
If the pump does not achieve the ultimate pressure:

☞ In case the diaphragms and valves have been replaced, a run-in period of several hours is required before the pump achieves its ultimate vacuum.

If all pump heads achieve a vacuum below 120 mbar but pump does not achieve the ultimate total pressure:

Check hose connectors between pump heads and manifolds for leaks. If necessary recheck pump chamber.

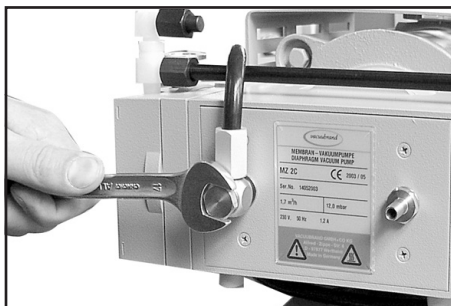
Version 2



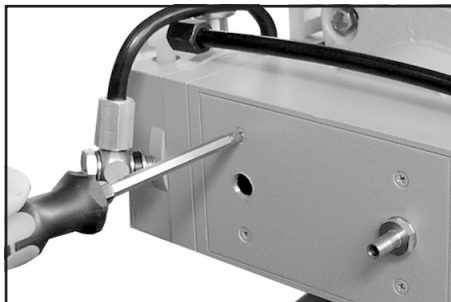
Tools required (metric):

- Phillips screw driver size 2
- Open-ended wrench size 10/15/17
- Open-ended wrench size 19, 4.5 mm thick
- Torque wrench size 19
- Hex key size 5
- Diaphragm key SW 66 (cat. no.: 20636554)
- Open-ended wrench size 19 with torque indicator

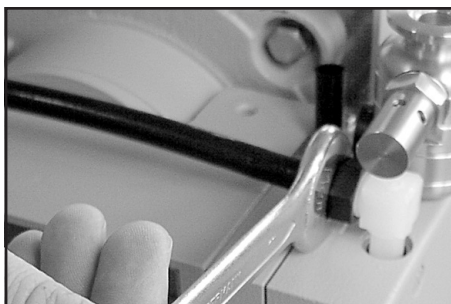
Cleaning and inspecting the pump heads



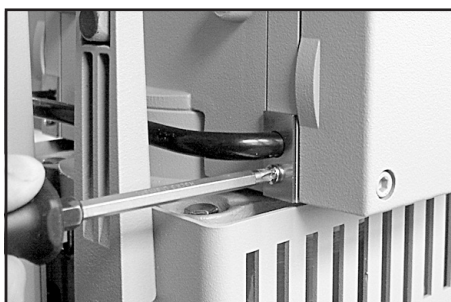
- ➔ Use open-ended wrench to unscrew the inert gas fitting at the housing cover.



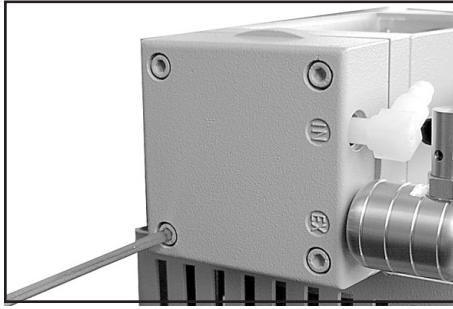
- ➔ Unscrew the housing plate from the pump.



- ➔ Unscrew the union nut at the elbow fitting of the pump head and remove hose.
- ⓘ Turn the fittings as little as possible and do not remove the fittings from the pump head. Through reassembly a leak may result.



- ➔ Position the pump on the motor. Unscrew the locking plate at the inert gas connection and remove hose.

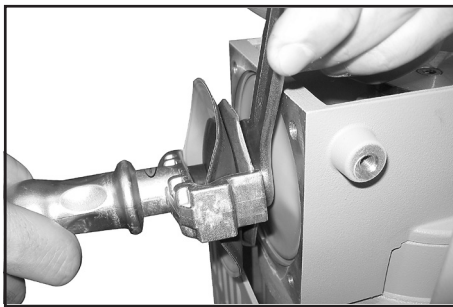


- ➔ Use hex key to remove four socket head screws from pump head and remove upper housing (housing cover with housing cover insert and head cover).
- ⚠ Never remove parts by using a spiky or sharp-edged tool (e. g. screw driver), we recommend to use a rubber mallet or compressed air (to be blown carefully into port).
- ➔ Carefully remove head cover from housing cover insert and check valves. Note position of valves and remove.
- ⚠ Replace valves if necessary.
- ⚠ Use petroleum ether or industrial solvent to remove deposits. Do not inhale.

Replacing the diaphragm



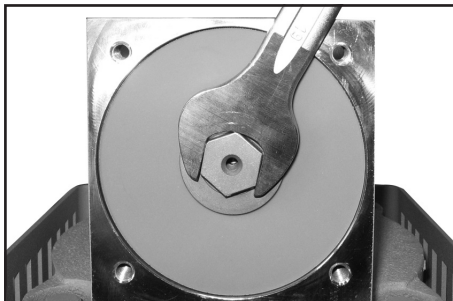
- ➔ Remove intermediate flange by hand.



- ⚠ Check diaphragm for damage and replace if necessary.
- ➔ Lift diaphragm carefully sidewise.
- ⚠ Never use a spiky or sharp-edged tool to lift the diaphragm.
- ➔ Use the diaphragm key to grip the diaphragm support disc below the diaphragm.
- ➔ Unscrew diaphragm support disc with diaphragm and diaphragm clamping disc.

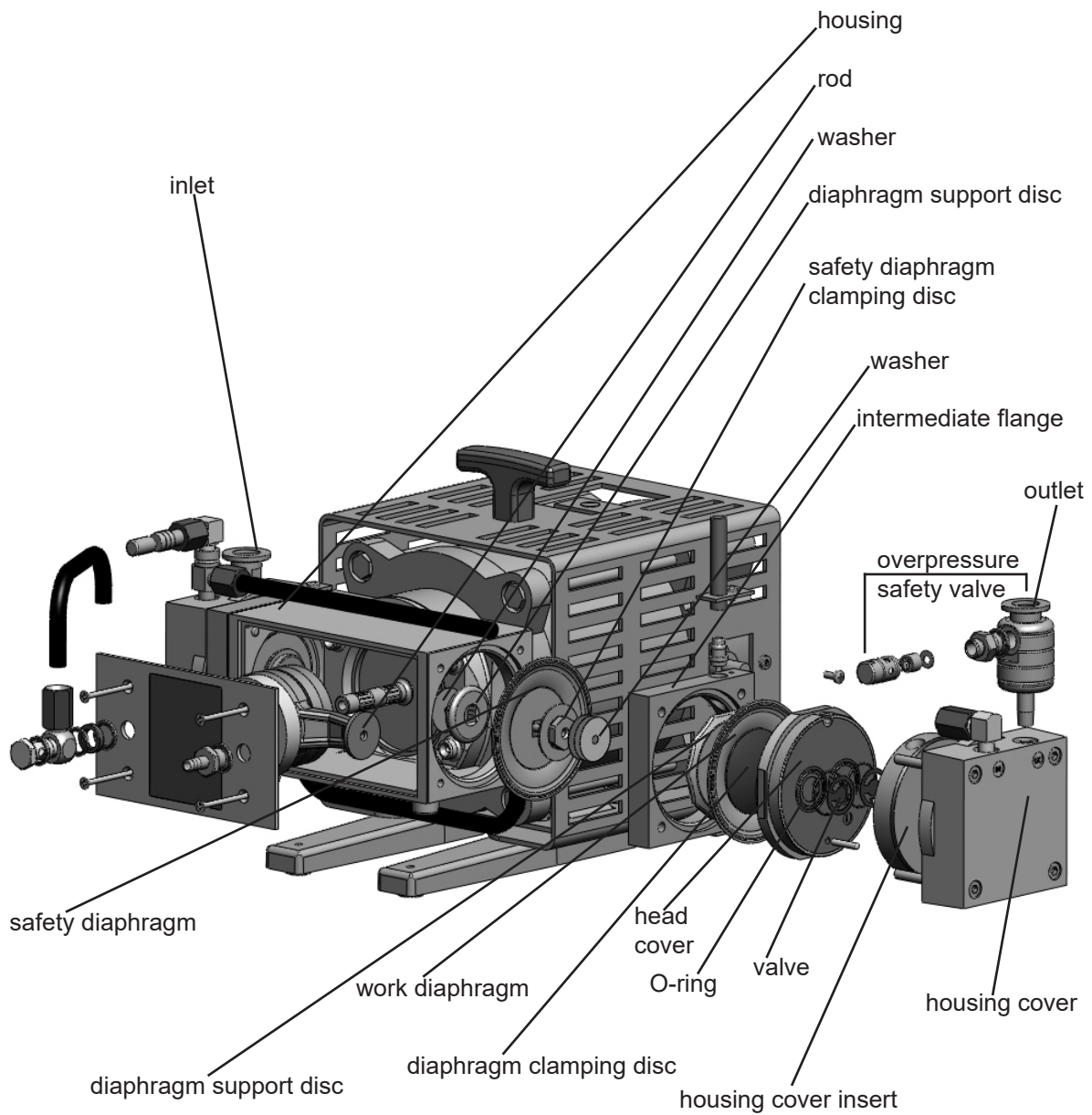
⚠ DANGER

- ➔ Never increase the amount of washers.
Risk of temperature increase!
Risk of explosion!

