



Molecular biology reagents

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µMACS™ VitalVirus HIV Isolation Kit

MultiMACS™ VitalVirus HIV Isolation Kit

User manual

Order no.

For 20 HIV isolations	130-092-805
For 96 HIV isolations	130-092-806
For 384 HIV isolations	130-092-807

Unless otherwise specifically indicated, all Miltenyi Biotec products and services are for research use only and not for diagnostic or therapeutic use.

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The cover photo shows a replica of the DNA model built in 1953 by James D. Watson and Francis Crick at the Cavendish Laboratory in Cambridge. This model is located at Heureka, the Finnish Science Centre. Photography by Alexander Budde. © Miltenyi Biotec GmbH, Germany. Detailed information on the history of the Watson-Crick model can be found in: de Chadarevian, S. (2003) Relics, replicas and commemorations. Endeavour 27: 75-79.

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1. Description

1.1 Components and size

µMACS™ VitalVirus HIV Isolation Kit	Order no. 130-092-805
Components	HIV Isolation Reagents, 1 box containing: CD44 MicroBeads, 1 mL Equilibration Buffer for protein applications, 4 mL Virus Wash Buffer, 30 mL Virus Lysis Buffer, 6 mL
Size	20 µ Columns, 1 box 20 isolations
µMACS VitalVirus HIV Isolation Starting Kit	Order no. 130-092-833
Components	1 µMACS VitalVirus HIV Isolation Kit 1 µMACS Separator 1 MultiStand
Size	20 isolations
MultiMACS™ VitalVirus HIV Isolation Kit (12×8)	Order no. 130-092-806
Components	HIV Isolation Reagents, 5 boxes, each containing: CD44 MicroBeads, 1 mL Equilibration Buffer for protein applications, 4 mL Virus Wash Buffer, 30 mL Virus Lysis Buffer, 6 mL Multi-8 Columns, 1 box containing: 12 Multi-8 Columns, separately packaged 1 MultiColumn Frame



1 Deep Well Block, with adhesive sealing foil, 96x2.5 mL
1 Microtiter Plate, U-bottom, with adhesive sealing foil

Size 96 isolations

MultiMACS VitalVirus HIV Isolation Kit (4x96)

Order no. 130-092-807

Components HIV Isolation Reagents, 20 boxes, each containing:
CD44 MicroBeads, 1 mL
Equilibration Buffer for protein applications, 4 mL
Virus Wash Buffer, 30 mL
Virus Lysis Buffer, 6 mL
Multi-96 Columns, 1 box containing:
4 Multi-96 Columns, packaged sterile in a Deep Well Block, 96x2.5 mL
4 Microtiter Plates, U-bottom, with adhesive sealing foil

Size 384 isolations

Product format

CD44 MicroBeads are supplied in a solution containing 0.05% sodium azide.

Storage

Store reagent boxes protected from light at 2–8 °C. Do not freeze. The expiration dates are indicated on the vial labels. Store Columns, Deep Well Blocks, and Microtiter Plates at room temperature, dry and protected from light.

Important note

μ Columns and Multi-8/96 Columns cannot be used for cell separation.

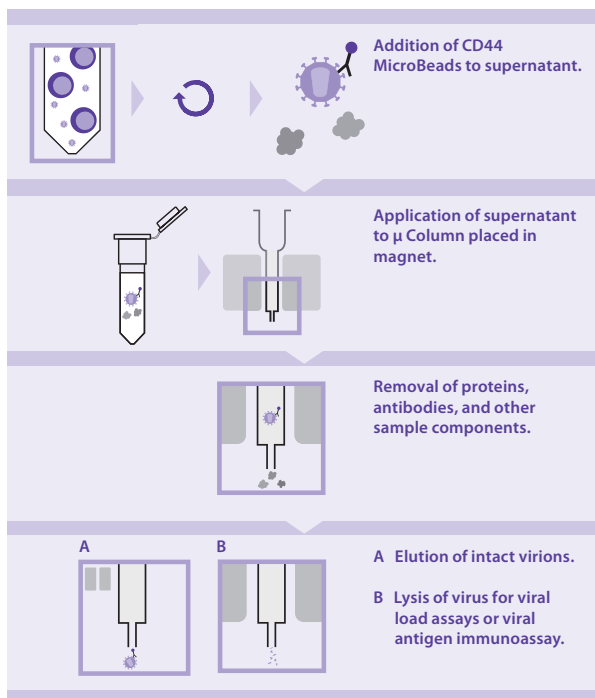
1.2 HIV isolation using host cell proteins

