

REUSEABLE LINED CONTAINER AND CLOSURE SYSTEM THEREFOR**Field of the invention**

- 5 This invention relates to industrial-sized drums and similar bulk containers for flowable materials. More particularly, the invention relates to removable liners and closure systems for such containers, typically but not exclusively removable liners and closure systems for steel drums.

10 **Invention Background**

- Current open head steel drums with internal polymer liners are meant for single use applications and are ideally collected and recycled after this single use. Single use packaging is costly in terms of energy and resource utilization. Statutory and regulatory requirements exist or are contemplated to penalize single use packaging and support a
- 15 circular economy to meet sustainability goals and reduce carbon emissions.

- Current steel drums with internal polymer liners are manufactured with a closure system and cover that is meant for single use. The closure system is crimped into the steel drum cover. See for example US4,195,750 which provides a crimped-in plastic closure flange,
- 20 for reception of a removable closure plug. The flange provides a surface disposed within the drum in use, accessible so that a polymer cover lining component can be pre-welded to this surface prior to crimping the flange into the cover. The drum cover may be of an open-head type, i.e. non-destructively removable and secured in place by a removable circumferential clamp band. This enables easy removal and replacement of a blow-
- 25 molded liner receivable within the body of the drum. However the crimped and welded drum cover assembly has to be shredded to isolate the steel and plastic components to enable recycling into the appropriate waste stream. Such drum cover assemblies are therefore limited to a single use when, as is often the case, the cover liner and closure flange cannot be effectively cleaned and reconditioned in situ attached to the drum cover.
- 30 These difficulties discourage the re-use of the entire drum assembly.

US5,222,620 provides a non-reuseable drum liner locking and locating apparatus in which the liner is attached to a fitting for receiving a closure plug. The fitting is passed through an opening in a drum lid, before the lid is attached to the drum. After the fitting is in place in the opening, a non-releaseable securing means permanently attaches the fitting to the lid, with the intention that the lid and/or fitting has to be destroyed to release the liner. The non-releaseable securing means is formed by an exterior lock nut with ratchet boxes which are non-releasably engaged by tabs formed from the material of the drum lid. The exterior lock nut is vulnerable to tampering and has to be protected by a dedicated seal cap, which adds to structural and installation complexity.

Therefore a need exists for a lined cover assembly for steel drums and other similar industrial-sized containers, which is more convenient to use and/or which is readily reconditionable for reuse, either in its entirety, or for re-use of some of its constituent parts; particularly for re-use of those parts which are more costly in either monetary or environmental terms, such as a steel drum cover.

Summary of the invention

The present invention provides a closure system for a container, the closure system comprising, assembled or as a kit of parts:

- a cover securable across an opening in a container body so that the container body and cover together enclose an interior space for the reception of contents of the container;
- a liner positionable adjacent to at least the cover for separating the container contents from the cover when the cover is installed across the opening;
- a flange receivable in an aperture through the cover to define a passage through the cover for filling and/or discharging the container contents, the filling and discharge passage being closeable by a removable closure member, wherein the liner is sealingly securable to the flange circumferentially of the passage; and
- an adaptor having an exterior screw thread engageable with an interior screw thread provided in the flange to secure the flange in the aperture. The adaptor may therefore be unscrewed from the flange, allowing the liner and flange to be readily separated from the cover, without destroying any of the liner, flange, adaptor, or cover. The cover can

thereby readily be re-used one or more (or many) times, simply by removing and replacing the liner, flange, and the adaptor, to the extent necessary, if these components are damaged and/or contaminated with residues from prior use of the container. The removed components may be replaced new or reconditioned ones. Reconditioning may
5 involve cleaning, repair and inspection for soundness. Any components which cannot be cleaned or repaired are easily recycled through the appropriate waste stream. Moreover, the exterior screw thread means that the adaptor can be largely or fully concealed within the closure assembly when fully assembled, and therefore protected by any anti-tamper features which will usually be present on the closure member and /or associated
10 components, such as an overcap, commonly used in industrial-sized containers such as steel drums and the like. The need for separate anti-tamper protection is therefore obviated, making the flange assembly structurally simple and easy to fit.

