

# EMBRYOMAP™

# SAMPLE PREP GUIDE

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## Revision history

| Version | Date        | Description of Change                                                                                                                                                                                                                                                                                            |
|---------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.0     | 30-Nov-2021 | Initial release.                                                                                                                                                                                                                                                                                                 |
| 1.1     | 30-Oct-2023 | <ul style="list-style-type: none"><li>• MiSeq FlowCell storage temperature on page 28 corrected.</li><li>• Storage duration of the Template preparation end products (page 15), EmbryoMap Libraries (page 22 and 23) and EmbryoMap Library Pool (page24) have been updated to one year from one month.</li></ul> |
| 1.2     | 26-Jan-2026 | <ul style="list-style-type: none"><li>• New section for library dilution and sequencing for MiSeq i100 Series Systems (page 27 and 28).</li><li>• Additional recommendations for thermal cycler ramp rates included (page 31).</li><li>• Minor language and formatting updates.</li></ul>                        |

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# 1 INTRODUCTION

The EmbryoMap Sample Prep system simultaneously amplifies DNA from multi-cell samples (e.g. trophectoderm biopsy) and prepares sequencing-ready libraries for Illumina platforms. The rapid sample preparation workflow can be completed within a four-and-a-half-hour period.

This protocol explains how to:

- Prepare up to 96 unique dual index libraries from multi-cell embryo biopsies.
- Prepare multiplexed library pools of up to 48 samples for cluster generation and paired-end sequencing on the Illumina MiSeq® System and Illumina MiSeq® i100 System.
- Prepare multiplexed library pools of up to 96 samples for cluster generation and paired-end sequencing on the Illumina MiSeq® i100 Plus System.
- A single EmbryoMap Sample Prep kit contains sufficient reagents for preparing 96 sequencing-ready libraries.

The EmbryoMap Sample Prep protocol offers:

- Rapid and easy whole genome amplification and library preparation in a single workflow.
- Low DNA input from 3-10 cells.
- Ready-to-use master-mixed reagents to reduce reagent containers, pipetting, and hands-on time.
- Safe stopping points, and sample retention points for repeat testing.

## Embryo Biopsy Collection, Storage and Shipping Recommendations

Collect biopsy samples into 0.2 mL, thin-walled PCR tubes. Biopsy samples should be suspended in a total volume of 2.5 µL of molecular grade 1× PBS (Phosphate Buffered Saline) and, if used, a maximum concentration of 0.5% PVP (Polyvinylpyrrolidone). Validate before using any alternative sample collection volume, wash, and collection buffers.

Validate sample storage and shipment conditions before use, particularly if different from the following recommendations. These factors may impact the quality and integrity of the samples. For best results, store embryo biopsies at -65°C to -85°C and keep frozen during shipping. Perform the DNA Extraction and Template Preparation steps within 14 days of sample collection.

# Workflow Recommendations

## Protocol Compliance

- Always use the latest version of the EmbryoMap Sample Prep guide, found on the Vitrolife website.
- Avoid contamination of samples and reagents during sample preparation. Contamination of reagents will compromise your test results.
- Incubation times, incubation temperatures, and pipetting volumes that differ from the specifications in this protocol will lead to suboptimal end products and compromise your test results.
- Adhere to all centrifuge and mixing steps in the protocol. Deviation from the recommended steps will lead to suboptimal end products and will compromise your test result.
- Follow the recommendations regarding ramp rates detailed in the equipment section.

## Warnings and Precautions

- Always use Personal Protective Equipment (PPE) during the laboratory steps.
- This kit is intended for use by qualified laboratory staff only. All laboratories are expected to follow Good Laboratory Practices (GLP) and have appropriate safety control measures in place.
- Check the documentation and safety data sheets (SDS) for guidelines on handling, preparing, and disposing kit components, intermediate mixtures, or wastes.
- Shipping conditions might differ from storage conditions. Some kit components must be brought to room temperature before use.
- All components have an expiration date. Do not use kit components beyond the expiration date printed on component labels.
- The EmbryoMap Sample Prep kits are manufactured in batches, called Lots, in accordance with strict quality standards. Each component or reagent in a single lot is tested to work with other reagents in the same Lot. To ensure proper performance, avoid interchanging, mixing, or combining reagents from different kits and lots.
- Do not exceed the maximum multiplexing capacity of the sequencing instrument and kit being used for your run. Higher levels of multiplexing might affect the data quality, resulting in reduced sample performance.

## Best practices

- Conduct the DNA Extraction, Template Preparation and assembly of Library Amplification reactions in a dedicated Pre-PCR environment, physically separated from exponentially amplified genetic material.
- Use a sterile containment cabinet (vertical laminar flow cabinet) when handling embryo biopsies, during Template Preparation and Library Amplification assembly steps of the protocol. Follow applicable safety practices when handling embryo biopsies.
- Thoroughly clean the containment cabinet before starting the protocol.
- If recommended by the cabinet or consumables' manufacturer, incubate tips, tubes, and pipettes with UV irradiation in the containment cabinet before starting the protocol.
- Make sure that you have a clean set of calibrated pipettes that are suitable for Pre-PCR activities, preferably exclusively dedicated to the EmbryoMap protocols.
- Always use a heated lid on the PCR machine. Do not carry out PCR reactions under oil.

## Avoiding contamination

- Pre-PCR environmental and sampling control measures (i.e., single use of molecular grade reagents and consumables) are required to reduce the risk of sample contamination prior to input into the EmbryoMap reactions.
- Failure to follow Pre-PCR best practices during the reaction set-up may lead to contamination of the PCR products and may affect subsequent analysis and/or compromise your test results.
- Always use a fresh pipette tip for each sample transfer and for adding reagents to each sample.
- Label and use separate reservoirs for each reagent.
- Seal any pierced wells of the Library Index Plate with an adhesive PCR plate seal after use to avoid contamination of work area. Change gloves if they come in contact with indexes.

## Sealing the Plate

- Always seal 96-well plates before mixing, vortexing, centrifugation and thermal cycling steps.
- Apply the adhesive seal to cover the plate and seal by applying pressure around the edges of every well, e.g. with a rubber roller or applicator.

