

Description

This invention relates to valve assemblies. It has particular application to valves which are used typically in relatively inaccessible locations, e.g. valves of the type which are used in subsea pipelines.

The components of valves, e.g. gate valves which are used in subsea locations, are subject to wear, corrosion and erosion and hence periodically need replacement. It has been proposed to mount the flow control components of such valves, typically the gates and seats, in an insert which can be removably mounted in a receiver receptacle. The receptacle can be coupled to the flow line which the valve controls. This enables the insert to be removed either by a diver or by a remotely operated vehicle for the replacement of the valve components. In such arrangements it is necessary to provide an adequate seal between the insert and the receiver. Known arrangements use inserts or receivers which are relatively complex to produce and an object of the present invention is to provide a valve arrangement of the insert type which is relatively simple to manufacture.

US-A-4179099 discloses a gate valve having a gate which is expandable axially of seat members to compress the seat members into metal to metal sealing engagement with both the gate and flat faces in opposed recesses in the receptacle.

US-A-2705019 discloses a gate valve comprising a receptacle having a cavity; and an insert assembly which is removably insertable into the cavity to a position in which bores through the receptacle and insert assembly extend coaxially to provide a flow path through the valve and through the flat surfaces; the insert assembly comprising a body which is slidably insertable into the cavity whilst supporting valve elements for controlling fluid flow through the flow path, the valve elements comprising two annular coaxial seat members carried within the bore through the insert assembly and arranged to engage respective ones of the flat surfaces, and, between the adjacent ends of the two seat members, a gate which is slidable transversely of the axis of the seat members to open and close the flow path; and according to the present invention, such a valve is characterised in that: said cavity has diametrically opposite recesses having opposed flat surfaces; the gate is expandable axially of the seat members to compress the seat members into metal to metal sealing engagement with both the gate and the flat surfaces; and in that parts of the opposed surfaces of the recesses are, from the entrance to the cavity towards said flat surfaces, converging towards one another, before merging into said flat surfaces, to guide the seat members to between the flat surfaces during insertion of the insert assembly.

The invention will be described now by way of example only, with particular reference to the accompa-

nying drawings. In the drawings:

Figure 1 is a sectional view of a valve assembly in accordance with the present invention, and

Figure 2 is a section on the line 2-2 of Figure 1.

Referring to the drawings a valve assembly comprises a receptacle 10 which can receive a valve insert assembly 11. The receptacle 10 comprises a metallic block formed with a first bore 12 into which the insert 11 is designed to locate. The bore 12 is closed at its lower end. The bore 12 is generally cylindrical and has an upper portion 14 which is slightly wider than the lower portion 15. The wall of the upper bore portion 14 also tapers slightly outwardly towards its upper end. At diametrically opposite positions the wall of the upper bore portion 14 is formed with longitudinally extending recesses 16, 17 which are of generally rectangular cross-section. A second bore 20 extends through the receptacle 10 in a direction generally perpendicular to the axis of the first bore 12. The second bore 20 opens into the lower part of the upper bore portion 14. The recesses 16, 17 are dimensioned such that a flat surface is provided around each opening of the bore 20 at its junction with the bore 12. The longitudinal extent of each recess 16, 17 is from the upper end of the bore 12 to a position just below the bore 20. The second bore 20 constitutes a flow path for fluid such as oil flowing in a subsea flow line. Typically the receptacle 10 will be connected to such a flow line.

The upper part of the receptacle block 10 around the open end of the bore 12 has an outwardly extending annular flange 25. The upper surface of the block inwardly of the flange is formed with an annular groove 26.

The insert assembly has a body portion 30 which is generally cylindrical. An upper part 31 of the body 30 has a diameter which is slightly greater than the lower part 32. The lower part 32 is designed to locate in the lower bore portion 15 whilst the upper part locates in the upper bore portion 14. As can be seen in Figure 2 diametrically opposite segmental portions 33, 34 of the upper body part 31 are cut away, these being located in juxtaposition with the recesses 16 and 17 of the receptacle 10. The body portion 30 is formed with a central through aperture 38 of rectangular cross-section, this aperture being arranged to receive an expanding type gate 40. The upper body part 31 is formed with tapped bores 39 which extend axially into the wall of the body portion 30 from the upper surface thereof. These bores are engaged by bolts 44 which couple the body 30 to a bonnet assembly 48.