The envelope of human immunodeficiency virus 1 (HIV-1) contains not only virus-encoded proteins, but also host cell proteins.^{1,2} These host cell proteins are incorporated either actively or passively when the virus buds from the cell membrane. Many of the cellular proteins present in the HIV envelope retain their biological function, suggesting that they could play a role in viral pathogenesis.¹ In addition, the presence of certain host cell type-specific antigens in the viral envelope serve as markers of the cellular origin of the virus particle.³

The VitalVirus HIV Isolation Kits use the presence of these host proteins in the virus envelope for the rapid and efficient magnetic isolation of infectious HIV-1 virions from culture-derived HIV-1, human plasma or serum, and other bodily fluids, e.g. cerebral spinal fluid, breast milk, cervical lavage. By attaching the MicroBeads to the host cell proteins in the virion membrane, the HIV-1 envelope protein, gp120, is still available for binding to its cellular receptors and the virion remains fully infectious.

It has been determined that CD44 is the most effective host cell marker for labeling and capture of HIV-1 from patient samples and culture-derived virus, independent of the origin of the virus (lymphoid or myeloid cells).⁴ Accordingly, the MicroBeads contained in the VitalVirus HIV Isolation Kits are coupled to a CD44 monoclonal antibody.

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Principle of virus isolation with MACS[®] Technology.

1.3 Isolation of HIV-1 using MACS[®] Technology

Principle of HIV isolation with μ MACS[™] VitalVirus HIV Isolation Kit and μ MACS Separator

Isolation of HIV-1 from human samples and culture-derived virus is performed by positive selection using CD44 MicroBeads. First, virions are magnetically labeled with the CD44 MicroBeads during a short incubation period, see overview on the left. The magnetically labeled virions are then enriched within a μ Column in the magnetic field of a μ MACS[™] Separator. Four isolations can be performed in parallel.

After removing proteins, antibodies, and other (inhibitory) sample components, there are two elution options: Either (A) the intact virions can be collected by removing the μ Column from the magnet and eluting infectious virus particles with medium, or (B) the virions can be lysed directly in the column within the magnetic field and the lysates analysed for p24 antigen or viral RNA content.

Principle of HIV isolation with MultiMACS[™] VitalVirus HIV Isolation Kits and MultiMACS Separator Unit (MultiMACS Separator)

The principle of magnetic immunoprecipitation using MultiColumns and the MultiMACS[™] Separator is identical to the μ MACS Principle described above. However, in contrast to μ MACS[™] Separation, the MultiMACS[™] System allows the semi- and fully automated separation of up to 96 samples in parallel.

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1.4 Product applications

- Enrichment and detection of HIV-1 for viral load analysis and quantification of HIV-1 from normal, dilute, and/or difficult samples, e.g. cerebral spinal fluid, cervical lavage, breast milk. The VitalVirus HIV Isolation Kits can be used in conjunction with commercially available kits for viral load analysis.
- Enrichment of live and infectious HIV-1 for downstream studies, including neutralization studies, and the development of primary isolates.
- Enrichment of infectious HIV-1 in the presence of neutralizing antibodies or other uncharacterized HIV serum inhibitors.
- Enrichment of infectious HIV-1 for drug resistance phenotyping.