## Handling SPRIselect beads

- Store the SPRIselect beads at room temperature, protected from light.
- Vortex mix the SPRIselect beads thoroughly before use.
- Pipette the SPRIselect bead suspension slowly as it is highly viscous.
- Make sure no SPRIselect bead suspension remains in the pipette after dispensing the beads into the plate wells.
- While aspirating the supernatant always place the pipette tips opposite to the bead pellet.
- If beads are accidentally aspirated with supernatant, dispense the beads back into the plate well and leave on the magnetic stand until liquid is clear.
- During the ethanol washes, dispense 80% ethanol to the opposite side to the bead pellet and do not disturb the pellet.
- Always prepare fresh 80% ethanol for use in the wash steps.

## Plate transfers

- When transferring volumes between plates, transfer the specified volume from each well of a plate to the corresponding well of the other plate.
- The Library Index Plate has been designed so that each Index Name corresponds to the source plate well. For example, the unique dual index reagent in Library Index Plate well “A1” has the Index Name “UDI-A01”. To ensure sample tracking, always perform Library Amplification reactions and store final libraries in the plate well that corresponds to the index name and source well.

## Additional Resources

The following documentation is available to download from the Vitrolife website.

| Resource                      | Description                                                                                         |
|-------------------------------|-----------------------------------------------------------------------------------------------------|
| EmbryoMap eMap Software Guide | Provides detailed instructions on run planning, data analysis and reporting with the eMap software. |
| eMap_Accessioning_A           | Template for importing sample data for a single Subject.                                            |
| eMap_Accessioning_B           | Template for importing sample data for multiple Subjects.                                           |
| eMap_FastTrack                | Template for importing sample data, plate definition and index assignment for multiple Subjects.    |
| eMap_QuantData                | Template for uploading final library quantification data.                                           |
| EmbryoMap QC Guidance         | Provides guidance on acceptance criteria for the data generated through the EmbryoMap system.       |
| EmbryoMap Calling Guide       | Provides detailed instructions on data analysis with the eMap software.                             |

Please contact [support.genomics@vitrolife.com](mailto:support.genomics@vitrolife.com) for requirements and compatibility, additional documentation, software downloads, online training, frequently asked questions, and best practices.

For more information about updates to the MiSeq system guide, MiSeq Control Software (MCS), visit the MiSeq support pages on the Illumina website.

For more information about updates to the MiSeq i100 Series System guide, MiSeq i100 Series Control Software, or MiSeq i100 Series DRAGEN Software, visit the MiSeq i100 Series support pages on the Illumina website.

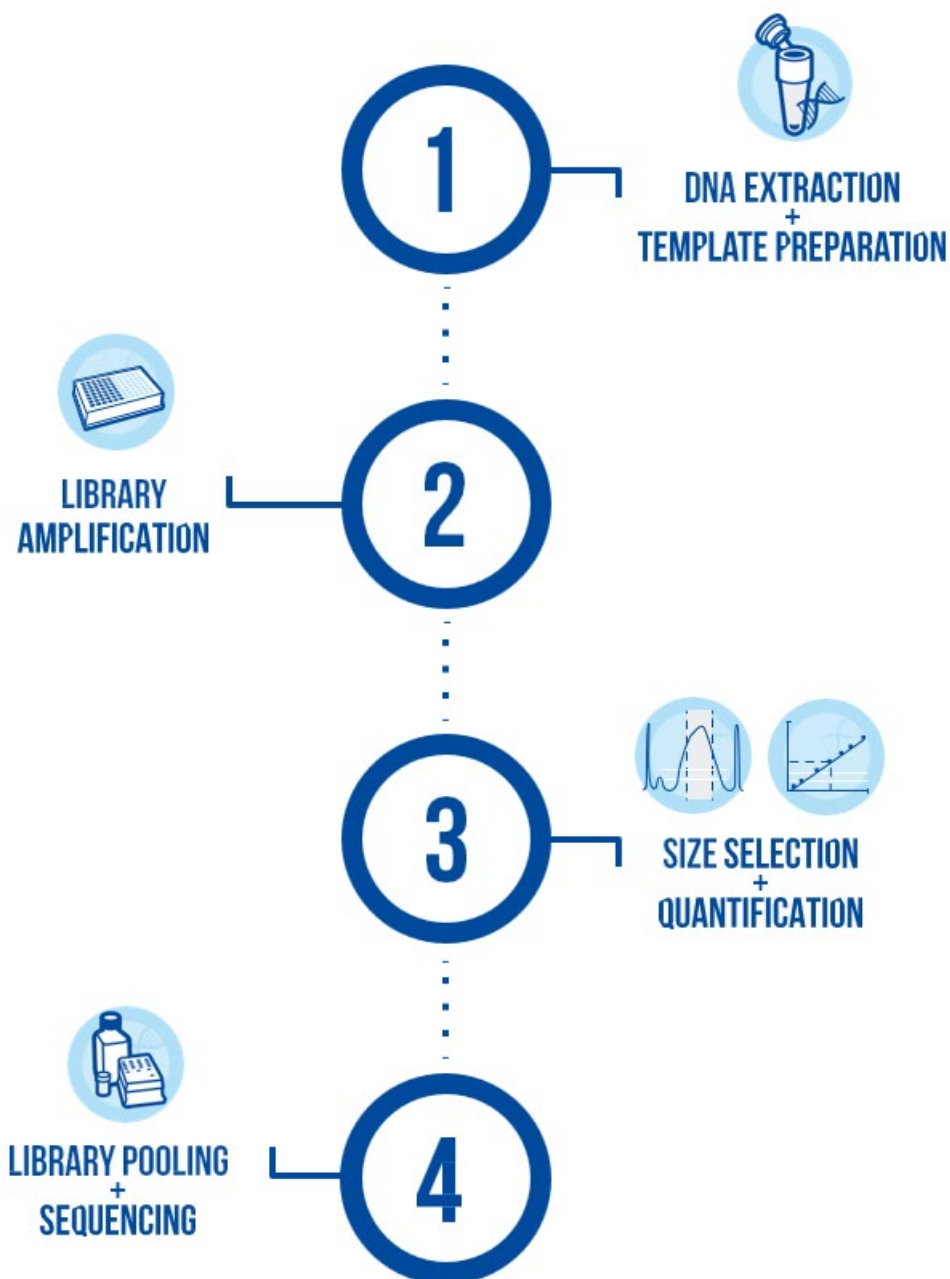
## EmbryoMap Sample Prep Kit Components

Reagents for 96 reactions

| Reagent Name          | Identifier    | Quantity | Description                       |
|-----------------------|---------------|----------|-----------------------------------|
| Extraction Mix        | Red cap       | 2        | Reagents for 48 samples per tube  |
| Amplification Mix 1   | White cap     | 2        | Reagents for 48 samples per tube  |
| Amplification Mix 2   | Blue cap      | 4        | Reagents for 24 samples per tube  |
| Elution Buffer        | Clear cap     | 4        | Reagents for 24 samples per tube  |
| Library Index Plate A | 96-well plate | 1        | Reagents for 96 samples per plate |

## EmbryoMap Sample Prep Workflow

The following diagram illustrates the EmbryoMap sample prep workflow.