The flange may be configured for reception in a flange pocket formed in the cover, the
15 flange comprising an outward end distal to the container interior when thus received, the flange outward end being configured for engagement beneath a complementary in-turned rim of the flange pocket, whereby the flange is substantially completely containable within the flange pocket. The flange pocket thereby serves to conceal and protect the flange against tampering.

20 The adaptor may nevertheless comprise a securing rim comprising a radially extending shoulder configured to clamp the in-turned rim of the flange pocket against the flange's outward end, when the adaptor is screwed into the flange. The securing rim thus extends above the flange pocket, but may readily be made of sufficiently low profile to be
25 effectively concealed and protected by the usual anti-tamper measures ordinarily associated with the closure member, such as an overcap. The securing rim and/or an interior passage of the adaptor may be provided with drive features configured for engagement with a complementary drive tool, used for screwing the adaptor into, and unscrewing the adaptor from, the flange. The securing rim may radially overhang an
30 adjacent part of the flange pocket. This provides a shoulder facing toward the container

body, which may be used e.g. for securing an overcap over the adaptor and closure member.

5 The closure system may comprise a gasket configured for simultaneous sealing engagement with the securing rim and the in-turned rim of the flange pocket, and optionally also with the flange, e.g. at or adjacent to its outward end. A single gasket may therefore be sufficient to seal the whole closure system (in conjunction with any gasket(s) used in association with the closure member). This minimises the required parts inventory and simplifies installation.

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The flange and the adaptor may be provided with co-operating anti-backout features such as ratchet teeth. The adaptor may be provided with an (e.g. internal) thread configured for removably securing the closure member to the closure assembly. The anti-backout features may be configured to provide sufficient resistance to unscrewing of the
15 adaptor from the flange to prevent such unscrewing as a result of removal of the closure member. The anti-backout features may nevertheless be configured to allow unscrewing of the adaptor from the flange without damage. This facilitates re-use and/or recycling of the closure system components as and when appropriate.

20 The flange may comprise a non-circular transverse cross-sectional profile configured for engagement within a complementary part of the flange pocket, to secure the flange against rotation. For example the flange non-circular transverse cross-sectional profile and co-operating flange pocket part if manufactured by the present applicant may have the familiar octagonal shape characteristic of Tri-Sure ® products.

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The invention also extends to a removably lined container lid comprising the above-described novel closure system, and/or a lined container comprising the above-described novel closure system.

30 The invention and some of its optional features and advantages is further explained below with reference to illustrative embodiments shown in the drawings.

Brief description of the drawings

FIG. 1 is a perspective view showing a closure system embodying the invention, in use on an open-head drum, in which the cover is a removable and replaceable drum lid;

5 FIG. 2 is a vertical cross-section on a diametral plane through the drum and drum lid of FIG. 1;

FIG. 3 is an exploded perspective view, showing part of the closure system of the preceding Figures;

FIG. 4a is an exploded perspective view showing flange and adaptor components of the closure system of FIG. 3, together with a corresponding flange pocket of the drum lid;

FIG. 4b is a side view corresponding to FIG. 4a;

FIG. 4c is a cross-sectional view corresponding to FIG. 4b;

FIG. 5a is a perspective view of the assembled components of FIGs 4a-4c, also showing part of the cover (lid) liner (the flange being largely hidden);

15 FIG. 5b is a side view corresponding to FIG. 5a;

FIG. 5c is a cross-sectional view corresponding to FIG. 5b;

FIGs 6a-6c are views similar to FIGs. 4a-4c, but showing further or alternative flange and adaptor components and their corresponding flange pocket;

FIGs. 7a-7c correspond to FIGs. 5a-5c, but relate to the further or alternative flange components and flange pocket of FIGs. 6a-6c;

FIG. 8 shows a perspective view of a cover liner as may be used in the embodiments shown in the preceding Figures;

FIG. 9 is a plan view of the liner of FIG. 8;

FIG. 10 is a side view of the liner of FIG. 8;