1.5 Reagent and instrument requirements**1.5.1 Equipment required for up to 4 isolations in parallel**

- μ MACS™ Separator (# 130-042-602)
- MACS® MultiStand (# 130-042-303)

1.5.2. Equipment and disposables required for 8–96 isolations in parallel

- MultiMACS™ 96 Separation Unit (# 130-091-937)
- (Optional) MultiColumn Elution Rack, please contact Technical Support

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For manual use

- 8-channel pipette with tips, e.g. 8-Channel Impact® Pipettor from Matrix Technologies, Corporation:
 - i) Volume range 15–1250 μ L with 1250 μ L TallTip (102 mm) Filter Tips for transferring lysate and dispensing wash buffers quickly without foaming
 - ii) Volume range 5–250 μ L for dispensing hot elution buffer in a single pipetting mode
- Disposable reagent reservoirs for multichannel pipettes for Equilibration Buffer, Virus Wash Buffer, Virus Lysis Buffer or elution solutions

For automated use

- Liquid handling platform with 4 to 8 pipetting channels, range 20–1000 μ L, and a gripper tool to grip plates sideways
- MultiMACS™ Adapter and software tool mumcli.exe, available for download from www.miltenyibiotec.com | MACSmolecular | MACS Separators and columns
- Reservoir holder and reagent reservoirs for CD44 MicroBeads, Equilibration Buffer, Virus Wash Buffer, Virus Lysis Buffer, or elution solutions

For culture of isolated virions

- Sterile disposables, e.g. sterile deep well block and elution plate



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1.5.3 Reagent requirements

- Fetal bovine serum (FBS) or bovine serum albumin (BSA) for supplementation of Virus Wash Buffer
- (Optional) Syringe plunger (5 mL) for elution of intact virions
- (Optional) Lysis buffer from commercial viral load assay kit, e.g. NucliSens EasyQ viral load assay, bioMerieux, Inc., for in-column viral lysis and subsequent quantification

1.6 Related products

- Multi-8 Columns (# 130-092-444)
- Multi-96 Columns (# 130-092-445)
- Deep Well Block (DWB, 2.5 mL, with sealing foil, # 130-092-549)
- MACS® products for cell separation: www.miltenyibiotec.com
- MACSmolecular products and services for molecular analyses: www.miltenyibiotec.com | MACSmolecular

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2. Sample preparation and magnetic labeling

Up to 1 mL virus-containing sample such as plasma, serum, cerebral spinal fluid, breast milk, culture supernatant, etc., can be processed per isolation.

If fresh, non-frozen samples are used, virus isolation should be started as soon as possible after sample collection to minimize HIV-1 degradation.

1. For virus samples in saline solutions, e.g. vaginal lavage samples: Add non-specific blocking reagent, i.e. 0.5% BSA or 2% FBS end concentration.
2. Briefly centrifuge sample, except breast milk samples, at 13,000 \times g for 30 seconds to remove particulate matter. Transfer supernatant to a fresh tube, avoiding floating fragments.
 - ▲ **Note:** Do not centrifuge breast milk samples as milk will separate.
3. For samples less than 200 μ L: Adjust total volume to 200 μ L with Virus Wash Buffer containing 0.5% BSA or 2% FBS.
4. Add 50 μ L of anti-CD44 MicroBeads per 200 μ L virus-containing sample, i.e. plasma, serum, or culture supernatant, and incubate for 30 minutes at room temperature. Maximum sample volume is 1 mL.
5. Proceed to chapter 3 for separation using μ Columns with the μ MACS™ Separator or to chapter 4 for separation using Multi-8/96 Columns with the MultiMACS™ Separator.



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3. Magnetic HIV separation using μ Columns and the μ MACS™ Separator

3.1 Magnetic separation

1. Place a μ Column in the magnetic field of the μ MACS™ Separator that is mounted on the MACS® MultiStand.
2. Prepare the column by applying 100 μ L of Equilibration Buffer for protein applications on top of the column.
3. Rinse columns with 3 \times 100 μ L of Virus Wash Buffer containing 0.5% BSA (or 2% FBS). Only add new buffer when the column reservoir is empty.
4. Add the magnetically labeled sample from section 2.1, step 4, to the column.
5. Wash the μ Column with 4 \times 200 μ L of Virus Wash Buffer containing 0.5% BSA (or 2% FBS).
6. For elution of infectious HIV, proceed to section 3.2; for elution of HIV virus lysate proceed to section 3.3 or 3.4.

