

Guidelines for the Blood Transfusion Services

7.3: Red Cell Components

<http://www.transfusionguidelines.org/red-book/chapter-7/7-3>

7.3: Red Cell Components

Red cell components are manufactured from whole blood or apheresis donations and suspended in additive solution and/or plasma. All red cell components are leucocyte depleted. Some components undergo additional processing steps described.

Specifications

7.3.1: Red Cells, Leucocyte Depleted

A red cell component containing less than 1×10^6 leucocytes.

7.3.1.1: Technical information

- A red cell component prepared by removing a proportion of the plasma from leucocyte-depleted whole blood or by leucodepleting plasma reduced red cells.
- Red Cells, Leucocyte Depleted should be administered through a CE/UKCA/UKNI marked transfusion set.

7.3.1.2: Labelling

For general guidelines, see section 6.6.

The following shall be included on the label:

(* = in eye-readable and UKBTS approved barcode format)

- Red Cells, Leucocyte Depleted* and volume
- the blood component producer's name*
- the donation number*
- the ABO group*
- the RhD group stated as positive or negative*
- the name, composition and volume of the anticoagulant solution
- the date of collection
- the expiry date*
- the temperature of storage
- the blood pack lot number.*

In addition, the following statements should be made:

INSTRUCTION*Always check patient/component compatibility/identity**Inspect pack and contents for signs of deterioration or damage**Risk of adverse reaction/infection, including vCJD***7.3.1.3: Storage**

For general guidelines, see section 6.7.

- The component may be stored for a maximum of 35 days at a core temperature of $4 \pm 2^{\circ}\text{C}$ if an adenine supplemented anticoagulant is used, otherwise the maximum period of storage is 28 days at a core temperature of $4 \pm 2^{\circ}\text{C}$.
- Variation from the core temperature of $4 \pm 2^{\circ}\text{C}$ of the finished component must be kept to a minimum during storage at all stages of the blood supply chain and restricted to any short period necessary for examining, labelling or issuing the component.
- Exceptionally, i.e. due to equipment failure at a Blood Centre or hospital, for temperature excursions where the core temperature has not exceeded 10°C or fallen below 1°C , components may be released for transfusion provided that:
 - the component has been exposed to such a temperature change on one occasion only
 - the duration of the temperature change has not exceeded 5 hours
 - a documented system is available in each Blood Centre or hospital to cover such eventualities
 - adequate records of the incident are compiled and retained.

7.3.1.4: Testing

In addition to the mandatory and other tests required for blood donations described in Chapter 9, and leucocyte counting (see sections 6.3 and 7.1.1), a minimum of 75% of those components tested for the parameters shown in Table 7.3.1 shall meet the specified values.

Table 7.3.1 Red Cells, Leucocyte Depleted – additional tests

Parameter	Frequency of test	Specification
Volume	1% or as determined by statistical process control	280 ± 60 mL
Haemoglobin content	(if ≤ 10 components produced per month then test every available component)	≥ 40 g/unit
Haemolysis	As per section 7.1.3	$< 0.8\%$ of red cell mass
Leucocyte count ¹	As per sections 6.3 and 7.1.1	$< 1 \times 10^6$ /unit
¹ Methods validated for counting low numbers of leucocytes must be used		

7.3.1.5: Transportation

For general guidelines, see section 6.11.

For red cell components, transit containers, packing materials and procedures should have been validated to ensure the component surface temperature can be maintained between 2°C and 10°C during transportation. Additionally:

- the validation exercise should be repeated periodically
- if melting ice is used, it should not come into direct contact with the components
- dead air space in packaging containers should be minimised
- as far as is practicable, transit containers should be equilibrated to their storage temperature prior to filling with components
- for transportation between blood supplier and hospital an upper limit of 10°C surface temperature is acceptable but should be limited to one occasion, not exceeding 12 hours

In some instances, it is necessary to issue red cell components from the blood supplier to hospitals that have not been cooled to their storage temperature prior to placing in the transit container. The transport temperature specified above is not applicable for such consignments.

7.3.1.6: Removal from and return to 2-6°C controlled storage within hospitals

For occasions when red cells are removed from 2-6°C controlled storage (e.g. when issued to a clinical area immediately prior to transfusion) and returned then:

If possible, time out of a controlled temperature environment should be restricted to under 30 minutes

- if 30 minutes is exceeded the unit should not be returned to the issue location in the refrigerator, but returned to the transfusion laboratory or quarantined remotely using electronic blood tracking
- up to 60 minutes out of controlled temperature is acceptable, provided the unit is then quarantined by placing in a secure refrigerator for at least 6 hours prior to reissue, to allow the unit to return to 2-6°C
- Hospitals will need to identify such units so that they are not subject to being out of controlled temperature storage for between 30 and 60 minutes on more than three occasions.