25 FIG. 11 is a perspective view showing part of the cover (lid) liner in greater detail, assembled with a flange;

FIG. 12 is a perspective view of the cover (lid) liner fitted with flange components and partially assembled with a cover (lid), ready for final assembly by fitment of adaptors;

FIG. 13 is a sectioned perspective view through a part of the assembly of FIG. 12;

30 FIG. 14 is a cross-sectional view generally corresponding to FIG. 13, but further showing an adaptor, closure plug and overcap in place within and upon the assembly;

FIG. 15 is a cross-sectional view generally corresponding to FIG. 14, but showing further or alternative flange and adaptor components and their corresponding closure plug and overcap, and a part of the container body.

5 Description of illustrative embodiments

FIG. 1 shows the closure system 100 fitted to a container body 10 for example a steel drum body. The cover in this illustrative embodiment is a removable and replaceable circular cover or lid 110 for example also of steel, which when in place covers and closes an otherwise open end ("head") of the drum body 10. The lid 110 may be secured in place
10 with a clamp band 12 which is tightened to press a circumferential sealing gasket of the lid 110 against an end chime of the drum body 10. The lid 110 includes one or more apertures (two in the illustrative instance shown in FIG. 1) for accessing the drum contents when the lid 110 is in place. Each aperture is equipped with a respective set of closure components ("closure sets" 150, 250), providing the aperture with openable and
15 re-closable leak-proof fluid sealing means. For example, the closure set 150 may include an industry standard G2 closure plug of approximately 50.8 mm (2 inches) diameter, used primarily for dispensing the container contents; whereas the closure set 250 may include an industry standard G $\frac{3}{4}$ closure plug of approximately 19.1 mm (0.75 inches) diameter, used primarily for venting-in as the container contents are dispensed.
20 However, these dimensions and functions are not critical to the invention and any suitably sized closure members may be used as needed. Similarly, any suitable number of apertures/closure sets may be provided. Other suitable materials may be used to make the drum body and lid besides steel, for example aluminum or other metals, fiberboard, plastics, or mixtures of these and other materials.

25 From the cross-sectional view in FIG. 2, it can be seen that the drum body 10 contains a removable liner 14 e.g. of blow-molded plastics material, compatible with the drum's intended contents. For example the liner may be formed of LDPE about 0.38mm (0.015 inches) in thickness. The drum body liner 14 has an out-turned skirt at its open end,
30 which may be hooked over the end chime at the open head end of the drum body 10.

FIG. 3 shows part of the closure system 100 for the drum of the preceding Figures. More particularly, the following parts are shown in exploded perspective view. These parts may be assembled to form the closure system 100.

- A generally circular cover or lid 110 (shown in part) for securing across the open head end of the drum body 12 so that, together with other components of the closure system 100, the lid 110 may serve to enclose and seal off the drum interior.
- A lid liner 114 (again only partly shown in FIG.2) whose shape generally matches that of the lid 110. The lid liner 114 may be formed of a material compatible with the container contents, for example LDPE about 0.38mm (0.015 inches) in thickness. However these features are not essential to the invention. The liner 114 is positioned in the assembly adjacent to and on the inside of the lid 110 so that it separates the container contents from the lid 110 when the lid 110 is secured in place to close the open end of the drum. Together with the drum body liner 12, the lid liner 112 thus serves to isolate the drum contents and prevent them from contacting the drum body 10 and the drum lid 110.
- A closure set 150 comprising the following:
 - A flange 112 receivable in an aperture 116 through the lid 110 so as to define a passage 118 through the lid 110 e.g. for discharging the container contents. The liner 114 is sealingly securable to the flange 112 circumferentially of the passage 118, as further described below.
 - A closure member or plug 120 removably installable in the discharge passage 118.
 - An adaptor 122 having an exterior screw thread 124 engageable with a complementary internal screw thread 126 provided in the flange 112 to secure the flange 112 in the lid aperture 116. The liner 112 attached to the flange 112 is thereby secured to the lid 110 in correct register with the aperture 116.
 - A sealing gasket 128 for the closure member or plug 120. This gasket is e.g. positionable beneath a radially projecting rim 130 of the closure member 120 so as to seal the rim 130 against a co-operating annular land 132 formed within the outer end of the adaptor 122.