**Figure 1:** EmbryoMap Sample Prep Workflow

# 2 PROTOCOL

## Tips and Techniques

- Before beginning sample preparation, generate a Laboratory Planner using the eMap Software and generate the PDF to aid sample tracking.
- The entire workflow can be comfortably completed within the working day (approx. 4.5 hours). If the protocol must be stopped, observe the safe stopping points specified in the protocol.
- Remove cold-racks from frozen storage 10 minutes before use, to prevent samples from re-freezing during use.
- While preparing the control samples, do not mix positive control dilutions containing genomic DNA by vortexing. Use pipette-mixing or by flicking the capped tube to mix the contents. Pulse centrifuge the tubes to collect contents.

## Preparation of Control Samples

### Consumables

| Item                    | Quantity |
|-------------------------|----------|
| 1× PBS                  | 1.0 mL   |
| Genomic DNA (100 ng/μL) | 5 μL     |

### Preparation

- Prepare the sterile Pre-PCR containment cabinet and associated consumables by cleaning with an appropriate DNA decontamination solution.
- If recommended by cabinet or consumables' manufacturer, incubate tips, tubes, and pipettes with UV irradiation in the containment cabinet before starting the protocol.
- Prepare a fresh aliquot of sterile 1× PBS, filtered at 0.22 μm.

## Steps

1. In the Pre-PCR cabinet, label three sterile Lo-Bind 1.5 mL microcentrifuge tubes and prepare their contents, as in **Table 1**.

**Table 1:** Preparation of control samples

| Control Tube | Description        | Volume 1× PBS | Volume of genomic DNA / stock solution |
|--------------|--------------------|---------------|----------------------------------------|
| Tube 1       | 1× PBS negative    | 100 µL        | None                                   |
| Tube 2       | 2.5 ng/µL positive | 195 µL        | 5 µL of 100 ng/µL stock                |
| Tube 3       | 25 pg/µL positive  | 495 µL        | 5 µL of Tube 2                         |

2. Add 1×PBS into each tube, adding volumes shown in **Table 1**.
3. Add 5 µL of the 100 ng/µL genomic DNA to tube 2 containing 195 µL of 1× PBS and mix.
4. Add 5 µL of the diluted 2.5 ng/µL of genomic DNA from Tube 2 into Tube 3 containing 495 µL of 1×PBS and mix.
5. In the Pre-PCR cabinet label two sterile 0.2 ml flat-capped PCR tubes as in **Table 2**.

**Table 2:** PCR Tubes for Control Samples

| PCR Tube | Description      | Contents                                     |
|----------|------------------|----------------------------------------------|
| 1        | Negative control | 2.5 µL of control tube 1 (1× PBS negative)   |
| 2        | Positive control | 2.5 µL of control tube 3 (25 pg/µL positive) |

6. Pipette 2.5 µL of the positive (25 pg/ µL) and negative (1× PBS) control samples into the PCR tubes according to the contents listed in **Table 2**.



### ATTENTION

Use a fresh tip for each tube and cap each tube immediately after transfer.

7. Store the control PCR tubes in a 96-well cold-rack until required.
8. Proceed immediately to the DNA Extraction step.

## DNA Extraction

### Consumables

| Item           | Identifier | Quantity          |
|----------------|------------|-------------------|
| Extraction Mix | Red cap    | 7.5 µL per sample |

### Preparation

- Perform these steps in a Pre-PCR work area.
- Remove the cold-rack(s) from frozen storage 10 minutes before use.
- Thaw the Extraction Mix, invert to mix and pulse centrifuge. Keep on a cold-rack until use.

### Steps

1. Centrifuge the embryo biopsy sample tubes and control sample tubes at  $200 \times g$  for 3 minutes (at 4°C if possible), then line up sample tubes in a 96-well cold-rack.
2. Add 7.5 µL of Extraction Mix to each sample tube, including controls. Dispense against the side of the tube above the sample droplet. Open one sample tube at a time.



#### ATTENTION

Do not pipette mix, flick mix or vortex the sample tubes. Use a fresh pipette tip for each sample.

**Table 3:** Components of the DNA Extraction reaction

| Item           | Cap colour | Volume (µL) |
|----------------|------------|-------------|
| Sample         | -          | 2.5         |
| Extraction Mix | Red cap    | 7.5         |
| Total          |            | 10.0        |

3. Centrifuge sample tubes at  $280 \times g$  for 20 seconds to collect all contents to the bottom of the tubes.
4. Incubate samples in a designated Pre-PCR thermal cycler as in **Table 4**, with a heated lid set at 101°C – 105°C.

**Table 4:** Thermal cycler program for DNA Extraction

| Number of cycles | Temperature of cycle | Incubation time |
|------------------|----------------------|-----------------|
| 1                | 75°C                 | 10 min          |
| 1                | 95°C                 | 4 min           |
| 1                | 4°C                  | Hold            |

5. After DNA Extraction, remove the sample tubes and centrifuge at 280×g for 20 seconds.
6. Place the sample tubes on a cold-rack and proceed immediately to the Template Preparation step.

## Template Preparation

### Consumables

| Item                | Identifier | Quantity         |
|---------------------|------------|------------------|
| Amplification Mix 1 | White cap  | 10 µL per sample |

### Preparation

- Perform these steps in a Pre-PCR work area.
- Thaw the Amplification Mix 1, invert to mix and pulse centrifuge. Keep on a cold-rack until use.

### Steps

1. Add 10 µL of Amplification Mix 1 to each sample tube including controls as in **Table 5**. Dispense against the side of the tube above the sample droplet. Open one sample tube at a time.



#### ATTENTION

Do not pipette mix, flick mix or vortex the sample tubes. Use a fresh pipette tip for each sample.