The body 30 also has a lateral through bore 50 extending perpendicular to the longitudinal axis of the aperture 38. The bore 50 when the insert is in position in the receptacle is arranged so that it extends coaxially with the bore 20. Two annular seat members 52, 53 are carried by the body 30 at opposite end por-

tions of the bore 50. The annular inner and outer end faces of each seat member carry metal seals 54 which are located in grooves in the seats.

The gate 40 is an expanding type gate which is coupled by an upwardly extending rod 55 which extends through the bonnet 48 to an actuating mechanism (not shown). The actuating mechanism can be operated to actuate the gate in a known manner. The gate comprises two juxtaposed parts 58, 59 which have matching inner engaging profiles 60, such that when one part is moved axially relative to the other the effective lateral dimension of the gate is varied. The two parts of the gate have a through bore 60' which can be aligned by axial movement of the gate with the bore 20. When the gate 40 is in the position shown in Figure 1 it prevents flow through the flow line 20. When the gate is raised to bring the bore 60 into alignment with the flow line 20 the valve is open and fluid can flow through the valve.

The bonnet assembly 48 is formed with a shoulder 62 which in the assembled position is engaged by an annular clamping ring 65 which receivably engages the flange 25 to couple the bonnet assembly to the housing 10. The lower face of the bonnet has an annular groove 66 which aligned with the groove 26. A suitable seal is disposed in the aligned grooves.

In operation the valve body 30 is initially connected to the bonnet assembly 48 using the bolts 44. The gate 40 is arranged such that its lateral extent is at a minimum. The bonnet with the body 30 suspended from it is then lowered towards the receptacle 10. The body 30 is aligned such that the diametrically opposed flats on the body are at positions corresponding to those of the recesses 16 and 17 in the receptacle 10. The body 30 is then lowered into the bore 12 formed in the receptacle. As can be seen the outer dimensions of the body 30 are such that there is a small clearance between the body and the wall of the bore 12. Also with the gate in its condition of minimum lateral extent there is a clearance between the outer ends of the seat members 52, 53 and the wall of the bore 12 in the receptacle. When the body has been lowered to a position corresponding to that shown in Figure 1 the gate is actuated such that its lateral extent is increased. This action places a relatively high load between the gate and the seat members 52, 53 which causes a metal-to-metal seal to be formed both between the gate body and seal 54 on the inner end of each member 52, 53 and between the receptacle body 10 and the seal 54 on the outer end of each seat member. The bonnet 48 is secured to the receptacle body 10 by the clamping ring 65. As will be seen the arrangement is relatively simple to assemble and operate and is also relatively simple to manufacture. The assembly can be carried out by a remotely operated vehicle or by a diver.

The arrangement shown in the drawings has a gate body 30 which is connected to a bonnet assembly

bly 40 by means of the bolts 44. It will be appreciated that it is possible to manufacture an arrangement in which the body 30 and the bonnet assembly 48 are integral.

It will be appreciated that retrieval of the insert assembly is substantially the reverse of assembly procedure described above. The ring 65 is released and the gate is actuated to assume its minimum lateral dimension condition. The insert assembly can then be removed from the receptacle.