- Another sealing gasket 134 which co-operatively seals e.g. between the adaptor 122, the lid 110, and/or the flange 112, e.g. as further described below.
- An overcap 136 securable to the adaptor 122, and/or to the plug 120, e.g. as further described below. The overcap 136 covers, conceals, and is therefore able, when required, to provide anti-tamper protection to the plug 120 and to the adaptor 122, as well as ensuring cleanliness of the closure set, protecting it against environmental contaminants. Suitable overcaps are described in WO2005/056412, in WO2008/139136, or in the present applicant's co-pending international patent application nos. PCT/EP2024/050629 and PCT/EP2024/050631.

By virtue of the threaded connection formed by the complementary threads 124, 126, the flange 112 with its attached liner 114 may be readily and, where desired, non-destructively, detached from the lid 110. The lid 110 is thereby easily refurbished after use, e.g. by fitting a replacement liner and flange 114, 112 and/or plug 120 and/or adaptor 122, any of which may be new or reconditioned, according to circumstances. Parts which are not re-used are not formed from mixed materials and can therefore be easily recycled to the appropriate waste stream. The sealing gaskets 128, 134 are likewise readily replaceable.

Other closure sets (e.g. such as 250, FIGs. 1 and 2), if provided, are broadly similar to the closure set 150 and therefore will not be further described except for certain points of difference.

Figures 4a-4c show the flange 112 and adaptor 122 in more detail in an exploded view. They are shown juxtaposed with a flange pocket 142 which is formed in the lid 110 around the aperture 116, for reception of the flange 112. Figures 5a-5c show these components when assembled, and with the cover or lid liner 114 sealingly connected to the flange 112. The flange 112 comprises a central boss or neck 144 having a through-going passageway on whose wall the internal thread 126 is provided. During assembly,

the boss 144 is inserted through the aperture 116 in the cover or lid 110 and through a corresponding aperture 138 in the liner 114 of the cover or lid 110 (see e.g. FIGs. 3, 8, and 9). The flange pocket 142 has an interior surface contoured to generally correspond to the exterior surface contours of the boss 144, so that the boss 144 is a snug fit in the flange pocket 142. The flange 112 has a radially extending base portion 146 (hence perhaps why the entire component is generally known as a “flange”) which is of larger diameter than the boss 144 and the apertures 116, 138. The adaptor 122 has a radially outwardly extending securing rim 147 at its outward end. The flange pocket 142 has a radially in-turned rim 148 at its outward end. Therefore when the adapter 122 is screwed fully into the flange 112 by engagement of the threads 124, 126, the in-turned rim 148 of the flange pocket 142 is trapped between the outward end of the flange boss 144 and a shoulder formed beneath the outwardly extending securing rim 147 of the adaptor 122. The flange 112 is thereby removably clamped as a snug and secure fit in the flange pocket 142 of the lid or cover 110. The sealing gasket 134 may be received in an annular seat on the body of the adapter 122, between the outward end of the thread 124 and the radially outwardly extending rim 147 (see e.g. FIGs. 5c and 7c). Therefore when the adapter 122 is screwed fully into the flange 112, the sealing gasket 134 may be energized and deform to make a three-way leak-resistant seal between the outward end of the flange boss 144, the in-turned rim 148 of the flange pocket 142, and the radially outwardly extending rim 147 of the adaptor 122.