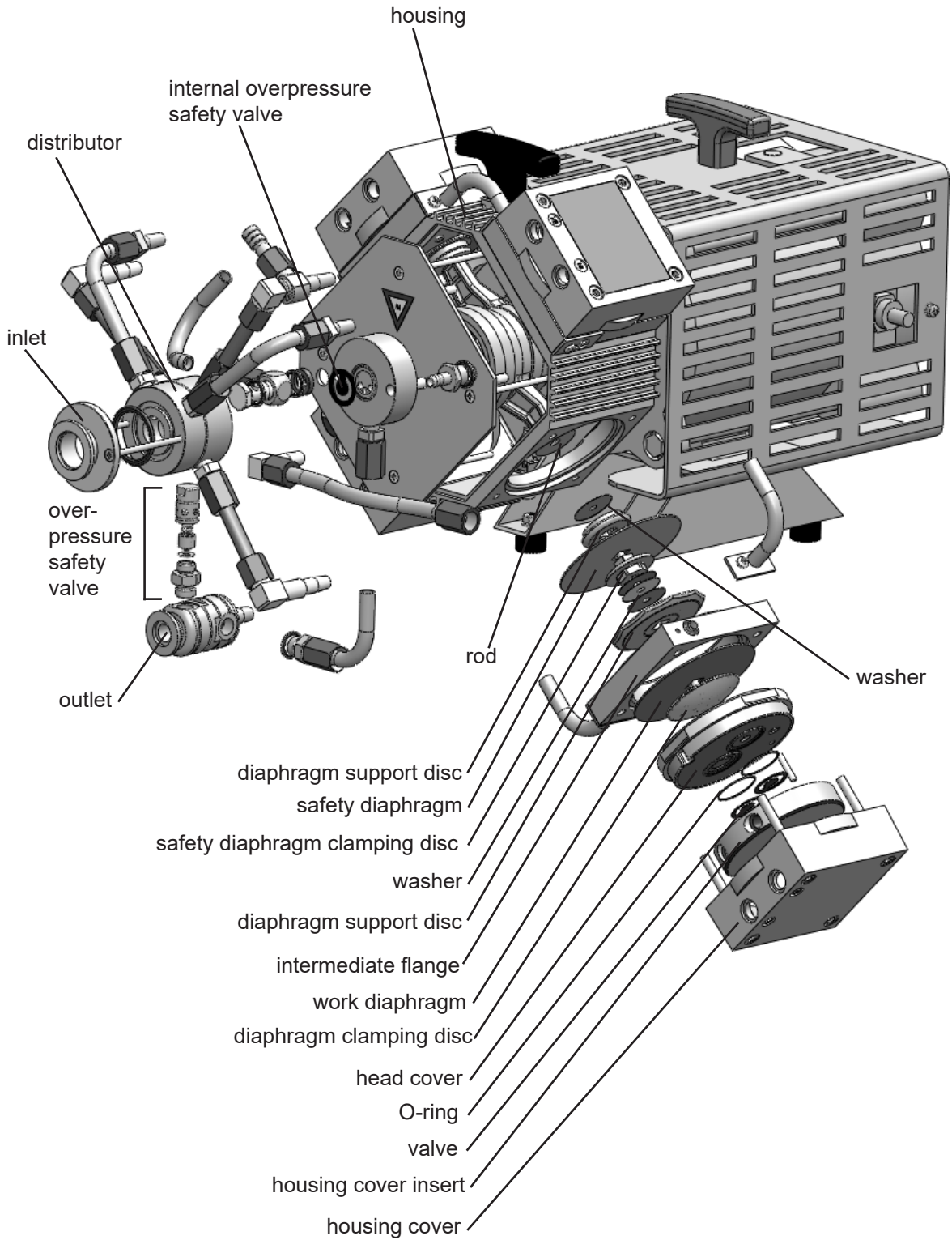


- ➔ Remove clamping disc of the safety diaphragm with an open-ended wrench and remove together with safety diaphragm and support disc.

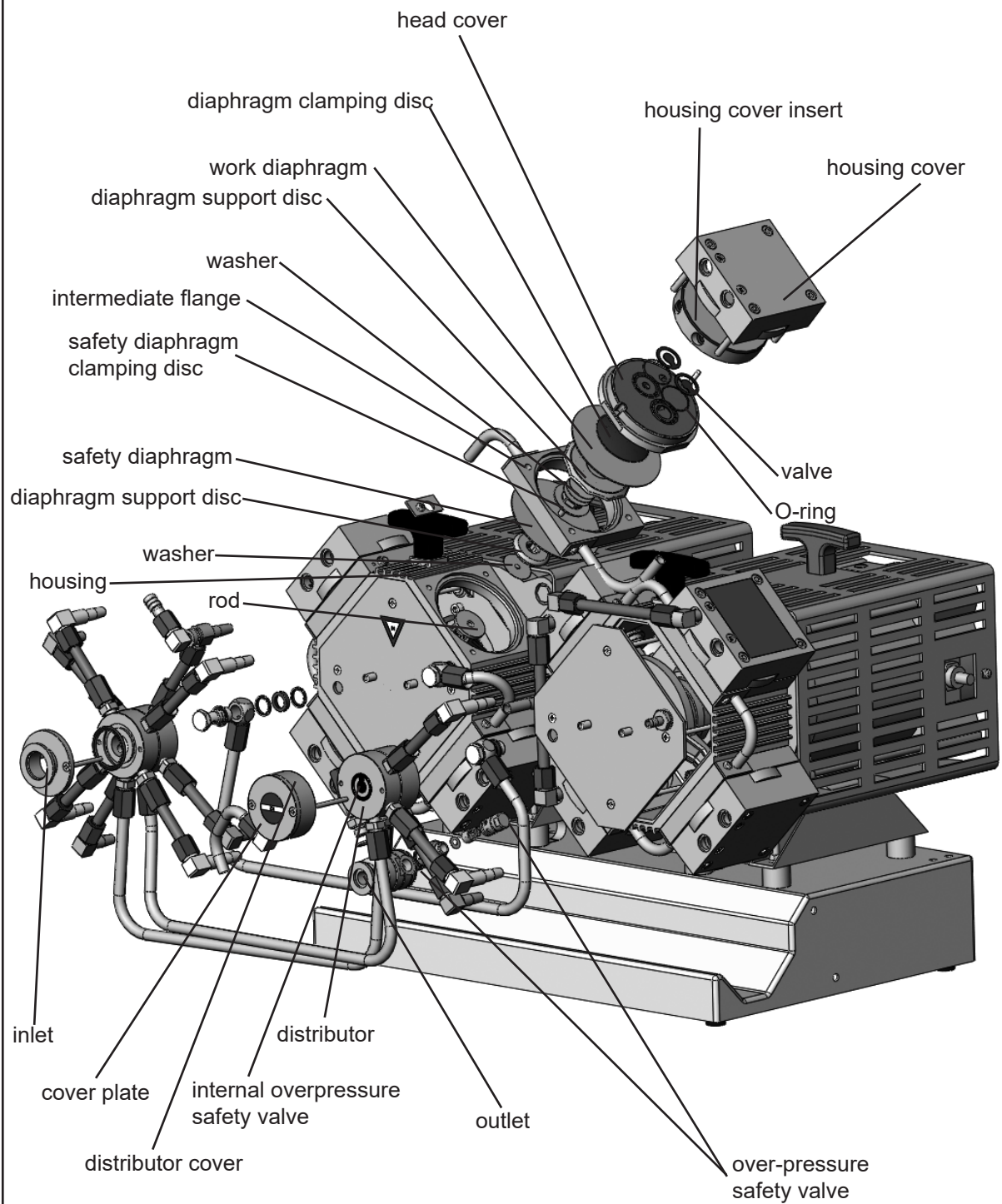
View of the disassembled pump head parts (fig. MZ 2C EX)

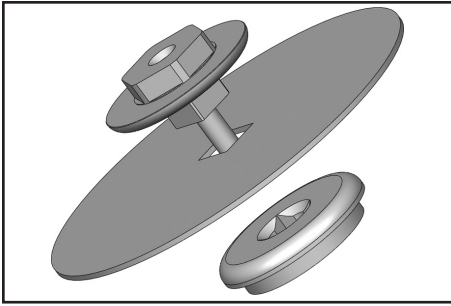


View of the disassembled pump head parts (fig. MD 4C EX)



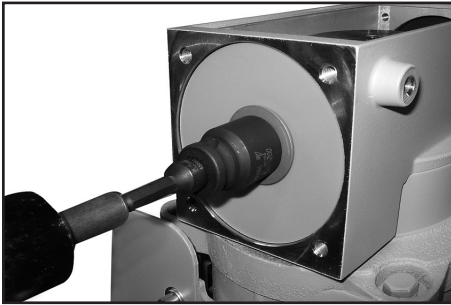
View of the disassembled pump head parts (fig. MV 10C EX)





Before reassembling ensure that all parts are clean, dry and lint free, especially the valve seat.