3.2 Elution of intact virions

Perform elution of virus with column outside of magnetic separator to obtain viable and infectious virus for downstream studies. HIV virions remain infectious even with MicroBeads attached.

1. Remove the column from the magnetic separator and place column over a tube, e.g. a 1.5 mL tube, or a culture plate. Add 200–500 μ L of

cell culture medium (or PBS or other physiological buffer) and collect the eluate containing magnetically labeled virions.

▲ **Note:** (Optional) To increase elution efficiency, add media/buffer and apply syringe plunger (5 mL) with pressure.

3.3 Elution of viral lysates for viral antigen immunoassay

1. Add 100 μ L of Virus Lysis Buffer to the column. Incubate the column at room temperature for 5 minutes.

▲ **Note:** The Viral Lysis Buffer contains 0.5% Igepal-630, which will fully lyse and inactivate HIV for the downstream immunoassay.
2. Add an additional 150 μ L of Virus Lysis Buffer and collect all drops.
3. Proceed to immunoassay.

3.4 Elution of viral lysates for viral load determination

1. Add 50 μ L of lysis buffer, typically supplied in viral load assay kit, to the column. Collect flow-through. Incubate the column at room temperature for 5 minutes.
2. Add an additional 150 μ L of lysis buffer and collect all drops.
3. Combine the eluates (total volume 200 μ L) and add 700 μ L of lysis buffer. Proceed to viral load determination assay.

▲ **Note:** The NucleoSens EasyQ viral load assay requires 900 μ L final volume and supplies 900 μ L aliquots of buffer.

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4. Magnetic HIV separation using Multi-8/96 Columns and the MultiMACS™ Separation Unit

▲ **Caution:** Read the MultiMACS™ Separator user manual carefully before running a process. Read the section Warnings and precautions before switching on the instrument. Always be sure that the MultiMACS 96 Magnet, the MultiMACS Column Holder, and the plates are in the same orientation, see MultiMACS Separator user manual for details.

MultiMACS Separator programs

The MultiMACS Separator comes with a list of pre-defined separation programs to choose from, please visit www.miltenyibiotec.com for updates. For MultiMACS VitalVirus HIV Isolation Kits, the pre-defined programs below are recommended.

MULTI-8/96 POS

This program is for lysis of HIV and elution of the viral lysate. At the end of this process, elution is performed in the magnet and viral proteins or nucleic acids are eluted while the MicroBeads remain in the MultiColumn. MULTI-8/96 POS should be used for:

- Viral antigen immunoassays; after section 4.1, Magnetic separation, proceed to section 4.3, Elution of viral lysates for viral antigen immunoassay.
- Viral load determination; after section 4.1, Magnetic separation, proceed to section 4.4, Elution of viral lysates for viral load determination.

MULTI-8/96 POS+BEAD

This program is used for the collection of intact virions. The elution is carried out outside the MultiMACS™ Separator so that the eluate contains infectious virions with MicroBeads attached. After section 4.1, Magnetic separation, proceed to section 4.2, Elution of intact virions.

New programs

To run a program with different process parameters, a new program can be created or the parameters of an existing one can be edited. Please see details in the corresponding sections of the MultiMACS Separator user manual.

4.1 Magnetic separation

Before starting

Place the MultiMACS Separation Unit (MultiMACS Separator) in a biological safety hood and disinfect surface.

▲ **Note:** If using disposables not included in the kit, e.g. sterile microtiterplates, with other than standard height dimensions, use plates that comply to the ANSI/SBS standards and adjust the process parameter Plate Height, see MultiMACS Separator user manual.

1. Switch on the device and touch the Welcome Screen or wait for a few seconds until the Process Selection Screen appears.

```
WELCOME TO THE
MULTIMACS SEPARATOR
BY MILTENYI BIOTEC
```

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MULTI-8/96 POS	NEW	▲
MULTI-8/96 NEG/POS	SET UP	▼

▲ **Note:** The scroll function is only visible if there are more programs than displayed.