The flange 112 and flange pocket 142 may comprise complementary portions of non-circular transverse cross-sectional profile, whereby the flange 112 is secured against rotation when clamped in the flange pocket 142 by the adapter 122. For example, the flange boss 144 may comprise a non-circular profile (a generally octagonal profile 152 is shown in the drawings) in the junction region between the flange base portion 146 and the flange boss 144. The flange pocket 142 may thus have a matching non-circular transverse cross-sectioned region 154 at its inward end. The liner 114 for the lid or cover 110 may have a similarly shaped upstanding collar 140 surrounding the aperture 138 (see FIGs. 3 and 11, collar 140 not shown in FIGs. 8 and 9) in which the non-circular profile 152 of the flange 112 is received; the collar 140 being correspondingly received

in the non-circular region 154 of the flange pocket 142 when the flange 112 is clamped in the flange pocket 142 by the screwed-in adapter 122. Alternatively, the aperture 138 may be non-circular and dimensioned to closely fit the non-circular portion of the flange to ensure correct orientation of the flange.

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The flange 112 may be attached to the liner 114 with a continuous leak-tight seal around the aperture 138, in any suitable way, e.g. to form a subassembly for later securement to the lid or cover 110 by screwing in the adapter 122 (or adapters, if more than one lid aperture 116 and corresponding closure set 150, 250 is present). For example, a
10 continuous bead of a suitable sealant/adhesive may be applied around the aperture 138, between the opposing surfaces of the radially extending base portion 146 of the flange 112 and the liner 114. Additionally or alternatively, the radially extending base portion 146 may be configured to be ultrasonically weldable to the liner 114. For example in the illustrative embodiment shown in the drawings, the base portion 146 of the flange 112 is
15 provided with a plurality of circumferentially continuous ultrasonic energy-directing ridges 156.

The upstanding collar(s) 140 and/or aperture(s) 138 is/are are positioned and oriented on the lid liner 114 so that when positively located therein, the flange(s) 112 is (are)
20 properly centered for reception in the flange pocket(s) 142, also with the flange non-circular portion(s) 152 properly azimuthally aligned with the corresponding non-circular portion(s) 154 of the flange pocket(s) 142. Fitment of the liner 114 and flange(s) 112 subassembly (FIG. 11) to the lid/cover 110 (e.g. as shown in FIGs. 12 and 13) without interference is thereby facilitated. The inter-engaged non-circular portions 152, 154 then
25 also allow torsional loads imposed on the flange(s) 112 by screwing in or unscrewing the adaptor(s) 122 or closure member(s) 120 to be reacted through the robust cover 110 rather than through the more delicate cover liner 114 (protecting it against distortion or rupture). Screwing the adaptor(s) 122 into the flange(s) 112 can then secure the liner 114 and flange(s) subassembly to the lid by clamping the in-turned rim 148 of the or each
30 flange pocket 142 between the outward end of the (corresponding) flange boss 144 and

the outwardly extending rim 147 of the (corresponding) adaptor 122. This also energizes the adaptor sealing gaskets 134, as described above.

To prevent the or each adaptor 122 from backing out of its flange 112 when the
5 corresponding closure member 120 is unscrewed (e.g. when the end-user desires to
access the container contents), the or each adaptor 122 is provided, e.g. at its lower
periphery, next to the thread 124, with an anti-backout feature e.g. comprising a series of
ratchet teeth 158 (see e.g. Figs. 4a and 6a). This feature is configured to engage a
corresponding anti-backout feature comprising series of ratchet teeth 160 provided in
10 the flange 112, e.g. below the thread 126. The teeth 158, 160 may be radially directed in
“amplitude” as shown; although any other suitable arrangements may also be used (e.g.
axially directed, or corresponding obliquely angled, co-operating series of ratchet teeth).
The co-operating teeth 158, 160 deform to pass each other and allow the adaptor 122 to
be screwed fully into the flange 112 to sufficiently clamp the flange pocket 142 and
15 energize the sealing gasket 134 as previously described. The co-operating teeth 158, 160
are shaped and positioned such that when the adaptor is thus screwed fully in, the teeth
158, 160 engage each other sufficiently to resist the torques normally used to unscrew
the closure member 120 (perhaps plus a suitable safety factor). However, to allow the
adaptors 122 to be removed for ease of refurbishment and/or re-use of some or all the
20 closure assembly’s component parts, the ratchet teeth 158, 160 may be shaped to permit
the adaptor 122 to be non-destructively unscrewed from the flange 112 by application of
a suitably higher torque than that normally used to unscrew the closure member 120.
For example, the trailing flanks of the ratchet teeth 158, 160 in the screwing-in direction
may be at a small angle to the radial direction, on the opposite side of the radial direction
25 to the larger angle of the leading flanks (rather than lying in the radial direction or at a
small angle on the same side of the radial direction as the leading flanks, which would
produce a barbed, “one way only” ratchet profile). The accessible bore and/or the
securing rim 147 of the adaptor(s) 122 may be provided with suitable drive tool
engageable features, such as lugs 162, for screwing the adaptor into, and unscrewing the
30 adaptor from, a corresponding flange 112.