**Table 5:** Components of the Template Preparation reaction

| Item                   | Cap colour | Volume (µL) |
|------------------------|------------|-------------|
| DNA Extraction product | -          | 10          |
| Amplification Mix 1    | White      | 10          |
| Total                  |            | 20          |

2. Centrifuge sample tubes at 280 × g for 20 seconds to collect all contents to the bottom of the tubes.
3. Incubate samples in a designated Pre-PCR thermal cycler as in **Table 6**, with a heated lid set at 101°C – 105°C.

**Table 6:** Thermal cycler program for Template Preparation

| Number of cycles | Temperature of cycle | Incubation time |
|------------------|----------------------|-----------------|
| 1                | 95°C                 | 3 min           |
| 16               | 95°C                 | 15 sec          |
|                  | 15°C                 | 50 sec          |
|                  | 25°C                 | 40 sec          |
|                  | 35°C                 | 30 sec          |
|                  | 65°C                 | 40 sec          |
|                  | 75°C                 | 40 sec          |
| 1                | 4°C                  | Hold            |

4. After completion of the Template Preparation program, remove the sample tubes and centrifuge at  $280 \times g$  for 20 seconds to collect all contents to the bottom of the tubes.
5. Keep amplified Template Preparation products on a cold-rack before proceeding with the Library Amplification step.



**SAFE STOPPING POINT**

Sample tubes may be stored at -25°C to -15°C for up to one year. For long-term storage, -65°C to -85°C storage is recommended.

## Library Amplification

### Consumables

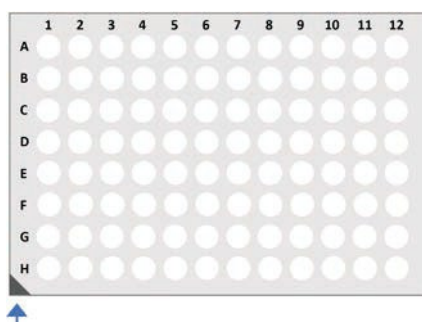
| Item                            | Identifier    | Quantity                     |
|---------------------------------|---------------|------------------------------|
| Amplification Mix 2             | Blue cap      | 40 µL per sample             |
| Library Index Plate A (96 UDIs) | 96-well plate | 5 µL unique index per sample |

### Preparation

- Assemble the Library Amplification reactions in a Pre-PCR work area. Perform the Library Amplification on a thermal cycler in a Post-PCR area.
- Use the eMap Laboratory Planner to aid sample-to-index tracking.
- Remove the cold-rack(s) from frozen storage 10 minutes before use.
- Thaw Library Index Plate A at room temperature for 10 minutes and centrifuge at  $280 \times g$  for 20 seconds.
- Gently wipe the foil seal of the Library Index Plate A with 70% (v/v) ethanol and allow to dry.
- Thaw the Amplification Mix 2, invert to mix and pulse centrifuge. Keep on a cold-rack until use.
- If Template Preparation products were stored frozen, thaw to room temperature and centrifuge at  $280 \times g$  for 20 seconds. Retain on a cold-rack until use.

### Steps

1. Label a new 0.2 mL PCR plate as "Library Amplification Plate" and the Plate ID that corresponds with the eMap Laboratory Planner, and place in a 96-well PCR cold-rack.
2. Dispense 40 µL of Amplification Mix 2 into each well of the Library Amplification Plate, according to the eMap Laboratory Planner.
3. Place the Library index plate A next to the Library Amplification Plate with the same orientation. Use the notch at the lower-left corner of the Library Index Plate A as a reference for well positions as illustrated below.



**Figure 2:** Orientation of the Library Index Plate A.

4. The Library Index Plate has a pierceable foil seal. For each sample, use a fresh pipette tip to pierce the foil seal and transfer 5  $\mu$ L of Index to the Library Amplification Plate, according to the eMap Laboratory Planner. Dispense directly into the 40  $\mu$ L of Amplification Mix 2. Do not pipette mix.
5. Add 5  $\mu$ L of Template Preparation product to the corresponding Library Amplification Plate well, according to the eMap Laboratory Planner. Dispense each sample directly into the 45  $\mu$ L of amplification mixture. Do not pipette mix.



#### ATTENTION

Follow the eMap Laboratory Planner and use additional witnessing steps to ensure accurate sample-to-index tracking.

**Table 7:** Components of Library Amplification reaction

| Item                         | Cap colour    | Volume ( $\mu$ L) |
|------------------------------|---------------|-------------------|
| Amplification Mix 2          | Blue cap      | 40                |
| Library Index                | 96-well plate | 5                 |
| Template Preparation product | -             | 5                 |
| Total                        |               | 50                |

6. Seal the Library Amplification Plate with a PCR seal and vortex mix at 1800 rpm for 1 minute.
7. Centrifuge the Library Amplification Plate at 280 x g for 20 seconds to collect contents.
8. Incubate samples in a designated Post-PCR thermal cycler as in **Table 8**, with a heated lid set at 101°C – 105°C.

**Table 8:** Thermal cycler program for Library Amplification

| Number of cycles | Temperature of cycle | Incubation time |
|------------------|----------------------|-----------------|
| 1                | 95°C                 | 3 min           |
|                  | 95°C                 | 30 sec          |
| 4                | 63°C                 | 25 sec          |
|                  | 68°C                 | 1 min           |
| 9                | 95°C                 | 30 sec          |
|                  | 68°C                 | 1 min           |
| 1                | 4°C                  | Hold            |

9. After completion of the Library Amplification program, centrifuge the Library Amplification Plate at 280 x g for 20 seconds before proceeding to Size Selection.

## Size Selection

This step uses SPRIselect Size Selection beads to purify the library DNA by solid phase reversible immobilization (SPRI). The Size Selection step optimises the library fragment size distribution and purifies libraries for sequencing. The median fragment size following Size Selection is approximately 550 bp.

### Consumables

| Item                                              | Identifier | Quantity           |
|---------------------------------------------------|------------|--------------------|
| Elution Buffer                                    | Clear cap  | 47.5 µL per sample |
| SPRIselect Beads<br>(Beckman Coulter; Cat# 23318) | -          | 45 µL per sample   |
| 80% ethanol, freshly prepared<br>(User-supplied)  | -          | 400 µL per sample  |



#### ATTENTION

Ethanol is highly flammable, keep away from all sources of ignition at all times.