Claims

1. A gate valve comprising a receptacle (10) having a cavity (12); and an insert assembly (11) which is removably insertable into the cavity to a position in which bores (20,50) through the receptacle and insert assembly extend coaxially to provide a flow path through the valve and through the flat surfaces; the insert assembly comprising a body (30) which is slidably insertable into the cavity whilst supporting valve elements for controlling fluid flow through the flow path, the valve elements comprising two annular coaxial seat members (52,53) carried within the bore (50) through the insert assembly and arranged to engage respective ones of the flat surfaces, and, between the adjacent ends of the two seat members, a gate (40) which is slidable transversely of the axis of the seat members to open and close the flow path; characterised in that: said cavity has diametrically opposite recesses having opposed flat surfaces; the gate is expandable axially of the seat members to compress the seat members into metal to metal sealing engagement with both the gate and the flat surfaces; and in that parts of the opposed surfaces (12,16) of the recesses are from the entrance to the cavity towards said flat surfaces, converging towards one another, before merging into said flat surfaces, to guide the seat members to between the flat surfaces during insertion of the insert assembly.
2. A valve according to claim 1, wherein the cavity (12) is substantially cylindrical, and the recesses (16,17) have substantially rectangular cross-sections in a plane perpendicular to the direction of insertion of the insert assembly (11) into the cavity.
3. A valve according to claim 1 or claim 2, wherein the body (30) is carried by a bonnet assembly (48).
4. A valve according to claim 3, wherein the body (30) is connected to the bonnet assembly (48) by securing means (44).



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The gate 40 is an expanding type gate which is coupled by an upwardly extending rod 55 which extends through the bonnet 48 to an actuating mechanism (not shown). The actuating mechanism can be operated to actuate the gate in a known manner. The gate comprises two juxtaposed parts 58, 59 which have matching inner engaging profiles 60, such that when one part is moved axially relative to the other the effective lateral dimension of the gate is varied. The two parts of the gate have a through bore 60' which can be aligned by axial movement of the gate with the bore 20. When the gate 40 is in the position shown in Figure 1 it prevents flow through the flow line 20. When the gate is raised to bring the bore 60 into alignment with the flow line 20 the valve is open and fluid can flow through the valve.

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The arrangement shown in the drawings has a gate body 30 which is connected to a bonnet assem-

bly 40 by means of the bolts 44. It will be appreciated that it is possible to manufacture an arrangement in which the body 30 and the bonnet assembly 48 are integral.

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2. A valve according to claim 1, wherein the cavity (12) is substantially cylindrical, and the recesses (16,17) have substantially rectangular cross-sections in a plane perpendicular to the direction of insertion of the insert assembly (11) into the cavity.
3. A valve according to claim 1 or claim 2, wherein the body (30) is carried by a bonnet assembly (48).
4. A valve according to claim 3, wherein the body (30) is connected to the bonnet assembly (48) by securing means (44).



5. A valve according to claim 3, wherein the body (30) and bonnet assembly (48) are formed integrally.
6. A valve according to any one of the preceding claims, wherein opposite end faces of the annular seat members (52,53) carry metal seal means (54) for sealing against the gate (40) and a receptacle (10).

Patentansprüche

1. Schieberventil umfassend eine Aufnahme (10) mit einem Hohlraum (12) und einer Einsatzbaugruppe (11), die austauschbar in den Hohlraum in eine Position einsetzbar ist, in der sich durch die Aufnahme und die Einsatzbaugruppe Bohrungen (20, 50) koaxial erstrecken, um einen Strömungsweg durch das Ventil und durch die flachen Oberflächen zu bilden, wobei die Einsatzbaugruppe einen Körper (30) umfaßt, der gleitbar in den Hohlraum einsetzbar ist, wobei er Ventilelemente zur Steuerung des Flüssigkeitsflusses durch den Strömungsweg trägt, wobei die Ventilelemente zwei ringförmige koaxiale Sitzelemente (52, 54), die innerhalb der Bohrung (50) durch die Einsatzbaugruppe aufgenommen sind und in jede der flachen Oberflächen eingreifen, und einen Schieber (40) zwischen den benachbarten Enden der beiden Sitzelemente umfassen, der gleitbar quer zur Achse der Sitzelemente zum Öffnen und Schließen des Strömungsweges vorgesehen ist, **dadurch gekennzeichnet, daß** der Hohlraum einander diametral gegenüberliegende Ausnehmungen mit gegenüberliegenden flachen Flächen aufweist; der Schieber axial gegen die Sitzelemente erweiterbar ist, so daß die Sitzelemente in eine Metall/Metall-Dichtungsanordnung sowohl mit dem Schieber als auch mit den flachen Flächen komprimierbar ist; und daß Teile gegenüberliegender Flächen (12, 16) der Ausnehmungen vom Eingang der Bohrung zu den flachen Flächen aufeinanderzulaufen bevor sie in die flachen Flächen übergehen, um die Sitzelemente zwischen die flachen Flächen während des Einsetzens der Einsatzbaugruppe zu führen.
2. Ventil nach Anspruch 1, **dadurch gekennzeichnet, daß** der Hohlraum (12) im wesentlichen zylindrisch ist und die Ausnehmungen (16, 17) einen im wesentlichen rechteckigen Querschnitt in einer Ebene senkrecht zur Einsetzrichtung der Einsatzbaugruppe (11) in den Hohlraum aufweisen.
3. Ventil nach Anspruch 1 oder 2, **dadurch gekennzeichnet, daß** der Körper (30) durch einen