- ➔ Position new safety diaphragm between safety diaphragm clamping disc and safety diaphragm support disc.
- ⚠ Attention: Position diaphragm with pale side towards diaphragm clamping disc.
- ⚠ Make sure that the square head screw of the diaphragm clamping disc is correctly seated in the guide hole of the diaphragm support disc.



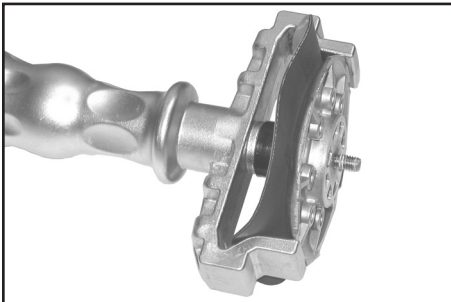
Use torque wrench w/f 19 to screw safety diaphragm support disc, safety diaphragm and safety diaphragm clamping disc to rod.

- ⚠ Attention: **Absolutely assemble all washers correctly if available (between safety diaphragm support disc and rod). Never assemble more washers!**

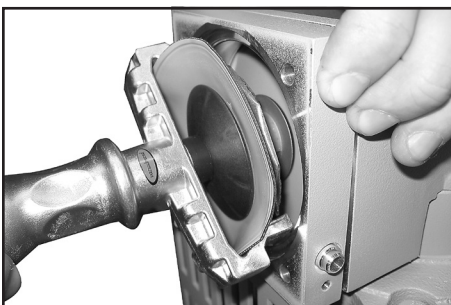
! DANGER

- ⚠ Make sure that the square head screw of the diaphragm clamping disc is correctly seated in the guide hole of the diaphragm support disc.

Optimum torque for the safety diaphragm clamping disc: **6 Nm.**

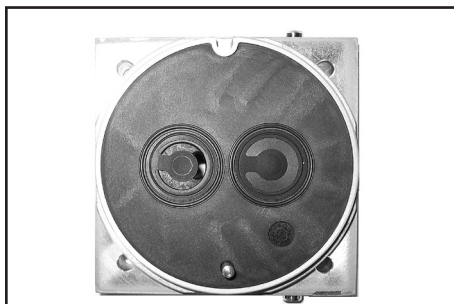


- ➔ Position new work diaphragm between diaphragm clamping disc and diaphragm support disc.
- ⚠ Attention: Position diaphragm with pale side towards diaphragm clamping disc (to pump chamber).
- ⚠ Make sure that the square head screw of the diaphragm clamping disc is correctly seated in the guide hole of the diaphragm support disc.
- ➔ Lift diaphragm at the side and position carefully together with diaphragm clamping disc and diaphragm support disc in the diaphragm key.
- ⚠ Avoid damage of the diaphragm: Do not bend diaphragm too much.



- ➔ Position intermediate flange to housing.
- ➔ Screw diaphragm clamping disc, diaphragm, diaphragm support disc and washers to connecting rod.
- ➔ Optimum torque for the diaphragm support disc: 6 Nm, it is recommended to use a torque key. Attach hex key to diaphragm key (hexagonal bolt 6 mm wide).
- Attention:** Never use the diaphragm key with any additional tools like tongs or hex keys without torque limitation.

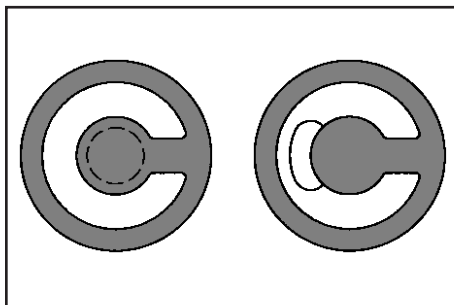
Assembling the pump head



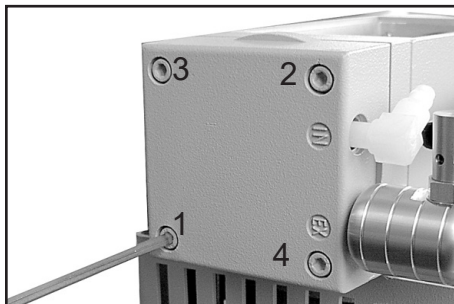
- ➔ Position pump in a way so that the disassembled pump head is above, support if necessary.
- ➔ By turning eccentric bushing (front of connecting rod), bring connecting rod into a position in which diaphragm is in contact with housing and centred with respect to bore.

Reassemble in reverse order.

- ➔ Install head cover with O-ring, valves and housing cover with housing cover insert.



- ☞ Make sure that the valves are correctly seated: Valves at the outlet with round centred opening under valve, valves at the inlet with kidney-shaped opening beside valve.
- ☞ Ensure that the diaphragm is positioned centrally so that it will become clamped uniformly between housing and head cover.

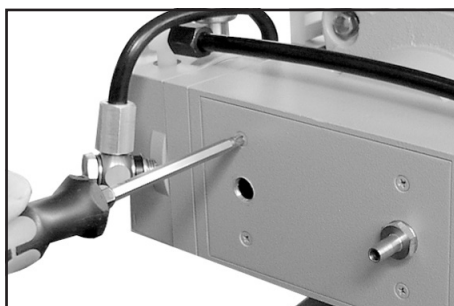


- ➔ Screw in four socket head screws fixing housing cover crosswise (e. g. in the sequence 1,2,3,4) first slightly, then tighten.

- ☞ Do not tighten until head cover is in contact with housing, torque 12 Nm.

Attention: Ensure that the diaphragm clamping disc never hits the head cover! In case of loud knocking switch off the pump immediately.

Inspect pump or replace diaphragms and valves at the other pump heads analogue.



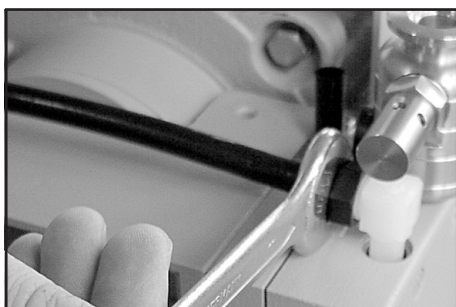
- ➔ Screw housing plate to pump.

Individual performance check of a pump head

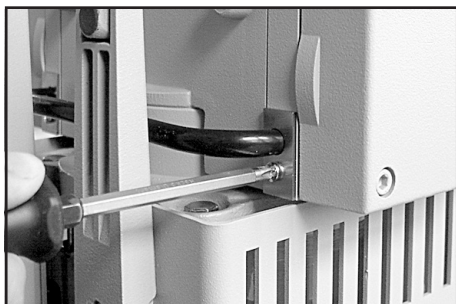


- ➔ Measure the pressure at the inlet port of the individual head: Use a suitable vacuum gauge (e. g. DVR 2pro, cat. no.: 20682906), make sure that it is correctly calibrated, and measure the pressure at the inlet port. A vacuum of less than 120 mbar should be indicated.
- ☞ If the reading is higher, recheck the pump chamber and make sure that the valves and the diaphragms are correctly seated (diaphragms concentric with bore).

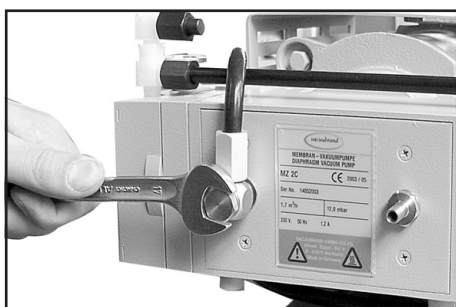
Assembling fittings



- ➔ Position pump on pump feet.
- ➔ Connect hose to elbow fitting.
- ➔ Tighten union nuts first by hand and then tighten one full turn using open ended wrench.



- ➔ Position the pump on the motor.
Attach hose to the inert gas connection and screw the locking plate.



- ➔ Use open-ended wrench to screw the inert gas fitting at the housing cover.