### Tips and Techniques

- Resuspend the SPRIselect beads completely before beginning. This step is essential for accurate quantitation and seeding of the sequencing flow cell.
- Do not aspirate beads when removing the supernatant. Loss of beads will result in reduced DNA yield. If any beads are inadvertently aspirated into the pipette tips, dispense the beads back into the plate and incubate on the magnet stand for 2 minutes or until the liquid is clear. Resume the removal of the supernatant.
- During washing, do not incubate the beads in 80% ethanol for more than 30 seconds. Longer incubation times may result in reduced yield and suboptimal size selection that may affect sequencing performance. Adjust your sample batch size accordingly for optimal performance.
- After removing excess ethanol, do not over-dry the beads before adding Elution Buffer. Adjust the drying time as appropriate for your laboratory conditions. Over-drying may result in reduced yield and suboptimal size selection. Beads that are over-dried appear cracked.
- During elution, if the supernatant is not clear after the 2-minute incubation on the magnet stand, gently pipette mix the supernatant whilst holding the pipette tip opposite the bead pellet. This will encourage residual beads to migrate towards the magnet. The clear supernatant can then be transferred to the Final Library Plate.

## Preparation

- Make a new preparation of 80% ethanol (molecular biology grade) and maintain at room temperature.
- Thaw the Elution Buffer, invert to mix and pulse centrifuge to collect contents. Keep at room temperature.
- Vortex the SPRIselect beads thoroughly, immediately before use. Invert the tube to ensure that no bead pellet remains at the bottom of the storage container.
- For higher sample throughput, use new reagent reservoirs or troughs to facilitate multi-channel pipetting of SPRIselect beads, 80% ethanol and Elution Buffer.

## Steps

1. Label two new 0.8 mL deep-well plates as “SS1” and “SS2”, respectively. Label a new PCR plate as “Final Library Plate” and the Plate ID that corresponds with the eMap Laboratory Planner.
2. Add 25  $\mu$ L thoroughly mixed SPRIselect beads to each well of the SS1 plate, according to the eMap Laboratory Planner.
3. Transfer 45  $\mu$ L of Library Amplification product from the Library Amplification Plate to the corresponding well of the SS1 plate containing SPRIselect beads.
4. Seal the SS1 plate and shake at 1800 rpm for 1 minute.
5. Incubate the SS1 plate at room temperature for 5 minutes.
6. During the 5-minute incubation, add 20  $\mu$ L thoroughly mixed SPRIselect beads to each well of the SS2 plate, according to the eMap Laboratory Planner.
7. Pulse centrifuge the SS1 plate at  $280 \times g$  for 5 seconds to collect droplets.
8. Place the SS1 plate on a magnetic stand and wait until the liquid is clear (~2 minutes). Keep the plate on the stand during the following step.
9. Transfer 65  $\mu$ L of supernatant from each well of the SS1 plate to the corresponding well of the SS2 plate containing SPRIselect beads, then discard the SS1 plate.
10. Seal the SS2 plate and shake at 1800 rpm for 1 minute.
11. Incubate the SS2 at room temperature for 5 minutes.
12. Pulse centrifuge the SS2 plate at  $280 \times g$  for 5 seconds to collect droplets.
13. Place the SS2 plate on a magnetic stand and wait until the liquid is clear (~2 minutes).
14. With the SS2 plate on the magnetic stand, remove and discard all supernatant from each well of the SS2 plate.

15. Keeping the SS2 plate on the magnetic stand, wash two times as follows:
  - a. Add 200  $\mu$ L freshly prepared 80% ethanol to each well, opposite the aggregated beads, being careful not to disturb the pellet at the bottom of the well.
  - b. Incubate on the magnetic stand for 30 seconds. Start the timer after dispensing 80% ethanol into the first well.
  - c. Remove and discard all supernatant from each well.
16. Using fine pipette tips (10/20  $\mu$ L), remove residual 80% ethanol from each well.
17. Air-dry the SS2 plate on the magnetic stand for 3-5 minutes, or until the beads are visibly dry but not cracked.
18. Remove the SS2 plate from the magnetic stand and add 47.5  $\mu$ L of Elution Buffer to each sample well.



**ATTENTION**

Retain residual Elution Buffer for use during Library Dilution and Denaturation. Elution Buffer can be stored at room temperature.

19. Shake the SS2 plate at 1800 rpm for 1 minute.
20. Pulse centrifuge the SS2 plate at  $280 \times g$  for 5 seconds to collect droplets.
21. Place the SS2 plate on a magnetic stand and wait until the liquid is clear (~2 minutes).
22. Transfer 45  $\mu$ L of each sample supernatant to the corresponding well of the Final Library Plate according to the eMap Laboratory Planner, then proceed immediately to Library Quantification.

## Library Quantification

Accurate quantification of the DNA libraries is essential for successful sample normalisation and seeding of the sequencing instrument. Quantify the DNA libraries using a fluorometric-based method such as the Quant-iT™ or Qubit™ dsDNA, high sensitivity, assay kits. Follow the manufacturer's instructions and safety recommendations while using the quantification kits and validate for use with your specific plate reader or Qubit™ fluorometer.

### Qubit Method

The Qubit method is a single-tube workflow that is suited to lower sample throughput of 8-24 samples. This method uses a 2-point standard curve.

### Consumables

| Item                                                | Part#                                                                               |
|-----------------------------------------------------|-------------------------------------------------------------------------------------|
| Qubit™ dsDNA HS Assay Kit                           | (ThermoFisher Scientific, Cat# Q32851/Q33230).                                      |
| Qubit™ Assay Tubes or Qubit™ Flex Assay Tube Strips | (ThermoFisher Scientific; Cat# Q32856) or<br>(ThermoFisher Scientific; Cat# Q33252) |

### Preparation

- If supplied, aliquot the Qubit dsDNA HS reagent into single-use aliquots and store at 2– 8°C to prevent freeze-thaw cycles. Protect the Qubit dsDNA HS reagent from light.
- Bring all reagents to room temperature for 30 minutes before use.
- Prepare and label the required number of 0.5 mL Qubit Assay Tubes or Assay Tube Strips for the samples and both high and low standards.

### Steps

1. If not supplied as a 1× solution, prepare the Working Solution by mixing Qubit dsDNA HS reagent 1:200 with the Qubit dsDNA HS buffer.
2. Add 190 µL of the Working Solution to each Assay Tube/Strip used for the two standards.
3. Add 10 µL of standard to the respective Assay Tube/Strip.
4. Add 195 µL of the Working Solution to each Assay Tube/Strip used for the library samples.
5. Add 5 µL of sample Final Library to each respective Assay Tube/Strip and mix by vortexing for 2-3 seconds.
6. Incubate the Assay Tubes/Strips for 2 minutes at room temperature whilst protected from light.