The lid or cover 110 and the lid or cover liner 114 are each formed with a downwardly open peripheral channel (respectively referenced 164 and 166 in the drawings – see FIGs. 3, 11, 12, 13, and 15). The lid liner's peripheral channel 166 is configured to fit snugly inside the lid's peripheral channel 164 when the lid liner 114 is secured to the lid 112 by the adaptor(s) 122 and flange(s) 112. A sealing ring 168 may be fitted within the lid liner peripheral channel 166, as shown in FIG. 15. As previously outlined, the open end of the container body liner 14 may be doubled over or otherwise formed to provide a depending skirt 170. The skirt 170 may be configured to enfold and extend below the end chime 172 at the open head of the container body 10 when the container body liner 14 is fitted into the container body 10. The free edge of the lid liner's peripheral channel 166 may project beyond the free edge of the lid's peripheral channel 164 to extend below the end chime 172 and partially overlap the outside of the skirt 170 when the lid 112 is placed over the open head of the container 10. In this configuration, the sealing ring 168 lies between the body liner 14 and the lid liner 114 and also between the lid's peripheral channel 164 and the end chime 172. Also in this configuration, the free edge of the lid's peripheral channel 164 may overlap only an upper part of the end chime 172. Therefore when the clamp band 12 is fitted around the lid 110 and end chime 172 and is tightened, not only is the lid 110 drawn down onto the end chime 172 to compress the sealing ring 168 between the liners 14 and 114, but also the free edge of the lid liner's peripheral channel 166, the skirt 170 and a depending part 174 of the sealing ring 168 are pressed inwards and stretched around the end chime 172 to further improve the fluid seal. The schematic view in FIG. 15 shows the skirt 170 (container body liner 14), seal ring part 174 and lid liner 114 in their relaxed, unstretched condition, but shows the clamp band 12 in its tightened position.

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The passage 118 through the flange(s) 112 and adaptor(s) 122 may be closed in a fluid-tight way by any suitable closure. In the illustrative example shown in the drawings (see especially FIGs. 4a, 6a, 14, and 15), the passage 118 through the adaptor(s) 122 has an internal thread 176 for reception of an externally threaded closure plug 120 (FIG. 3). This may be for example a standard G2 closure plug as shown in the drawings for the closure set 150 (FIGs. 1 and 14) and for example a standard G $\frac{3}{4}$ closure plug as shown for the

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closure set 250 (FIGs. 1 and 15). The closure plug 120 may be fitted with a sealing gasket 128 in the conventional way, e.g. positioned beneath a radially extending lip 178 at the upper end of the plug 120 body. When the plug 120 is screwed fully into the adaptor 122, the sealing gasket 128 is compressed against a circumferential sealing land 132 (FIGs 4a, 5a, 6a, and 7a) provided around the wall of the passage 118, above the thread 176. The closure plug(s) 120 and adaptor(s) 122 may be protected by a tamper-indicating overcap 136 (FIGs. 3, 14, and 15). Where space permits, this may engage in a central well in the closure plug in the conventional way. Additionally or alternatively the overcap 136 may engage with a downwardly facing shoulder provided around the outside of the flange pocket 142, or (as shown in the drawings) provided beneath the radially outward extension of the adaptor's rim 147, which at least in part radially overhangs the adjacent in-turned rim 148 of the flange pocket 142. This radial overhang and the height of the rim 147 exposed above the flange pocket 142 are both relatively modest, so that the plug 120 and adaptor 122 may be covered simultaneously by a single tamper-evidencing overcap 136 of substantially conventional form.