! DANGER

Attention: Perform a leak test always after opening the pump by using an appropriate leak detector (e. g. helium leak detector)!

Ensure that the diaphragm clamping disc never hits the head cover while pump is running! Noise check!

If the pump does not achieve the ultimate pressure:

- ☞ In case the diaphragms and valves have been replaced, a run-in period of several hours is required before the pump achieves its ultimate vacuum.

If all pump heads achieve a vacuum below 120 mbar but pump does not achieve the ultimate total pressure:

Check hose connectors between pump heads and manifolds for leaks. If necessary recheck pump chamber.

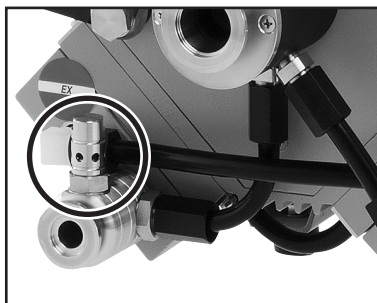
Inspecting the overpressure safety valve

Inspecting the overpressure safety valve at the outlet:

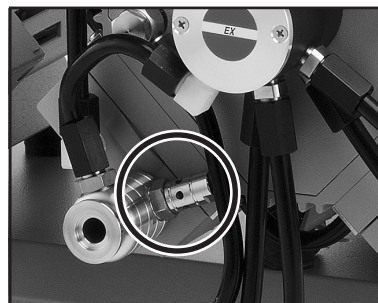
- ➔ Unscrew the overpressure safety valve at the outlet of the pump.



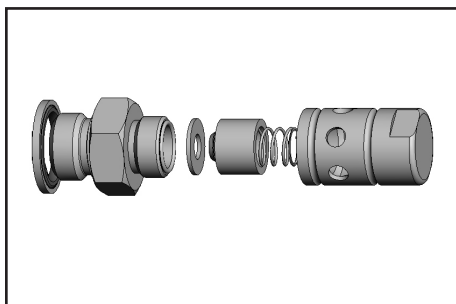
MZ 2C EX



MD 4C EX

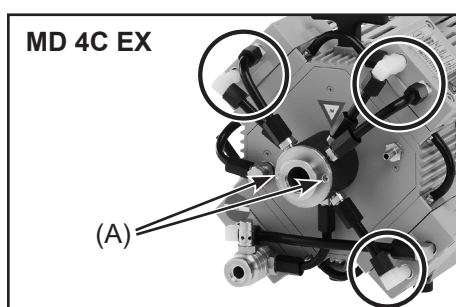


MV 10C EX



- ➔ Disassemble the overpressure safety valve and inspect the parts for faultless condition, replace damaged parts.
- ➔ Reassemble the valve correctly.
- ➔ Screw the overpressure safety valve to the outlet of the pump.

Inspection and replacement of the internal overpressure safety valve at the manifold: (only MD 4C EX / MD 4C EX + AK + EK)



- ➔ Use an open-ended wrench (width 17 mm) to unscrew at the pump heads the union nuts of the tubings which are connected to the manifold (5x).

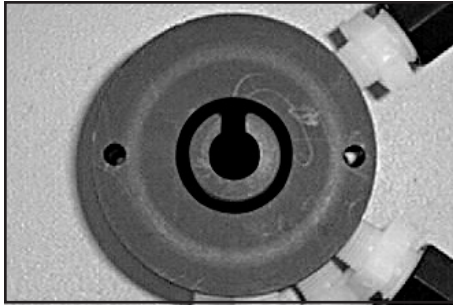
Elbow fitting (3x):

- ➔ Turn the fitting with an open-ended wrench (width 14 mm) to detach the tubing from the pump head (1/4 of a turn at maximum).
- ⚠ Do not remove the elbow fitting from the pump head.

Straight fitting (2x):

- ➔ Pull the tubing off the fitting.

- ➔ Unscrew the two countersunk screws (A) at the cover plate and remove cover plate together with distributor and tubing.



- ➔ Note position of valve and remove.
- ⚠ Check valve for damage and replace if necessary. Make sure that the valve is correctly seated.
- ➔ Reassemble distributor and cover plate.

Elbow fitting (3x):

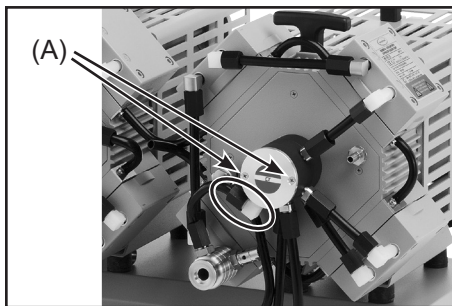
- ➔ Slip the tubing onto the elbow fitting by turning the fitting with an open-ended wrench (width 15 mm).

Straight fitting (2x):

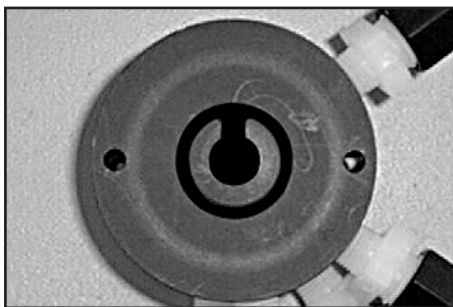
- ➔ Slip the tubing onto the fitting.

- ➔ Tighten union nuts first by hand and then tighten **one** full turn using the open ended wrench (width 17 mm).

Inspection and replacement of the internal overpressure safety valve at the manifold at the outlet: (only MV 10C EX / MV 10C EX + AK + EK)



- ➔ Use an open-ended wrench (width 17 mm) to unscrew at the pump head the union nut of the tubing which is connected to the outlet.
- ➔ Turn the fitting with an open-ended wrench (width 14 mm) to detach the tubing from the fitting (1/4 of a turn at maximum).
- ⚠ Do not remove the elbow fitting from the distributor cover.
- ➔ Unscrew the two countersunk screws (A) at the cover plate and remove cover plate together with distributor cover.



- ➔ Note position of valve and remove.
- ⚠ Check valve for damage and replace if necessary. Make sure that the valve is correctly seated.
- ➔ Reassemble distributor cover and cover plate.
- ➔ Slip the tubing onto the elbow fitting by turning the fitting with an open-ended wrench (width 15 mm).
- ➔ Tighten union nut first by hand and then tighten **one** full turn using the open ended wrench (width 17 mm).

Notes on assembling fittings

The threads of the fittings at the pump heads might be sealed with PTFE bond (width 10 mm or 5 mm, thickness 0.1 mm).

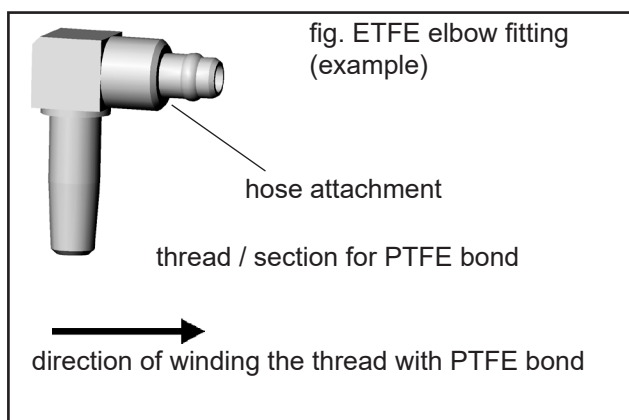
If the fittings are turned or have been removed, use new PTFE bond when reassembling.

If not using new fittings clean the thread of the fittings from PTFE bond.

Wind the thread of the fitting two times against the direction of turning in (anticlockwise) with PTFE bond.

Tighten the PTFE bond firmly. Ensure that the PTFE bond ends flush with the fittings. Ensure that the PTFE bond not covers the openings in the elbow fittings.

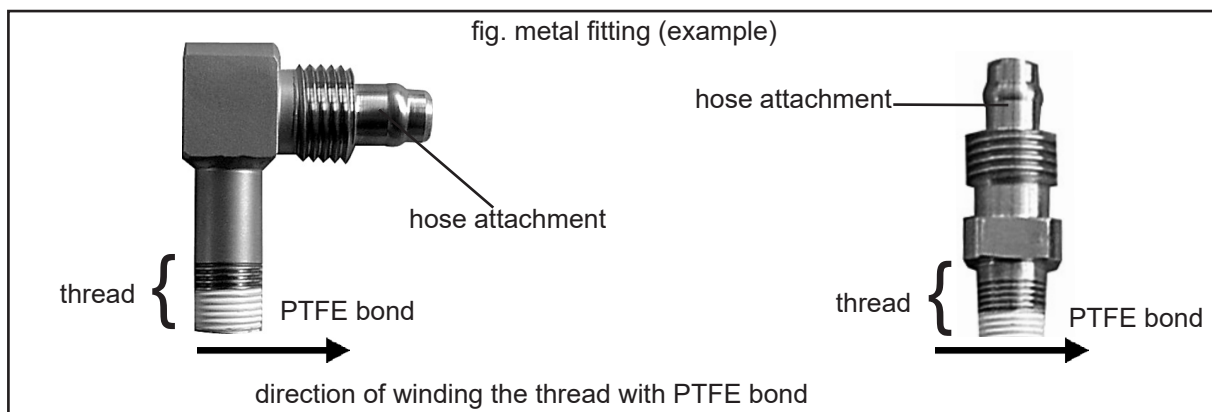
Screw in elbow fittings (clockwise) until only half of a thread course is visible. Do not overtighten. Avoid canting of the thread.