- The last process performed on the MultiMACS™ is displayed on the upper left segment, default: MULTI-8/96 POS. The second last process is listed below.

If necessary, scroll through the list of available process names by touching the symbol ▲, or ▼ until MULTI-8/96 POS or MULTI-8/96 POS+BEAD is displayed.

- Elution of intact virions: MULTI-8/96 POS+BEAD.
- Elution of viral lysates for viral antigen immunoassay: MULTI-8/96 POS.
- Elution of viral lysates for viral load determination: MULTI-8/96 POS.

Touch the relevant program to go to the Process Management Screen.

MULTI-8/96 POS	←	→
VIEW EDIT	ESC	▶

- If necessary, check the process parameters, see MultiMACS Separator user manual.

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Touch ▶ to start the process and to move the magnet to the start position. Follow the instructions given on the Touch Display.

INSERT MULTI-8/96 COLUMNS	MOVE BACK	OK
	ESC	

- For purification of less than 96 samples**

Unpack the necessary number of individual, sterile-packed Multi-8 Columns and put them in the MultiColumn Frame. Avoid touching the column tips.

For purification of 96 samples

Unpack Multi-96 Columns. Avoid touching the column tips.

- Insert a MultiColumn Frame with up to 12 Multi-8 Columns or a pre-packed Multi-96 Column into the MultiMACS Column Holder. Touch OK to move the magnet upwards and for the next screen.

INSERT WASTE PLATE: DWB (44 MM)	MOVE BACK	OK
	ESC	

- Place the waste plate, e.g. Deep Well Block, onto the Tip-Touch Plate. If using a plate with a different height, adjust the process parameter Plate Height of the waste plate, see MultiMACS™ Separator user manual for details.

▲ **Note:** Use a clean Deep Well Block for each isolation procedure. Further Deep Well Blocks, 96x2.5 mL, are available separately (# 130-092-549).

Touch OK to move the MultiMACS 96 Magnet downwards. The column tips now slightly immerse in the waste plate. The following screen appears.

RINSE, APPLY SAMPLE, WASH. IF REQUIRED: PRE-ELUTE	MOVE BACK	OK
	ESC	

- Rinse columns with 100 µL of Equilibration Buffer for protein applications and let buffer run through.

▲ **Note:** Columns are "flow stop" and do not run dry.

- Rinse the columns with 3x100 µL of Virus Wash Buffer containing 0.5% BSA (or 2% FBS). Let the buffer pass through the columns. Only add new buffer when the column reservoir is empty.
- Add the magnetically labeled sample (from section 2, step 4, Sample preparation and magnetic labeling) to the column and let the liquid pass through.
- Wash the µ Column with 4x200 µL of Virus Wash Buffer containing 0.5% BSA (or 2% FBS). Let the buffer pass through the columns.

- Touch OK for the next screen.

TIP-TOUCH COLUMNS IN PLATE	←	OK
	ESC	

- Move the Tip-Touch Plate firmly back and forth once so that the inner walls of the wells of the Deep Well Block touch the tips of the Multi-8 Columns. This process removes any drops on the column tips that did not fall off by gravity.
- Proceed with section 4.2 for Elution of intact virions, section 4.3 for Elution of viral lysates for virus antigen immunoassay, or section 4.4 for Preparation of HIV virus lysates for virus load determination.

4.2 Elution of intact virions

- Touch OK to move the MultiMACS™ 96 Magnet upwards.

REMOVE WASTE PLATE	MOVE BACK	OK
	ESC	

- Remove the Deep Well Block. The block and flow-through should be autoclaved to destroy infectious virus.

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- Touch **OK** to move the MultiMACS™ 96 Magnet away from the Column Holder. The following screen appears.