Deckelbaugruppe (48) getragen wird.

4. Ventil nach Anspruch 3, **dadurch gekennzeichnet, daß** der Körper (30) mit der Deckelbaugruppe (48) durch Sicherungsmittel (44) verbunden ist.
5. Ventil nach Anspruch 3, **dadurch gekennzeichnet, daß** der Körper (30) und die Deckelbaugruppe (48) einstückig ausgebildet sind.
6. Ventil nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, daß** einander gegenüberliegende Stirnflächen des ringförmigen Sitzelements (52, 53) Metaldichtungsmittel (54) zur Dichtung gegen den Schieber (40) und die Aufnahme (10) tragen.

Revendications

1. Vanne à obturateur comportant un réceptacle (10) ayant une cavité (12) et un ensemble (11) formant élément rapporté qui peut être inséré de manière amovible dans la cavité dans une position dans laquelle des alésages (20, 50) traversant le réceptacle et l'ensemble formant élément rapporté s'étendent coaxialement pour fournir un trajet d'écoulement à travers la vanne et à travers les surfaces plates; l'ensemble formant élément rapporté comportant un corps (30) qui peut être inséré de manière coulissante dans la cavité tout en supportant des éléments de vanne pour commander l'écoulement de fluide à travers le trajet d'écoulement, les éléments de vanne comportant deux éléments (52, 53) formant sièges annulaires coaxiaux supportés à l'intérieur de l'alésage (50) à travers l'ensemble formant élément rapporté et agencés pour venir en contact respectif avec l'une des surfaces plates, et, entre les extrémités adjacentes des deux éléments formant sièges, un obturateur (40) qui peut coulisser transversalement par rapport à l'axe des éléments formant sièges pour ouvrir et fermer le trajet d'écoulement, caractérisée en ce que ladite cavité comporte des évidements diamétralement opposés ayant des surfaces plates opposées, l'obturateur étant extensible axialement par rapport aux éléments formant sièges pour comprimer les éléments formant sièges en contact étanche métal sur métal avec à la fois l'obturateur et les surfaces plates, et en ce que des parties de surfaces opposées (12, 16) des évidements sont convergentes l'une vers l'autre à partir de l'entrée de la cavité vers lesdites surfaces plates, avant d'être réunies auxdites surfaces plates pour guider les éléments formant sièges entre les surfaces plates pendant l'insertion



de l'ensemble formant élément rapporté.

2. Vanne selon la revendication 1, dans laquelle la cavité (12) est pratiquement cylindrique, et les évidements (16, 17) ont des sections transversales pratiquement rectangulaires dans un plan perpendiculaire à la direction d'insertion de l'ensemble (11) formant élément rapporté dans la cavité. 5
3. Vanne selon la revendication 1 ou 2, dans laquelle le corps (30) est porté par un ensemble (48) formant chapeau de vanne. 10
4. Vanne selon la revendication 3, dans laquelle le corps (30) est relié à l'ensemble (48) formant chapeau de vanne par des moyens de fixation (44). 15
5. Vanne selon la revendication 3, dans laquelle le corps (30) et l'ensemble (48) formant chapeau de vanne sont formés venus de matière. 20
6. Vanne selon l'une quelconque des revendications précédentes, dans laquelle les faces d'extrémité opposées des éléments (52, 53) formant siège annulaires portent des moyens (54) d'étanchéité métalliques pour assurer l'étanchéité contre l'obturateur (40) et un réceptacle (10). 25

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