7. Measure the fluorescence and calculate the concentration of each sample Final Library using a Qubit Fluorometer or a Qubit Flex Fluorometer as per the manufacturer's instructions.



#### ATTENTION

If the sample concentration falls outside the standard curve, adjust the ratio of sample to standard as necessary. Adjust for the dilution factor when calculating the final library concentration.



#### SAFE STOPPING POINT

Sample tubes may be stored at -25°C to -15°C for up to one year  
For long-term storage, -65°C to -85°C storage is recommended.

## Quant-iT Method

The Quant-iT method is a plate-format workflow that is suited to higher sample throughput of >24 samples. This method uses an 8-point standard curve.

## Consumables

| Item                                                              | Part#                                            |
|-------------------------------------------------------------------|--------------------------------------------------|
| Quant-iT™ dsDNA Assay Kit, high sensitivity                       | (ThermoFisher Scientific; Cat# Q33120 or Q33232) |
| 96-well Microplates, F-Bottom (Chimney Well), Black, Non-Binding. | (e.g. Greiner BioOne; Cat# 655900)               |

## Preparation

- If supplied, aliquot the Quant-iT dsDNA HS reagent into single-use aliquots and store at 2–8°C to prevent freeze-thaw cycles. Protect the Quant-iT dsDNA HS reagent from light.
- Bring all reagents to room temperature for 30 minutes before use.
- The required reagents and microplates will be number of sample libraries + 16 standard curve reactions, where the 8-point standard curve should be run in duplicate.
- For microplate readers with mixing capabilities, setup for orbital shaking at ~300 rpm for 20 seconds prior to measuring. Otherwise, ensure reagents are mixed well by pipetting.

## Steps

1. If not supplied as a 1× solution, prepare the Working Solution by mixing Quant-iT dsDNA HS reagent 1:200 with the Quant-iT dsDNA HS buffer.
2. Add 200 µL of the Working Solution to the required wells of the assay microplate.
3. Add 5 µL of each sample Final Library to the sample wells and mix well by pipetting.
4. Add 10 µL of each Quant-iT Standard to standard wells and mix well by pipetting. Measure the standards in duplicate.
5. Incubate the assay microplate for 2 minutes at room temperature whilst protected from light. The fluorescence signal is stable for 3 hours at room temperature when kept in the dark.
6. Measure the fluorescence using a microplate reader using excitation/emission fluorescein wavelengths at ~480/530 nm.
7. Calculate the concentration of the sample libraries using the standard curve as directed by the microplate reader manufacturer and/or instrument-specific software tools.



### ATTENTION

If the sample concentration falls outside the standard curve, adjust the ratio of sample to standard as necessary. Adjust for the dilution factor when calculating the final library concentration.



### SAFE STOPPING POINT

Sample tubes may be stored at -25°C to -15°C for up to one year.  
For long-term storage, -65°C to -85°C storage is recommended.

# Library Pooling

## Consumables

| Item                | Identifier | Quantity         |
|---------------------|------------|------------------|
| Final Library Plate | Plate ID   | Variable $\mu$ L |

## Preparation

- Generate a Pooling Guide using the eMap Software:
  - Select the appropriate SampleSheet for the sequencing instrument.
  - Select the appropriate Normalisation reference for the eMap analysis.
  - Enter the corresponding Final Library concentrations for the Plate ID.
  - Select 8–48 samples to be included in the pool for MiSeq or MiSeq i100 systems.
  - Select 8–96 samples to be included in the pool for MiSeq i100 Plus systems.
  - Up to two additional negative amplification controls may be included in the library pool for optional sequencing QC assessment for 48-plex runs. Negative amplification samples will not consume reads on the flow cell, but must have a unique index assignment.
  - Select a pooling mass to ensure a pooling volume of 2–20  $\mu$ L for each positive sample. This will help to minimise variation when pipetting small volumes and ensure that sufficient material remains to allow re-pooling if required.
  - Name the pool with a unique Pool ID and click Save.
- Download the Pooling Guide PDF to aid sample tracking and note the Pool Concentration (nM) and dilution instructions for preparation of the 1 nM pool.

## Steps

1. Centrifuge the Final Library Plate at  $280 \times g$  for 20 seconds.
2. Label a new 1.5 mL, low DNA-retention microcentrifuge tube as “Library Pool” with the Pool ID, date and Pool Concentration (nM), and place on ice.
3. Combine the required volume of each sample library according to the eMap Pooling Guide. Use a fresh tip for each sample library.
4. Vortex and centrifuge the stock Library Pool.
5. [Optional] Quantify the Library Pool as described previously and calculate the nM concentration for duplex DNA with an average fragment length of 550 bp. This step is advised for improved accuracy when seeding the Illumina instrument.



### SAFE STOPPING POINT

The stock Library Pool may be stored at  $-25^{\circ}\text{C}$  to  $-15^{\circ}\text{C}$  for up to one year. For long term storage,  $-65^{\circ}\text{C}$  to  $-85^{\circ}\text{C}$  storage is recommended.

# MiSeq: Library Dilution, Denaturation and Sequencing

## Consumables

| Item                               | Identifier      | Quantity        |
|------------------------------------|-----------------|-----------------|
| Elution Buffer                     | Clear cap       | 200 µL per pool |
| MiSeq® Reagent Kit v3 - Box 1 of 2 | Part # 15043893 | 1 per run       |
| MiSeq® Reagent Kit v3 - Box 2 of 2 | Part# 15043894  | 1 per run       |

## Preparation

- Complete run definition in the eMap Software by entering the Run Description and serial numbers for the flow cell, reagent cartridge and MiSeq instrument for the selected Pool ID.
- Generate the run-specific SampleSheet.csv and save in a location that is accessible by the MiSeq instrument computer.
- Thaw the MiSeq reagent cartridge in a room temperature water bath for 45 minutes immediately before use, or at 2°C to 8°C overnight.



### ATTENTION

Certain sequencing components contain formamide, a probable reproductive toxin. See the SDS at [support.illumina.com/sds.html](http://support.illumina.com/sds.html).