Transfusion should be completed within 4 hours of issue out of a controlled temperature environment.

7.3.2: Red Cells in Additive Solution, Leucocyte Depleted

A red cell component derived from whole blood or collected by apheresis containing less than 1×10^6 leucocytes and suspended in an approved additive solution.

7.3.2.1: Technical information

- A red cell component prepared by removing a proportion of the plasma from leucocyte-depleted whole blood and suspending in an approved additive solution, or by collection using apheresis

technology. Leucodepletion may be carried out on either the whole blood starting material or on the final component.

- Red Cells in Additive Solution, Leucocyte Depleted may be collected by a variety of apheresis systems using different protocols and anticoagulants. Each procedural protocol must be fully validated so that the resulting red cells meet the required specifications.
- Red Cells in Additive Solution, Leucocyte Depleted should be administered through a CE/UKCA /UKNI marked transfusion set.
- May be produced by remanufacture of Red Cells for Exchange Transfusion, Leucocyte Depleted (section 7.3) up to 7 days after donation.

7.3.2.2: Labelling

For general guidelines, see section 6.6.

The following shall be included on the label:

(* = in eye-readable and UKBTS approved barcode format)

- Red Cells in Additive Solution, Leucocyte Depleted* and volume
- the blood component producer's name*
- the donation number* and if collected via apheresis technology and divided, sub-batch number
- the ABO group*
- the RhD group stated as positive or negative*
- the name, composition and volume of the additive solution
- the date of collection
- the expiry date*
- the temperature of storage
- the blood pack lot number.*

In addition, the following statements should be made:

INSTRUCTION

Always check patient/component compatibility/identity

Inspect pack and contents for signs of deterioration or damage

Risk of adverse reaction/infection, including vCJD

7.3.2.3: Storage

For general guidelines, see section 6.7.

- The component may be stored for a maximum of 35 days at a core temperature of $4 \pm 2^{\circ}\text{C}$.
- Variation from the core temperature of $4 \pm 2^{\circ}\text{C}$ of the finished component must be kept to a minimum during storage at all stages of the blood supply chain and restricted to any short period necessary for examining, labelling or issuing the component.
- Exceptionally, i.e. due to equipment failure at a Blood Centre or hospital, for temperature excursions where the core temperature has not exceeded 10°C or fallen below 1°C , components may be released for transfusion provided that:
 - the component has been exposed to such a temperature change on one occasion only
 - the duration of the temperature excursion has not exceeded 5 hours

- a documented system is available in each Blood Centre or hospital to cover such eventualities
- adequate records of the incident are compiled and retained.

7.3.2.4: Testing

In addition to the mandatory and other tests required for blood donations described in Chapter 9, and leucocyte counting (see sections 6.3 and 7.1.1), a minimum of 75% of those components tested for the parameters shown in Table 7.3.2 shall meet the specified values.

Table 7.3.2 Red Cells in Additive Solution, Leucocyte Depleted – additional tests

Parameter	Frequency of test	Specification
Volume ¹	1% or as determined by statistical process control (if <=10 components produced per month then test every available component)	280 ±60 mL
Haemoglobin content ²		>=40 g/unit
Haematocrit ^{3,4}		0.50 – 0.70
Haemolysis	As per section 7.1.3	<0.8% of red cell mass
Leucocyte count ⁵	As per sections 6.3 and 7.1.1	<1 × 10 ⁶ /unit
¹ Units measured and found to be <210 mL or >375 mL should only be issued for transfusion under concessionary release		
² Units measured and found to have <30 g/unit should only be issued for transfusion under concessionary release		
³ Units measured and found to have haematocrit <0.40 or >0.70 should only be issued for transfusion under concessionary release		
⁴ A minimum of 90% of those components tested shall meet the specified value		
⁵ Methods validated for counting low numbers of leucocytes must be used		

7.3.2.5: Transportation

For general guidelines, see section 6.11.

For red cell components, transit containers, packing materials and procedures should have been validated to ensure the component surface temperature can be maintained between 2°C and 10°C during transportation. Additionally:

- the validation exercise should be repeated periodically
- if melting ice is used, it should not come into direct contact with the components
- dead air space in packaging containers should be minimised
- as far as is practicable, transit containers should be equilibrated to their storage temperature prior to filling with components
- for transportation between blood supplier and hospital an upper limit of 10°C surface temperature is acceptable but should be limited to one occasion, not exceeding 12 hours

In some instances, it is necessary to issue red cell components from the blood supplier to hospitals that have not been cooled to their storage temperature prior to placing in the transit container. The transport temperature specified above is not applicable for such consignments.