REMOVE COLUMNS FOR EXTERNAL ELUTION TOUCH OK TO END	MOVE BACK ESC	OK
---	---------------------	----

- Touch **OK** to end MultiMACS process. Place MultiColumn Elution Rack onto a microtiter plate compatible with the chosen downstream application, e.g. virus titration or direct infection of cells. Remove Column Frame with Multi-8/96 Columns and place this in the MultiColumn Elution Rack so that the column tips are slightly immersed in the elution plate.
- Add 200–500 µL of cell culture medium (or PBS or other physiological buffer) and collect the eluate containing magnetically labeled virions.
- Remove Multi-8/96 Columns. If less than 12 Multi-8 Columns were used, remove the used Multi-8 Columns from the Multi-8 Column Frame. Autoclave Multi-8/96 Columns to destroy infectious virus. Disinfect and store the Multi-8 Column Frame.

4.3 Elution of viral lysates for virus antigen immunoassay

- Touch **OK** to move the MultiMACS™ 96 Magnet upwards.

INSERT ELUTION PLATE: MTP (14 MM)	MOVE BACK ESC	OK
---	---------------------	----

- Remove Deep Well Block. The block and flow-through should be autoclaved to destroy infectious virus. Insert the elution plate (Microtiter Plate). If using a plate with a different height, e.g. for elution volumes > 200 µL, adjust the process parameter Plate Height of the elution plate; see MultiMACS Separator user manual for details.
- Touch **OK** and the MultiMACS 96 Magnet will move downwards until column tips slightly immerse in the elution plate. The next screen appears.

APPLY ELUTION BUFFER	MOVE BACK ESC	OK
----------------------------	---------------------	----

- Add 100 µL of Virus Lysis Buffer to the Multi-8 Column. Incubate the column at room temperature for 5 minutes.

▲ Note: The Viral Lysis Buffer contains 0.5% Igepal-630 which will fully lyse and inactivate HIV for the downstream immunoassay.

- Add an additional 150 µL of Virus Lysis Buffer and wait for approximately 2 minutes until the buffer has passed through.
- Touch **OK** for the next screen.

TIP-TOUCH COLUMNS IN PLATE	← ESC	OK
----------------------------------	----------	----

- Move the Tip-Touch Plate firmly back and forth once so that the inner walls of the wells of the elution plate touch the tips of the Multi-8 Columns. This process removes any drops on the column tips that did not fall off by gravity.
- Touch **OK** to move the MultiMACS™ 96 Magnet upwards.

REMOVE ELUTION PLATE	MOVE BACK ESC	OK
-------------------------	---------------------	----

- Remove elution plate and use samples for viral antigen immunoassay. Alternatively, seal the plate with adhesive foil and store it at –20 °C or –70 °C.

- Touch **OK** to move the MultiMACS™ 96 Magnet away from the Column Holder.

REMOVE COLUMNS, TOUCH OK TO END PROCESS	MOVE BACK ESC	OK
--	---------------------	----

- Remove Multi-8/96 Columns. If less than 12 Multi-8 Columns were used, remove the used Multi-8 Columns from the Multi-8 Column Frame. Autoclave Multi-8/96 Columns. Disinfect and store the Multi-8 Column Frame. Touch **OK** to finish the process.

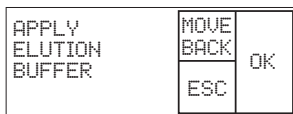
4.4 Elution of viral lysates for virus load determination

- Touch **OK** to move the MultiMACS 96 Magnet upwards.

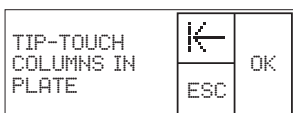
INSERT ELUTION PLATE: MTP (14 MM)	MOVE BACK ESC	OK
---	---------------------	----

- Remove Deep Well Block. The block and flow-through should be autoclaved to destroy infectious virus. Insert the elution plate (Microtiter Plate). If using a plate with a different height, e.g. for elution volumes > 200 µL, adjust the process parameter Plate Height of the elution plate, see MultiMACS Separator user manual.

3. Touch **OK** and the MultiMACS™ 96 Magnet will move downwards until column tips slightly immerse in the elution plate. The next screen appears.