- Ensure the cartridge is fully thawed, then invert the cartridge 10 times to mix contents. Gently tap the cartridge on the benchtop to remove bubbles from the reagent reservoirs. Dry the cartridge with a paper towel.
- Thaw the Illumina HT1 (Hyb Buffer) tube on ice and mix by vortexing. Ensure no precipitates are visible in the solution and keep on ice.
- Bring Elution Buffer to room temperature before use.
- If the stock Library Pool was stored frozen, thaw, briefly vortex to mix, pulse centrifuge to collect contents and keep on ice.
- The dilution instructions for preparing the 1 nM Pool can be found in the eMap Pooling Guide PDF.

## Steps

1. Label a new 1.5 mL, low DNA-retention microcentrifuge tube as “1 nM Pool” with the Pool ID and date and keep on ice.
2. Prepare a 1 nM dilution of the stock Library Pool in a final volume of 200 µl Elution Buffer as directed by the eMap Pooling Guide PDF.

E.g. for a library pool with a Pool Concentration of 16 nM: Volume

of stock Library Pool =  $200/16 = 12.5$  µL Volume of Elution

Buffer =  $200-12.5 = 187.5$  µL

3. Transfer 10 µl of the 1 nM Pool to a new 0.2 mL PCR tube or PCR 8-tube strip.
4. Add 90 µl Illumina HT1 (Hyb Buffer).



#### ATTENTION

The optimal cluster density range for a MiSeq is from 1200–1400K/mm<sup>2</sup>.

If necessary, adjust the proportion of 1 nM Pool in a final volume of 100 µL HT1 to optimise MiSeq seeding. Under- and over-clustering may impact the quality of the results.

5. Vortex and centrifuge the library pool/HT1 mixture.
6. Immediately incubate samples in a designated Post-PCR thermal cycler as in **Table 9**, with a heated lid set at 101°C – 105°C.

**Table 9:** Thermal cycler program for Denaturation

| Number of cycles | Temperature of cycle | Incubation time |
|------------------|----------------------|-----------------|
| 1                | 96°C                 | 5 min           |
| 1                | 4°C                  | 1 min           |
| 1                | 4°C                  | Hold            |

7. Aliquot 600 µL of HT1 (Hyb Buffer) into a new 1.5 mL, low DNA-retention microcentrifuge tube and place on ice.
8. During the Denature incubation, prepare and load a MiSeq flow cell into the MiSeq instrument according to the manufacturer's instructions.
9. After denaturation, remove the sample tube from the thermal cycler and centrifuge briefly to collect contents.



#### ATTENTION

HT1 diluted/denatured library pools are not stable for storage. Perform heat denaturation immediately before loading the library into the MiSeq reagent cartridge.

10. Immediately transfer 100 µL of denatured pool/HT1 mixture to the 600 µL pre-cooled aliquot of HT1, pulse vortex and centrifuge, then keep on ice.
11. Transfer 600 µL of the final denatured and diluted library pool to position 17 of the MiSeq reagent cartridge. Tap the cartridge on the benchtop to remove bubbles.
12. Load the remaining reagents onto the MiSeq and complete run setup by selecting the appropriate SampleSheet for the run, according to the manufacturer's instructions. Press Start Run to begin sequencing on the MiSeq.

# MiSeq i100 Series: Library Dilution and Sequencing

## Consumables

| Item                                                                              | Identifier      | Quantity                 |
|-----------------------------------------------------------------------------------|-----------------|--------------------------|
| Resuspension Buffer (RSB)                                                         | Red Cap         | 200 µL per pool          |
| Library Denaturation Buffer (KLD)                                                 | Blue Cap        | 300 µL per pool          |
| MiSeq™ i100 Series Wet Cartridge                                                  | Part # 20079638 | 1 per run                |
| MiSeq™ i100 Series Dry Cartridge 25M 100 Cycles* <b>OR</b>                        | Part # 20100085 | 1 per run (≤ 48 Samples) |
| MiSeq™ i100 Series Dry Cartridge 50M 100 Cycles<br>(MiSeq i100 Plus System Only)* | Part# 20119416  | 1 per run (≤ 96 Samples) |

\* Users will only have one dry cartridge per kit, either the 25M (≤ 48 Samples) or 50M (≤ 96 Samples). The 50M Dry Cartridge is only compatible with the MiSeq i100 Plus System.

## Preparation

- Complete run definition in the eMap Software by entering the Run Description and serial numbers for the flow cell, reagent cartridge and MiSeq i100 Series instrument for the selected Pool ID.
- Generate the run-specific <PoolID>\_SampleSheet.csv and save in a defined SampleSheet directory on the local network which is accessible by the MiSeq i100 Series instrument.
- Use the `emap-upload-interface-i100.exe` tool to convert the eMap SampleSheet to a new i100 compatible SampleSheet which will be used to set up the sequencing run.
- From the sequencing runs menu on the MiSeq i100 System, import the i100 SampleSheet to set up the run and proceed to load the consumables.
- For further information on the instrument and sequencing run setup, please refer to our EmbryoMap on MiSeq i100 Series Installation Guide and EmbryoMap on MiSeq i100 Series Run Setup Guide.



### ATTENTION

See the SDS at [support.illumina.com/sds.html](http://support.illumina.com/sds.html).

- Invert the wet cartridge 10 times to mix contents.
- If the stock Library Pool was stored frozen, thaw, briefly vortex to mix, pulse centrifuge to collect contents and keep on ice.
- The dilution volumes for preparing the 1 nM Pool can be found in the eMap Pooling Guide.



### ATTENTION

The dilution of the final library pool to 1nM should be performed using the Resuspension buffer from the MiSeq i100 Series Wet Cartridge box

## Steps

1. Label a new 1.5 mL, low DNA-retention microcentrifuge tube as “1 nM Pool” with the Pool ID and date.
2. Prepare a 1 nM dilution of the stock Library Pool in a final volume of 200 µL RSB (Resuspension Buffer) as directed by the eMap Pooling Guide PDF.  
  
E.g. for a library pool with a Pool Concentration of 16 nM:  
  
Volume of stock Library Pool =  $200/16 = 12.5$  µL  
  
Volume of RSB =  $200-12.5 = 187.5$  µL
3. Vortex to mix and spin down.
4. Label a new 1.5 mL, low DNA-retention microcentrifuge tube as “Seq”.
5. Aliquot 276 µL of KLD (Library Denaturation Buffer) into a new 1.5 mL, low DNA-retention microcentrifuge tube.
6. Add 24 µL of the 1nM Pool to the tube
7. Vortex and spin down the library pool/KLD mixture.