! DANGER

Seal only the lower half of the thread of the stainless steel fittings with PTFE bond (width 5 mm), see figure. Sealing the complete thread with PTFE bond leads to interruption of the conductive connection!

Never seal the hose attachment of metal fittings with PTFE bond.



Repair - Maintenance - Return - Calibration

IMPORTANT

Every employer (user) is held responsible for the health and safety of his employees. This also applies to service personnel performing repair, maintenance, return or calibration.

The **health and safety clearance form** informs the contractor about any possible contamination of the device and forms the basis for the risk assessment.

In case of devices which have been in contact with biological substances of risk level 2 contact the VACUUBRAND service absolutely before dispatching the device. These devices have to be completely disassembled and decontaminated by the user prior to shipment. Do not return devices which have been in contact biological substances of risk level 3 or 4. These devices cannot be checked, maintained or repaired. Also decontaminated devices must not returned to VACUUBRAND due to a residual risk.

The same conditions apply to on-site work.

No repair, maintenance, return or calibration is possible unless the correctly completed health and safety clearance form is returned. Devices sent are rejected if applicable. Send a completed copy of the **health and safety clearance form** to us in advance. The declaration must arrive before the equipment. Enclose a second completed copy with the product.

Remove all components from the device that are no original VACUUBRAND components. VACUUBRAND will not be responsible for lost or damaged components that are no original components.

Drain the device completely of fluids and residues. Decontaminate the device. Close all openings airtight especially if using substances hazardous to health.

To expedite repair and to reduce costs, please enclose a detailed description of the problem and the product's operating conditions with every product returned.

If you do not wish a repair on the basis of our **quotation**, the device may be returned to you disassembled and at your expense.

In many cases, the components must be cleaned in the factory prior to repair.

For cleaning we use an environmentally friendly water based process. Unfortunately the combined attack of elevated temperature, cleaning agent, ultrasonic treatment and mechanical stress (from pressurised water) may result in damage to the paint. Please mark in the health and safety clearance form if you wish a repaint at your expense just in case such a damage should occur. We will also replace parts for cosmetic reasons at your request and at your expense.

Before returning the device

Pack the device properly, if necessary, please order original packaging materials at your costs.

Mark the package completely

Enclose the completed health and safety clearance form.

Notify the carrier of any possible contamination if required.

Scrapping and waste disposal

Dispose of the equipment and any components removed from it safely in accordance with all local and national safety and environmental requirements. Particular care must be taken with components and waste oil which have been contaminated with dangerous substances from your processes. Do not incinerate fluoroelastomer seals and O-rings. You may authorize us to dispose of the equipment **at your expense**. Otherwise we return the device at your expense.

Health and safety clearance form

1. Device (Model):

2. Serial no.:

3. Reason for return / malfunction:

4. Has the device been used in a copper process step (e.g., semiconductor production): yes no

5. Substances (gases, liquids, solids, biological material, e. g. bacteria, viruses) in contact with the device / which have been pumped:

.....
.....
.....

6. Risk level of the used biological material: none 1 2* 3** 4**

* Contact the VACUUBRAND service absolutely before dispatching the device.
** Devices which have been in contact with biological substances of risk level 3 or 4 cannot be checked, maintained or repaired. Also decontaminated devices must not returned to VACUUBRAND due to a residual risk.

7. Radioactive contamination: yes no

8. Prior to return to the factory the device has been decontaminated: yes no
Description of the decontamination method and the test / verification procedure:

.....
.....

9. All parts of the device are free of hazardous, harmful substances: yes no

10. Protective measures required for service staff:

11. If the paint is damaged, we wish a repaint or a replacement of parts for reason of appearance (repaint and replacement at customer's expense): yes no

12. Legally binding declaration

We assure for the returned device that all substances, which have been in contact with the device are listed in section 5 and that the information is complete and that we have not withheld any information. We declare that all measures - where applicable - have been taken listed in section "Repair - Maintenance - Return - Calibration". By our signature below, we acknowledge that we accept liability for any damage caused by providing incomplete or incorrect information and that we shall indemnify VACUUBRAND from any claims as regards damages from third parties. We are aware that as expressed in § 823 BGB (Public Law Code of Germany) we are directly liable for injuries or damages suffered by third parties, particularly VACUUBRAND employees occupied with handling/repairing the product. Shipping of the device must take place according to regulations.

Name: Signature:

Job title: Company's seal:

Date:

Release for repair grant by VACUUBRAND (date / signature):.....
Protective measures: Protective gloves, safety goggles Hood External cleaning

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ELNOR MOTORS NV

INSTRUCTIONS MANUAL: EXPLOSION PROOF INDUCTION MOTORS

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INTRODUCTION

An explosion-proof, and in particular a flameproof motor, is one that is inherently safe when working in potentially explosive atmospheres.

This means that its construction and assembly are designed so that ingress of explosive gases or dusts is rendered harmless for the environment.

In the event of accidental ignition, provoking an explosion inside the motor housing, the motor shell and brackets are strong enough to resist the internal pressure created by this explosion.

Moreover, assembly joints and shaft clearance must be long enough and offer minimum play, so that hot gases or dusts resulting from an explosion will be cooled sufficiently to create no possibility of an explosion outside the motor.

The outside temperature of the motor enclosure must also be kept well below the flash point of the gases or dusts present in the hazardous atmosphere, both in normal and abnormal working conditions.

Finally, it is the manufacturer's concern that components inside the motor should be able to withstand an occasional explosion without being adversely affected.

⚠ As explosion proof motors are constructed with special materials and technologies that comply with the legal regulations concerning potentially explosive atmospheres, a wrong connection or a minor modification of the motor destroys the compliance with security regulations. The rules concerning explosion proof apparatus must be observed unconditionally. Note that our motors are approved for a specific group of hazardous areas and temperature classes.

If you are unclear about any of the information's in this documentation, or if you require further information, please contact Elnor Motors.

GENERAL CHARACTERISTICS

Flame proof induction motor for explosive atmosphere.

Motor prefix	Motor Type	Max. Voltage (VAC)	Frequency (Hz)	Max. power (kW)
BA	3xy***	690	50,60 or 50/60	2,2
BAX	2xy***	400	50,60 or 50/60	0,35
or	1xy***	415	50,60 or 50/60	1
BAV	1xy***H2	415	50,60 or 50/60	1
	73xy***	690	50,60 or 50/60	0,55

BA – naturally cooled explosion proof motor;

BAV – fan cooled explosion proof motor;

BAX - explosion proof motor cooled by application;

xy – length of the stator stack, if length less than 100 mm;

*** - TR – three phase motor;

- C – single phase motor with start capacitor;

- E – single phase motor with permanent run-capacitor;

- CP – single phase motors with start and permanent-run capacitor;

Outside dimensions:

Since our motors are custom made, the outside dimensions, the motor foot/plate, the shaft and the motor face are particular to each customer, please refer to the general drawing attached to your offer.

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MOTOR MARKINGS

Product Marking

The equipment will be marked with the information shown below. Actual layout may vary depending on whether the equipment is single marked or multi marked (ie. ATEX, IECEx, INMETRO).