7.3.2.6: Removal from and return to 2-6°C controlled storage within hospitals

For occasions when red cells are removed from 2-6°C controlled storage (e.g. when issued to a clinical area immediately prior to transfusion) and returned then:

- If possible, time out of a controlled temperature environment should be restricted to under 30 minutes
- if 30 minutes is exceeded the unit should not be returned to the issue location in the refrigerator, but returned to the transfusion laboratory or quarantined remotely using electronic blood tracking
- up to 60 minutes out of controlled temperature is acceptable, provided the unit is then quarantined by placing in a secure refrigerator for at least 6 hours prior to reissue, to allow the unit to return to 2-6°C
- Hospitals will need to identify such units so that they are not subject to being out of controlled temperature storage for between 30 and 60 minutes on more than three occasions.

Transfusion should be completed within 4 hours of issue out of a controlled temperature environment.

7.3.3: Red Cells, Washed, Leucocyte Depleted

A red cell component, containing less than 1×10^6 leucocytes, which has been washed with 0.9% w/v sodium chloride for injection (BP) or other validated solution. The Red Cells, Washed, Leucocyte Depleted may then be suspended in an approved solution.

7.3.3.1: Technical information

- The amount of residual protein will depend on the washing protocol. Washing can be performed by interrupted or continuous flow centrifugation.
- The use of validated closed system washing procedures that incorporate chilled validated solution for suspension is recommended. This will minimise the risk of bacterial growth and help to produce a component that meets the transit temperature requirements.
- If the washing process results in the transfer of the final component into a pack that was not part of the original pack assembly, a secure system must be in place to ensure the correct donation identification number is put on the component pack of Red Cells, Washed, Leucocyte Depleted.
- Red Cells, Washed, Leucocyte Depleted should be administered through a CE/UKCA/UKNI marked transfusion set.

7.3.3.2: Labelling

For general guidelines, see section 6.6.

The following shall be included on the label:

(* = in eye-readable and UKBTS approved barcode format)

- Red Cells, Washed, Leucocyte Depleted* and volume
- the blood component producer's name*
- the donation number*
- the ABO group*
- the RhD group stated as positive or negative*
- the name, composition and volume of the suspending solution
- the date and time of preparation
- the expiry date and time*
- the temperature of storage
- the blood pack lot number.*

In addition, the following statements should be made:

INSTRUCTION

Always check patient/component compatibility/identity

Inspect pack and contents for signs of deterioration or damage

Risk of adverse reaction/infection, including vCJD

7.3.3.3: Storage

For general guidelines, see section 6.7.

- Where the component has been produced in a closed system and storage is required the component should be stored at a core temperature of $4 \pm 2^{\circ}\text{C}$ and used up to 14 days if stored in SAGM. Where alternative additive solutions are used, storage will be defined through validation.

7.3.3.4: Testing

In addition to the mandatory and other tests required for blood donations described in Chapter 9, and leucocyte counting (see sections 6.3 and 7.1.1), a minimum of 75% of those components tested for the parameters shown in Table 7.3.3 shall meet the specified values. Provided the component is prepared from a process that is validated for leucocyte removal, testing of washed red cells for residual leucocytes is not required.

Table 7.3.3 Red Cells, Washed, Leucocyte Depleted – additional tests

Parameter	Frequency of test	Specification
Volume ¹	100% unless the process capability by SPC demonstrates otherwise	Within locally specified volume range
Haemoglobin content ²		≥ 40 g/unit
Haematocrit ³		0.50 – 0.70
Residual protein ⁴		≤ 0.5 g/unit
Leucocyte count ⁵ (pre-wash)	As per sections 6.3 and 7.1.1	$< 1 \times 10^6$ /unit
¹ Units measured and found to be < 210 mL or > 375 mL should only be issued for transfusion under concessionary		

release
² Units measured and found to have <30 g/unit should only be issued for transfusion under concessionary release
³ Units measured and found to have haematocrit <0.40 or >0.70 should only be issued for transfusion under concessionary release
⁴ Units measured and found to have >0.5 g/unit should only be issued for transfusion under concessionary release
⁵ Methods validated for counting low numbers of leucocytes must be used

7.3.3.5: Transportation

For general guidelines, see section 6.11.

For red cell components, transit containers, packing materials and procedures should have been validated to ensure the component surface temperature can be maintained between 2°C and 10°C during transportation. Additionally:

- the validation exercise should be repeated periodically
- if melting ice is used, it should not come into direct contact with the components
- dead air space in packaging containers should be minimised
- as far as is practicable, transit containers should be equilibrated to their storage temperature prior to filling with components
- transport time normally should not exceed 12 hours.

In some instances, it is necessary to issue red cell components that have not been cooled to their storage temperature prior to placing in the transit container. The transport temperature specified above is not applicable for such consignments.