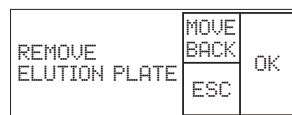


4. Add 50 µL of lysis buffer (typically supplied in virus load assay kit) to the Multi-8 Column. Collect flow-through. Incubate the column at room temperature for 5 minutes.
5. Add an additional 150 µL of lysis buffer and wait for approximately 2 minutes until the buffer has passed through.
6. Touch **OK** and the next screen appears.



7. Move the Tip-Touch Plate firmly back and forth once so that the inner walls of the wells of the elution plate touch the tips of the Multi-8 Columns. This process removes any drops on the column tips that did not fall off by gravity.

8. Touch **OK** to move the MultiMACS™ 96 Magnet upwards.



9. Remove elution plate. Combine the eluates (total volume 200 µL) and add 700 µL of Virus Lysis Buffer. Proceed to virus load determination assay. Alternatively, seal the plate with adhesive foil and store it at -20 °C or -70 °C.

▲ Note: The NucleoSens EasyQ virus load assay requires 900 µL final volume and supplies 900 µL aliquots of buffer.

10. Remove Multi-8/96 Columns. If less than 12 Multi-8 Columns were used, remove the used Multi-8 Columns from the Multi-8 Column Frame. Autoclave Multi-8/96 Columns to destroy infectious virus. Disinfect and store the Multi-8 Column Frame. Touch **OK** to finish the process.

5. Troubleshooting

Slow column flow

▲ Cell debris remaining in the viral supernatant or biological sample can clog the column. This should be efficiently removed by high-speed centrifugation (>10,000×g) before addition of the CD44 MicroBeads.

▲ Air bubble formation within the column can impair column flow. To prevent air bubble formation, use room-temperature buffers for the wash steps or, where possible, degas the buffers before use.

No recovery of infectious virus

▲ Columns are still magnetized. The µ Columns and Multi-8 Columns must be removed from the µMACS™ or MultiMACS™ Magnet to enable a successful elution of intact virions bound to CD44 MicroBeads. We recommend using the MultiColumn Elution Rack for elution of virus from Multi-8 Columns outside of the magnet. We also recommend elution to one side of the MultiMACS Separator as the magnetic field generated directly above and below the MultiMACS Magnet can lead to MicroBead retention within the Multi-8 Columns.

▲ Virus has been neutralized. Antibodies or other inhibitory molecules present in the sample have neutralized the virus particles before isolation.

▲ CD44 is not present in the HIV membrane. Check that the source of virus has been prepared in CD44 expressing cells by staining with CD44 antibody (clone DB105.2G12.1.6). Check the column flow-through for presence of infectious virus.

▲ Virus has been inactivated. Check elution buffer recipe.

No signal in viral antigen immunoassay or virus load assay

▲ CD44 is not present in the HIV membrane. Check that the source of virus has been prepared in CD44 expressing cells by staining with CD44 antibody (clone DB105.2G12.1.6). Check the column flow-through for presence of viral antigen or RNA.

▲ Virus has not been lysed. Make sure that the correct virus lysis buffer has been used.

6. References

1. Tremblay, M. J. *et al.* (1998) The acquisition of host-encoded proteins by nascent HIV-1. *Immunol. Today* 19: 346–351.
2. Ott, D. E. (1997) Cellular proteins in HIV virions. *Rev. Med. Virol.* 7: 167–180.
3. Lawn, S. D. *et al.* (2000) Cellular compartments of human immunodeficiency virus type 1 replication *in vivo*: Determination by presence of virion-associated host proteins and impact of opportunistic infection. *J. Virol.* 74: 139–145.
4. Lupo, L. D. and Butera, S. T. (2004) Application of μ MACS™ Streptavidin MicroBeads for the analysis of HIV-1 directly from patient plasma. *MACS&more* 8: 16–19.

Warning

CD44 MicroBeads contain sodium azide. Sodium azide yields hydrazoic acid under acid conditions, which is extremely toxic. Azide compounds should be diluted with running water before discarded. These precautions are recommended to avoid deposits in plumbing where explosive conditions may develop.

Warranty

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