ELNOR MOTORS N.V. B-3150 Haacht Belgium AB xx ATEX yyy X	Company name and address AB – name of the notified body issuing the EU type certificate; xx – year of issue of certificate; yyyy- number of EU type certificate; X – special conditions of use;
IECEx AB x x.yyyy X	AB – name of the certified body issuing the IECEx certificate; xx – year of issue of certificate; yyyy- number of Ex certificate; X – special conditions of use;
II2 G	Equipment group II – non-mining; Equipment category 2 – high protection (see table1); Ignition source risk G –gas;
Exdb IIB	Protection concept Ex d – flameproof enclosure Gas group IIB – Ethylene (for a complete list of gases in this category please refer to standard IEC60079-20-1)
Exdb IIC	Protection concept Ex d – flameproof enclosure Gas group IIC – typical gases are hydrogen and acetylene (for a complete list of gases in this category please refer to standard IEC60079-20-1)
IIB+H2	Gas group IIB+H2 (for a complete list of gases in this category please refer to standard IEC60079-20-1)
Tx	Maximum surface temperature T3, T4, T5 or T6 (see table2)
Gb	Equipment protection level Gb – zone 1(see table1)
Tamb –xx°C to +xx°C	Ambient temperature from minimum -40°C to maximum +70°C, depending on the motor type and protection type.
xxV	Nominal voltage
RPM xxxx	Nominal speed
xx A	Nominal current
P = xxx W	Nominal power
Sx	Service class
CL F	Thermal class
N° JJWW/NFNF xxx	Serial number where: JJ – last 2 digits of the year; WW – number of the week; NFNF – fabrication number; xxx – batch order number;
Customer Ref.	Customer reference if needed;

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USE OF MOTORS

⚠ The ELNOR motor is intended for industrial use only. The motor should not be used until the machine in which it is to be installed had met all the necessary approval and regulations. Before installation, the user must check if the group and protection class, marked on the motor label, corresponds with the requested conditions.

ZONES AND EQUIPMENT CATEGORIES				
Zones ¹⁾ ²⁾	Broad definitions of the zones (for guidance only) IEC/EN 60079-10-1	Equipment category 2014/34/EU	Equipment protection level IEC/EN 60079-0	Equipment integrity requirements
1	An area in which it is expected that an explosive gas atmosphere will occur occasionally during normal operation.	2	Gb	Equipment must be safe under normal operation, expected malfunction.

Table 1 zones and equipment categories

⚠ Under no circumstances may Elnor motors be used in zone0

1) - Motors of- Zone 1 can also be used in Zone 2

2) - Motors which are certified for gas must not be used in dust or in hybrid mixtures! Hybrid mixtures: when explosive gas and dust atmospheres occur simultaneously.

TEMPERATURE CLASS	
T CLASS	MAXIMUM SURFACE TEMPERATURE
T1	450°C
T2	300°C
T3	200°C
T4	135°C
T5	100°C
T6	85°C

Table 2 - Temperature class

Temperature classification of the motor depends on the internal thermal protection and it is given on the name plate.

⚠ Under no circumstances should a lower temperature class be used to replace a higher temperature class motor (ie. T3 should not replace a T6).

INCOMING INSPECTION

When receiving the motors, check if any damage has occurred to the packaging of the motors during transportation. If so, immediately notify the carrier, the insurance company and supplier. Failure to do so may invalidate any possible claims.

Inspect the following after packaging has been removed:

- Check for any damage to the motor;
- Check nameplate data to ensure correct motor has been received;
- Check if dimensions and colour are in compliance with your specifications;
- Rotate the shaft by hand to make sure it is turning freely;
- Make sure the motor was not exposed to excessive dirt and moisture during transportation and storage.

In the unlikely event of a claim, please contact our Sales Office.


⚠ Do not use the motor when damaged.

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STORAGE

The motor should be stored in a clean, dry and vibrations free environment. If the motor is to be stored for a long period of time, the shaft protected with anti-rust coating should be checked and "touched up" if necessary.

SAFETY CONSIDERATIONS


 Electric motors are source of electrical hazards and consequently their improper use may cause injury and/or damage to people, animals and objects. Only properly qualified personnel are permitted to perform such tasks as transport, assembly, commissioning and maintenance. The qualified personnel must know and observe all relevant safety standards.





The motor may not be opened in the presence of potentially explosive atmospheres, or when energized.

MOUNTING AND START UP

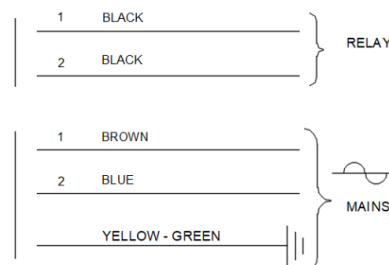
Electric data of the motor, valid for the rated power, can be found on the nameplate. It is the responsibility of the user to ensure that the motor nameplate voltage and frequency are the same as the mains supply.

 The user has to ensure that the earth connection is properly made. The grounding connectors are provided inside the terminal box and on the motor frame. According to IEC 60079-0, the grounding cable must have a cross section area of at least 4 mm². Always ensure compliance with local regulations and demands.

  Connection to the mains supply should only be executed by a recognised professional, respecting local demands and regulations.

If motors are supplied without cable the user must ensure that the diameter of the cable is adequate for the voltage and current involved. (See nameplate data of motor)

The connection of the wires must be done as described in the connection diagram that is delivered with the motor. The connection diagram is usually located inside the cover of the terminal box.



The connection diagram is structured as follows: (see example)

The leads can be coloured, numbered or both. Each line represents one lead. The given connection diagram is an example only.

An indication of the tightening torques for the electric connections is give in table bellow:

Thread size	M4	M5	M6
Torque (Nm)	1,5	2	3

Table 3. Tightening torques for electrical connections

The motor must be protected against overloads and short-circuits, through the use of a fuse that corresponds to the current draw as indicated on the nameplate.

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Since our motors are custom made, speed and torque curve are also specific for each motor type and they should be requested from the manufacturer.

The manufacturer cannot be held responsible for damage due to incorrect installation or use.

Free circulation of fresh air for cooling the motor must be guaranteed

The maximum ambient temperature must not exceed the given value that is indicated on the nameplate and in the motor certificate.

To guarantee the explosion proof protection, certified explosion proof cable glands with sealing joints adapted to the cable diameters, must be used in compliance with IEC/EN 60079-0 and IEC/EN 60079-1.

If cable glands are provided with the motor, the cable diameter range as indicated in the attached document, has to be respected. The supplied cable glands are suitable for non-shielded cables only. The cable must be chosen to withstand the maximum cable temperature, as indicated on the nameplate.

⚠ THE MOTOR WILL LOSE ITS EXPLOSION PROOF CHARACTERISTICS IF THE CABLE AND GLANDS ARE NOT FITTED CORRECTLY!

Note: If a spare opening for a cable gland isn't used, only the use of cable glands or blanking elements rated Ex db IIB Tx Gb - where Tx is the temperature class of the motor, as given on the name plate - suitable for use in an ambient of $-40^{\circ}\text{C} \leq T_{\text{amb}} \leq +70^{\circ}\text{C}$, minimum, in compliance with IEC/EN 60079-0 and IEC/EN 60079-1, retains the explosion proof characteristics.

Particular attention is to be given to the fixing torque of bolts and screws. The motor fixing bolts are factory mounted with the correct torque and should not be touched.

It may be necessary to open the terminal box for connecting the motor. When re-mounting the cover, only use the original screws. The fastening torque for the bolts is given in the table below:

Bolt thread size	M5	M6	M8
Torque (Nm)	4 - 5	7 - 9	12 - 14

Table 4. Fastening torque for bolts

- ⚠ Firstly tighten all bolts by hand before applying the full torque. If 4 bolts are present, firstly tighten two diametrically opposed bolts and then the other two.
- ⚠ Motors without a terminal box as all motors in range BA(X)2xx and some motors in range BA(X, V)3xx may not be opened. If opened motors will lose their explosion proof characteristics.
- ⚠ When the threaded blind holes provided on the motor flange are used, only appropriate bolts or screws should be used. The size of the thread engagement, diameter and maximum length, is provided on the customer specific drawing. Under no circumstances should a longer thread engagement be used.

Using a pulley or a coupling device:

Apply only well-balanced discs and couplings. Check the alignment after assembling. Take care while mounting of the pulley on the shaft: Hammering on the shaft will damage the motor bearings. Pulleys should only be mounted with appropriate mounting tools that do not stress the motor bearings.

Following these recommendations will greatly increase the expected motor bearing life. Safety regulations in respect of guarding couplings and belts from being accidentally touched must be applied.

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Motor type	Diameter (mm)	Length for F_R (mm)	$F_R(N)$ - max		$F_A (N)$ -max
			Cast iron end shield	Aluminium end shield	
BA73xx	11	30		NA	100
BA1xx	14	30	600	NA	150
BA2xx	14	11	NA	1000	140
BA3xx	20	100	600	300	200

Table 5. Permissible forces on shaft

- ⚠ F_R is computed assuming no axial force is present and in normal conditions of use;
- ⚠ F_A is computed assuming no radial force is present;
- ⚠ Since our motors are custom made it is impossible to list in the manual all de different shaft/end shield configurations. If your configuration is not present in the above table please ask the motor manufacturer.

MOTOR PROTECTION

Each motor is provided with an internal thermal protection. If the motor is supplied with a thermal protection, Thermik S06.135 or similar, that is brought out separately, the user must connect the protection in a way that the motor is switched off when the protector switches and doesn't start until an operator starts it manually.