7.3.4: Red Cells, Thawed and Washed, Leucocyte Depleted

A red cell component that contains less than 1×10^6 leucocytes, frozen in the presence of a cryoprotectant (preferably within 5 days of collection), and washed before use. Red Cells, Thawed and Washed, Leucocyte Depleted may then be suspended in an approved additive solution.

7.3.4.1: Technical information

- The concentration and nature of the cryoprotectant must provide appropriate protection of the red cells at the intended storage temperature. The entire process of freezing, thawing and washing must be validated and documented.
- The use of validated washing procedures that incorporate chilled saline or other validated solution for suspension is recommended. This will minimise the risk of bacterial contamination and helps to

produce a component that meets the transit temperature requirements. Use of an automated, closed washing system would be preferable.

- The target minimum haemoglobin content is 36 g.
- If the washing process results in the transfer of the final component into a pack that was not part of the original pack assembly, a secure system must be in place to ensure the correct donation identification number is put on the pack in which the component is frozen and the pack in which the final component is presented.
- Red Cells, Thawed and Washed, Leucocyte Depleted should be administered through a CE/UKCA /UKNI marked transfusion set.

7.3.4.2: Labelling

For general guidelines, see section 6.6.

The following shall be included on the label:

(* = in eye-readable and UKBTS approved barcode format)

- Red Cells, Thawed and Washed, Leucocyte Depleted* and volume
- the blood component producer's name*
- the donation number*
- the ABO group*
- the RhD group stated as positive or negative*
- the name, composition and volume of the suspending solution
- the date and time of preparation
- the expiry date and time*
- the temperature of storage
- the blood pack lot number.*

In addition, the following statements should be made:

INSTRUCTION

Always check patient/component compatibility/identity

Where possible administer by gravity only

Inspect pack and contents for signs of deterioration or damage

Risk of adverse reaction/infection, including vCJD

7.3.4.3: Storage

For general guidelines, see section 6.7.

- Maintenance of a constant storage temperature is important, particularly if a low-glycerol cryoprotectant system is used. Storage should be controlled to ensure the temperature is:
 - -60°C to -80°C if stored in an electrical freezer, when a high-glycerol method is used
 - -140°C to -150°C if stored in vapour phase liquid nitrogen, when a low-glycerol method is used.
- Storage may be extended to 30 years if the correct storage temperature is guaranteed.
- The thawed component should be used as soon as possible if produced in an open system. Where the component has been produced in a closed system and storage is required the component should

be stored at a core temperature of $4 \pm 2^{\circ}\text{C}$ and used within 24 hours of production if suspended in saline or a defined validated period if suspended in an approved additive solution.

7.3.4.4: Testing

In addition to the mandatory and other tests required for blood donations described in Chapter 9, and leucocyte counting (see sections 6.3 and 7.1.1), a minimum of 75% of those components tested for the parameters shown in Table 7.3.4 shall meet the specified values. Provided the component is prepared from a process that is validated for leucocyte removal, testing of washed red cells for residual leucocytes is not required.

Table 7.3.4 Red Cells, Thawed and Washed, Leucocyte Depleted – additional tests

Parameter	Frequency of test	Specification
Volume	All	Within locally defined nominal volume range
Supernatant haemoglobin ¹	1% or as determined by statistical process control (if ≤ 10 components produced per month then test every available component)	<0.2 g/unit
Red cell haemoglobin		≥ 36 g/unit
Leucocyte count ²	As per sections 6.3 and 7.1.1	$< 1 \times 10^6$ /unit
¹ Testing to be carried out prior to issue on all units as a product release criterion. Units measured and found to have ≥ 0.5 g/unit should not be issued for transfusion except under clinical concession on a named patient basis. This may apply to some units of rare red cell phenotype associated with a known red cell membrane defect causing increased fragility (such as Rh_{null} and K_o).		
² Methods validated for counting low numbers of leucocytes must be used. Pre-freeze testing.		

7.3.4.5: Transportation

For general guidelines, see section 6.11.

- The transport requirements for red cells in the frozen state will be influenced by the nature and concentration of cryoprotectant used: e.g. a component containing <20% glycerol requires a refrigerant colder than dry ice, such as the vapour phase of liquid nitrogen.
- For thawed red cell components, transit containers, packing materials and procedures should have been validated to ensure the component surface temperature can be maintained between 2°C and 10°C during transportation. Additionally:
 - the validation exercise should be repeated periodically
 - if melting ice is used, it should not come into direct contact with the components
 - dead air space in packaging containers should be minimised
 - as far as is practicable, transit containers should be equilibrated to their storage temperature prior to filling with components
 - transport time normally should not exceed 12 hours.

In some instances, it is necessary to issue red cell components that have not been cooled to their storage temperature prior to placing in the transit container. The transport temperature specified above is not applicable for such consignments.