Alternatively, the flange component(s) may be welded or otherwise suitably secured to a blown polymer bag by methods substantially the same as any of the methods described above for securing and sealing the flange component(s) to the open head drum cover liner. The closure sets thus provided are otherwise generally similar to those described above. Non-circular portions of the mated flanges and flange pockets may relieve strain on the polymer bag substantially as described above. The flange or flanges may be attached to the bag at the appropriate position(s) and orientation(s) to mate properly with corresponding flange pocket(s) in the container cover. In this alternative arrangement the blown bag and flange(s) subassembly may be assembled to an (e.g. steel) cover in the same way as the open head drum cover. This cover may be secured to the container body as described above. However, it may also be seamed or otherwise secured to the container (e.g. drum) body in a manner not designed to be openable by the end user; thereby creating a tight head drum/container. This provides a lower cost composite container consisting of an outer e.g. steel drum construction with an interior full polymer liner, as compared to a blow molded polymer drum being assembled into an

e.g. steel drum shell. A polymer bag-lined drum or like container may be suited to customers with high purity, high compatibility, or no metal contact requirements. It also offers a lower cost solution to markets that require high density storage e.g. in a steel drum shell or like container.

CLAIMS

1. A closure system for a container, the closure system comprising, assembled or as a kit of parts:
- 5 a cover securable across an opening in a container body so that the container body and cover together enclose an interior space for the reception of contents of the container;
- a liner positionable adjacent to at least the cover for separating the container contents from the cover when the cover is installed across the opening;
- a flange receivable in an aperture through the cover to define a passage through the cover
- 10 for filling and/or discharging the container contents, the filling and discharge passage being closeable by a removable closure member, wherein the liner is sealingly securable to the flange circumferentially of the passage; and
- an adaptor having an exterior screw thread engageable with an interior screw thread provided in the flange to secure the flange in the aperture.
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2. A closure system as claimed in claim 1, in which the flange is configured for reception in a flange pocket formed in the cover, the flange comprising an outward end distal to the container interior when thus received, the flange outward end being configured for engagement beneath a complementary in-turned rim of the flange pocket.
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3. A closure system as claimed in claim 2, in which the adaptor comprises a securing rim comprising a radially extending shoulder configured to clamp the in-turned rim of the flange pocket against the flange's outward end, when the adaptor is screwed into the flange.
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4. A closure system as claimed in claim 3, in which the securing rim and/or an interior passage of the adaptor is provided with drive features configured for engagement with a complementary drive tool.
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5. A closure system as claimed in claim 3 or 4, in which the securing rim radially overhangs an adjacent part of the flange pocket.

6. A closure system as claimed in claim 3, 4 or 5, comprising a gasket configured for simultaneous sealing engagement with the securing rim and the in-turned rim of the flange pocket.

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7. A closure system as claimed in claim 6, in which the gasket is configured for simultaneous sealing engagement with the flange.

8. A closure system as claimed in any preceding claim, in which the flange and the adaptor are provided with co-operating anti-backout features

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9. A closure system as claimed in claim 8, in which the adaptor is provided with a thread configured for removably securing the closure member to the closure assembly.

10. A closure system as claimed in claim 9, in which the anti-backout features are configured to provide sufficient resistance to unscrewing of the adaptor from the flange to prevent such unscrewing as a result of removal of the closure member.

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11. A closure system as claimed in claim 10, in which the anti-backout features are configured to allow unscrewing of the adaptor from the flange without causing damage sufficient to prevent re-use of the adaptor.

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12. A closure system as claimed in any preceding claim, in which the flange comprises a non-circular transverse cross-sectional profile configured for engagement within a complementary part of the flange pocket, to secure the flange against rotation.

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13. A closure system as claimed in any preceding claim, in which the liner comprises a bag.

14. A removably lined container lid comprising the closure system of any preceding claim.

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15. A removably lined container comprising the closure system of any of claims 1-13.