OPERATING CONDITIONS

In general our electric motors are designed for operation up to an altitude of 1000m above sea level and an ambient temperature between -20°C and $+40^{\circ}\text{C}$. Any variation is stated on the nameplate. Voltage variation may not exceed $\pm 10\%$. Motors should be kept dust free to allow heat exchange to occur.

BALL BEARINGS

The life of the ball bearings and radial and axial forces are motor specific, contact the motor manufacturer for information over life expectancy of ball bearing for your particular application. The maximum operating temperature of the ball bearings is 150°C .

MAINTENANCE

Re-greasing of the motor bearings is not necessary, the ball bearing are lubricated for life. Dust build-up on the motor must be avoided.

If the noise level is enhanced, switch off the motor immediately and inspect. Replacement of the bearings must only be performed at the manufacturer.

- ⚠ Unless agreed in writing maintenance action are to be done only by the manufacturer.


REPAIR


The explosion proof motor may not be opened while the motor is energised.

- ⚠ Unless agreed in writing repairs are to be done only by the manufacturer.

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Warning:

 The flameproof joints are not intended to be repaired or reworked by the user.

 The manufacturer is not responsible for motors that are modified or opened without his written agreement.

END OF LIFE

Dismantling of the motor should be done only by qualified personnel following the local safety regulations in place.

Motor contains iron, aluminium, copper and plastic parts which should be recycled by an approved recycling company at the end of life.

SPARE PARTS

For each order of spare parts, the type and number of the motor must be given; these data are indicated on the nameplate.

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CONDITIONS OF USE

Motor prefix	Motor Type	Specific conditions									
	3xy***	ATEX									
		<ol style="list-style-type: none"> An appropriate connection of the free end of the cable shall be foreseen in case the motor is provided with a permanently connected cable. If operated with a frequency drive, or when a temperature class better than a T3 has to be respected a thermal protection device has to be installed. The following table details the maximum set points of the thermal protection device per temperature class: 									
		<table border="1"> <thead> <tr> <th>Temperature class</th> <th>Set point windings</th> <th>Set point end shields/bearings</th> </tr> </thead> <tbody> <tr> <td>T3</td> <td>150</td> <td>135</td> </tr> <tr> <td>T4</td> <td>135</td> <td>120</td> </tr> </tbody> </table>	Temperature class	Set point windings	Set point end shields/bearings	T3	150	135	T4	135	120
		Temperature class	Set point windings	Set point end shields/bearings							
T3	150	135									
T4	135	120									
IECEX											
BA BAX BAV	2xy***	<ol style="list-style-type: none"> The flameproof joints are not intended to be repaired. The property class of the special fasteners used to fasten the end shields onto the stator housing 									
		<table border="1"> <thead> <tr> <th>Property class</th> <th>Part of the special fastener</th> </tr> </thead> <tbody> <tr> <td>4.6</td> <td>Hexagon cap screws</td> </tr> <tr> <td>5</td> <td>Hexagon nut (if used)</td> </tr> <tr> <td>8.8</td> <td>Socket cap screws</td> </tr> </tbody> </table>	Property class	Part of the special fastener	4.6	Hexagon cap screws	5	Hexagon nut (if used)	8.8	Socket cap screws	
		Property class	Part of the special fastener								
		4.6	Hexagon cap screws								
5	Hexagon nut (if used)										
8.8	Socket cap screws										
<ol style="list-style-type: none"> Model BAV : The motor may be equipped with one or two end shaft(s) or with an external fan. For the fan cooled motors in BAV construction, the motor fan is intended for cooling the motor. Model BAX : When the motor is used to drive a fan, the new assembly, fan and motor unit, requires separate certification. 											
		<ol style="list-style-type: none"> An appropriate connection of the free end of the cable shall be foreseen in case the motor is provided with a permanently connected cable The temperature has to be respected and if necessary a thermal protection device has to be installed when other classes have to be met then T3 class. If operated with a frequency drive then the motor needs to have his own internal thermal protection 									
	1xy***	<ol style="list-style-type: none"> the property class of the special fasteners used to fasten the end shields onto the stator housing must be at least:8,8; BAX - When the motor is used to drive a fan, the new assembly, fan and motor unit, requires separate certification; Optional push buttons can be installed in the wall of the enclosure; 									
	1xy***H2	<ol style="list-style-type: none"> the property class of the special fasteners used to fasten the end shields onto the stator housing must be at least 12.9; BAX - When the motor is used to drive a fan, the new assembly, fan and motor unit, requires separate certification; 									
	73xy***	<ol style="list-style-type: none"> An appropriate connection of the free end of the cable shall be foreseen when the motor is provided with a cable permanently connected to it; The flamepaths are specified in the manufacturer drawing; 									

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APPLICABLE STANDARDS

IECEX/IEC	General	
IEC 60204-1:2016	EN 60204-1:2018	Safety of machinery – Electrical equipment of machines – Part 1: General requirements
IEC 60034-1:2017	EN 60034-1:2010	Rotating electrical machines – Part 1: Rating and performance
IEC 60079-0:2017	IEC EN 60079-0:2018	Explosive Atmospheres – Part 0: Equipment – General requirements
IEC 60079-1:2014	EN 60079-1:2014	Explosive Atmospheres – Part 1: Equipment – Equipment protection by flameproof enclosures "d"
	EN 50581:2012	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances
	Directives 2014/34/EU	European ATEX Product Directive

MANUFACTURER INFORMATION:

ELNOR MOTORS NV
De Costerstraat 45
B-3150 HAACHT
BELGIUM

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Fax: +32 16 60 64 40
E-mail info@elnor.be
Internet <http://www.elnor.be>

This document has been made with the greatest care and is correct at the time of printing. It is meant as a general guideline and it is not meant to be complete. Always check with relevant regulations and guidelines.

Certificate for motors with mark „II 2G Ex db IIB T4 Gb“

APRAGAZ
a.s.b.l.
Your inspecting authority



- (1) **EU TYPE EXAMINATION CERTIFICATE**
- (2) **Equipment or Protective system intended for use
in potentially explosive atmospheres
Directive 2014/34/EU**
- (3) EU type examination certificate number: **APRAGAZ 20ATEX0209 X**
- (4) Equipment or protective system: Three-phase and single-phase asynchronous motors
Single-phase: BA(V or X) 3xy C or E or CP
Three-phase: BA(V or X) 3xy TR
- (5) Applicant - Manufacturer: Elnor Motors NV Belgium
- (6) Address: De Costerstraat 45
3150 Haacht (Wespelaar)
Belgium
- (7) This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.
- (8) APRAGAZ, notified body n° 0029 in accordance with article 17 of the directive 2014/34/EU of 26 February 2014, certifies that this equipment or protective system has been found in compliance with the essential health and safety requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in annexe II of the directive.
- The examination and test results are recorded in the confidential file n° 17566/006.
- (9) The conformity of the essential health and safety requirements has been assured by compliance with:
EN 60079-0: 2018
EN 60079-1: 2014
- (10) If the sign “X” is placed after the certificate number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.
- (11) This EU TYPE EXAMINATION CERTIFICATE relates only to the design and construction of this specified equipment or protective system in accordance with the directive 2014/34/EU. Further requirements of the directive apply to the manufacturing and supply of this equipment or protective system. These are not covered in this certificate.
- (12) The marking of the equipment or protective system shall include the following:
⊕ II 2 G Ex db IIB T4...T3 Gb

Brussels, 07 December 2020

APRAGAZ
Chaussée de Vilvorde 156
1120 Bruxelles
tel 02/264 03 60 fax 02/268 89 58
mail : info@apragaz.com

Ir. B. Nève
General Manager

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R.A. 001 rev2 – 08-2020



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Your inspecting authority



(13)

SCHEDULE

(14)

EU TYPE EXAMINATION CERTIFICATE N° APRAGAZ 20ATEX0209 X(15) Description of the equipment or protective system

Three-phase and single-phase asynchronous motors:

Single-phase: BA(V or X) 3xy C or E or CP

Three-phase: BA(V or X) 3xy TR

BA: a naturally cooled explosion proof motor

BAV: a fan cooled explosion proof motor

BAX: a motor cooled by the application

The motor consists of a flameproof enclosure which is made of an aluminium or a steel sheet metal carcass and has aluminium or cast iron end shields.

The fastenings are made by hex cap screw of property class 4.6, nuts of property class 5.0 and socket cap screws of property class 8.8.

The motor may be equipped with two ends shafts and can be electrically directly fed by a single cable or through a connection in the terminal box.

Temperature classes

The motors on S1 duty service cooled by the process have the temperature class T3. The motors have a temperature class T4 if they are equipped with a thermal protection suitable to the temperature class.

The motors with natural cooling, the motors energized by converters and the motors on S2 to S9 duty service are provided with a direct thermal protection or a PTC resistance suitable to the temperature class.

Electrical characteristics

Power range: from 0,25 kW to 2,5 kW

Voltage supply: up to 690 Volt – For VAC motors: 50/60 Hz

Insulation class: F

Routine tests

The manufacturer shall make the routine verifications and tests necessary to ensure that the electrical apparatus produced complies with the specifications submitted to the testing station together with the prototype or sample.

Every part of the motor legible for routine testing whether it's made from aluminium, iron cast or steel that is tested at 4*Pref is exempted from overpressure pressure testing, otherwise the routine tests at 11,01 bar need to be executed.

The control of the weld of the steel carcass is always to be tested at 11,01 bar.

A motor of every fabrication number is additionally tested on the test bench. This to verify the maximum surface temperatures on different parts on the motor for the specific type of motor.

Cables resisting up to 120°C should be selected for a T3 and cables resisting up to 100°C should be selected for a T4 motor.



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- (13) **SCHEDULE**
- (14) **EU TYPE EXAMINATION CERTIFICATE N° APRAGAZ 20ATEX0209 X**
- (15) Marking:

Elnor Motors NV Belgium
De Costerstraat 45
3150 Haacht (Wespelaar)
Belgium

Year CE + Identification n° of NOBO production control phase
Type: BA(X/V) 3xy
Serial number: 650xxxxx
Manufacturer date, fabrication number and batch number : JJWW/NFNF xxx



II 2 G Ex db IIB T4...T3 Gb
APRAGAZ 20ATEX0209 X

Warning:

Do not open under voltage.

Eventual prescriptions

Choice of cable needs to be compatible with a temperature of X °C.
Ambient temperature range: -40°C up to +70°C.
An adequate warning is to be printed when the motor is delivered without cable glands, plugs or cable.

Note:

This X °C is in function of the temperature class of the motor. X=120°C for a T3 motor and X=100°C for a T4 motor.

Depending on the foreseen duty class of the motor the temperature range can be narrowed.

- (16) The examination and test results are recorded in confidential report n° U194718.
- (17) Special conditions for safe use:

An appropriate connection of the free end of the cable shall be foreseen in case the motor is provided with a permanently connected cable.

If operated with a frequency drive, or when a temperature class better than a T3 has to be respected a thermal protection device has to be installed directly in the motor. The following table details the maximum set points of the direct thermal protection device per temperature class:

Temperature class	Set point windings in °C	Set point end shields/bearings in C°
T3	150	135
T4	135	120

- (18) Essential health and safety requirements:

The essential health and safety requirements are covered by the conformity to European standards listed at (9).

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R.A. 001 rev2 – 08-2020



**EG-Konformitätserklärung für Maschinen
EC Declaration of Conformity of the Machinery
Déclaration CE de conformité des machines**

Hersteller / Manufacturer / Fabricant:

VACUUBRAND GMBH + CO KG · Alfred-Zippe-Str. 4 · 97877 Wertheim · Germany

Hiermit erklärt der Hersteller, dass das Gerät konform ist mit den Bestimmungen der Richtlinien:

Hereby the manufacturer declares that the device is in conformity with the directives:

Par la présente, le fabricant déclare, que le dispositif est conforme aux directives:

2006/42/EG

2014/34/EU

2011/65/EU, 2015/863

Membranvakuumpumpe / Diaphragm vacuum pump / Pompe à membrane:

Typ / Type / Type: MZ 2C EX / MZ 2C EX + AK + EK / MZ 2C EX + IK + EK / MD 4C EX /

MD 4C EX + AK + EK / MV 10C EX / MV 10C EX + AK + EK

Artikelnummer / Order number / Numéro d'article: 20696920 / 20696921 / 20696922 / 22614231 /

20696930 / 20696931 / 20696932 / 20696945 / 22614250

Seriennummer / Serial number / Numéro de série: Siehe Typenschild / See rating plate / Voir plaque signalétique

Angewandte harmonisierte Normen / Harmonized standards applied / Normes harmonisées utilisées:

DIN EN ISO 12100:2011, DIN EN 61010-1:2020, IEC 61010-1:2010 (Ed. 3), DIN EN 1012-2:2011,

DIN EN 1127-1:2019, DIN EN ISO 80079-36:2016, DIN EN IEC 63000:2019


Motor / motor / moteur: EN 60204-1:2018, EN 60034-1:2010, IEC EN 60079-0:2018, EN 60079-1:2014, EN 50581:2012

Bevollmächtigter für die Zusammenstellung der technischen Unterlagen / Person authorised to compile the technical file / Personne autorisée à constituer le dossier technique:

Dr. F. Gitmans · VACUUBRAND GMBH + CO KG · Alfred-Zippe-Str. 4 · 97877 Wertheim · Germany

Wertheim, 23.07.2021

.....
Ort, Datum / place, date / lieu, date


.....

(Dr. F. Gitmans)

Geschäftsführer / Managing Director / Gérant

ppa. 
.....

(J. Kaibel)

Technischer Leiter / Technical Director /
Directeur technique



VACUUBRAND GMBH + CO KG

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DECLARATION OF CONFORMITY – China RoHS 2

VACUUBRAND GMBH + CO KG has made reasonable efforts to ensure that hazardous materials and substances may not be used in its products.

In order to determine the concentration of hazardous substances in all homogeneous materials of the subassemblies, a "Product Conformity Assessment" (PCA) procedure was performed. As defined in GB/T 26572 the "Maximum Concentration Value" limits (MCV) apply to these restricted substances:

- Lead (Pb): 0.1%
- Mercury (Hg): 0.1%
- Cadmium (Cd): 0.01%
- Hexavalent chromium (Cr(+VI)): 0.1%
- Polybrominated biphenyls (PBB): 0.1%
- Polybrominated diphenyl ether (PBDE): 0.1%

Environmentally Friendly Use Period (EFUP)

EFUP defines the period in years during which the hazardous substances contained in electrical and electronic products will not leak or mutate under normal operating conditions. During normal use by the user such electrical and electronic products will not result in serious environmental pollution, cause serious bodily injury or damage to the user's assets.

The Environmentally Friendly Use Period for VACUUBRAND products is 40 years.



此表格是按照SJ/T 11364-2014中规定所制定的。

This table is created according to SJ/T 11364-2014.

MATERIAL CONTENT DECLARATION FOR VACUUBRAND PRODUCTS							
部件名称 Part name	有毒有害物质或元素 Hazardous substances						环保期限标 识 EFUP
	铅 Pb	汞 Hg	镉 Cd	六价铬 Cr(+VI)	多溴联 苯 PBB	多溴二 苯醚 PBDE	
包装 Packaging	○	○	○	○	○	○	
塑料外壳 / 组件 Plastic housing / parts	○	○	○	○	○	○	
真空油 Vacuum oil	○	○	○	○	○	○	
电池 Battery	○	○	○	○	○	○	
玻璃 Glass	X	○	○	○	○	○	
电子电气组件 Electrical and electronic parts	X	○	○	○	○	○	
控制器 / 测量设备 Controller / measuring device	X	○	○	○	○	○	
金属外壳 / 组件 Metal housing / parts	X	○	○	○	○	○	
电机 Motor	X	○	○	○	○	○	
配件 Accessories	X	○	○	○	○	○	

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注释: 此表格适用于所有产品。以上列出的元件或组件不一定都属于所附产品的组成。

Note: Table applies to all products. Some of the components or parts listed above may not be part of the enclosed product.

- O: 表示该有毒有害物质在该部件所有均质材料中的含量均在GB/T 26572规定的限量要求以下。
 O: Indicates that the above mentioned hazardous substance contained in all homogeneous materials of the part is below the required limit as defined in GB/T 26572.
- X: 表示该有毒有害物质至少在该部件某一均质材料中的含量超出GB/T 26572规定的限量要求。
 X: Indicates that the above mentioned hazardous substance contained in at least one of the homogeneous materials of this part is above the required limit as defined in GB/T 26572.

除上表所示信息外，还需声明的是，这些部件并非是有意图用铅（Pb）、汞（Hg）、铬（Cd）、六价铬（Cr(+VI)）、多溴联苯（PBB）或多溴二苯醚（PBDE）来制造的。

Apart from the disclosures in the above table, the subassemblies are not intentionally manufactured or formulated with lead (Pb), mercury (Hg), cadmium (Cd), hexavalent chromium (Cr+VI), polybrominated biphenyls (PBB), and polybrominated diphenyl ethers (PBDE).

Products manufactured by VACUUBRAND may enter into further devices (e.g., rotary evaporator) or can be used together with other appliances (e.g., usage as booster pumps).

With these products and appliances in particular, please note the EFUP labeled on these products. VACUUBRAND will not take responsibility for the EFUP of those products and appliances.

Place, date: Wertheim, 06/04/2020

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