### ATTENTION

The instructions above are based on a final loading concentration of 80 pM. The optimal loading concentration for EmbryoMap libraries is 70-80 pM which typically translates to a clusters passing filter of  $\geq 30M$ . If necessary, adjust the proportion of 1 nM Pool in a final volume of 300 µL KLD to optimise MiSeq i100 System seeding. Under- and over-clustering may impact the quality of the results.

8. Transfer 250 µL of the final diluted library pool onto the dry cartridge.
9. From the Start screen on the MiSeq i100 system, go to the Menu icon in the top left and select “Runs”.
10. Select the “Import Sample Sheet” option and import the i100 SampleSheet.
11. Select “Save as Planned”.
12. Return to the start screen and select “Start”.
13. Select the newly planned sequencing run and proceed with consumable loading.
14. Load the reagents onto the MiSeq i100 system to complete run setup. Wait for the pre-run checks to complete and the sequencing run will start automatically.



### ATTENTION

The MiSeq i100 Systems perform library denaturation on the instrument as part of the sequencing run. There is no need for denaturation before loading the dry cartridge.  
RSB and KLD diluted library pools are not suitable for storage.

# 3 SUPPORTING INFORMATION

## EmbryoMap Kit Contents

EmbryoMap™ Sample Prep (96 rxns) REF 13301

| Kit Name              | Identifier    | REF     | Quantity | Storage temp   |
|-----------------------|---------------|---------|----------|----------------|
| Extraction Mix        | Red cap       | BE00759 | 2        | -25°C to -15°C |
| Amplification Mix 1   | White cap     | BE00760 | 2        | -25°C to -15°C |
| Amplification Mix 2   | Blue cap      | BE00761 | 4        | -25°C to -15°C |
| Elution Buffer        | Clear cap     | BF00762 | 4        | -25°C to -15°C |
| Library Index Plate A | 96-well plate | DX00749 | 1        | -25°C to -15°C |

MiSeq Reagent Kit v3 - Box 1 of 2 REF 15043893

| Kit Name          | REF      | Quantity | Storage temp   |
|-------------------|----------|----------|----------------|
| Reagent Cartridge | 15043963 | 1        | -25°C to -15°C |
| HT1               | 15070155 | 1        | -25°C to -15°C |

MiSeq Reagent Kit v3 - Box 2 of 2 REF 15043894

| Kit Name        | REF      | Quantity | Storage temp |
|-----------------|----------|----------|--------------|
| PR2 Bottle      | 15041807 | 1        | 2°C to 8°C   |
| MiSeq Flow Cell | 15028382 | 1        | 2°C to 8°C   |

MiSeq™ i100 Series Wet Cartridge - REF 20079638

| Kit Name                          | REF      | Quantity | Storage temp |
|-----------------------------------|----------|----------|--------------|
| Resuspension Buffer (RSB)         | 20109766 | 1        | RT           |
| Library Denaturation Buffer (KLD) | 20107619 | 1        | RT           |
| MiSeq™ i100 Series Wet Cartridge  | 20079638 | 1        | RT           |

MiSeq™ i100 Series Dry Cartridge 25M 100 Cycle - REF 20126567

| Kit Name                                        | REF      | Quantity | Storage temp |
|-------------------------------------------------|----------|----------|--------------|
| MiSeq™ i100 Series Dry Cartridge 25M 100 Cycles | 20100085 | 1        | RT           |

MiSeq™ i100 Series Dry Cartridge 50M 100 Cycles - REF 20141595

| Kit Name                                        | REF      | Quantity | Storage temp |
|-------------------------------------------------|----------|----------|--------------|
| MiSeq™ i100 Series Dry Cartridge 50M 100 Cycles | 20119416 | 1        | RT           |

## Consumables and Equipment

Make sure that you have the required consumables and equipment before starting the protocol. Some items are required only for specific workflows, e.g. quantification method. The protocol has been optimised and validated using the items listed. Comparable performance is not guaranteed when using alternate consumables and equipment.

### General laboratory consumables (User Supplied)

| Consumable                                                         | Supplier                                                          |
|--------------------------------------------------------------------|-------------------------------------------------------------------|
| 10 µL filtered pipette tips                                        | General Lab supplier                                              |
| 10 µL single and/or multi-channel pipettes                         | General Lab supplier                                              |
| 50 µL filtered pipette tips                                        | General Lab supplier                                              |
| 50 µL single and/or multi-channel pipettes                         | General Lab supplier                                              |
| 200 µL filtered pipette tips                                       | General Lab supplier                                              |
| 200 µL single and/or multi-channel pipettes                        | General Lab supplier                                              |
| 1000 µL filtered pipette tips                                      | General Lab supplier                                              |
| 1000 µL single channel pipettes                                    | General Lab supplier                                              |
| Conical centrifuge tubes, 15 mL                                    | General Lab supplier                                              |
| Conical centrifuge tubes, 50 mL                                    | General Lab supplier                                              |
| Adhesive seal roller                                               | General Lab supplier                                              |
| Reagent reservoirs, multi-channel, disposable                      | General Lab supplier                                              |
| Ethanol absolute ≥99.8%, Certified AR for Analysis                 | General Lab supplier                                              |
| 1× PBS, pH 7.4, DNase/RNase-free                                   | General Lab supplier                                              |
| PCR-grade water                                                    | General Lab supplier                                              |
| Thin-walled, PCR Tubes with Flat Cap, 0.2 mL                       | Axygen, Cat# PCR-02-L-C                                           |
| PCR Tubes, 8-tube strips, 0.2 mL                                   | Eppendorf; Cat# 0030124359                                        |
| 96-well PCR plates or<br>Hard-Shell 96-well PCR plates (HSP plate) | ThermoFisher Scientific; Cat# AB0600;<br>or Bio-Rad; Cat# HSP9601 |
| 96-well storage plates, round well, 0.8 mL                         | ThermoFisher Scientific; Cat# AB0859                              |
| Adhesive PCR plate seals                                           | ThermoFisher Scientific; Cat# AB0558                              |
| DNA LoBind® Tubes, 1.5 mL                                          | Eppendorf; Cat# 0030108051                                        |

### MiSeq maintenance consumables (User Supplied)

| Consumable                    | Supplier                         |
|-------------------------------|----------------------------------|
| Sodium hypochlorite solution  | Sigma-Aldrich; Cat # 239305      |
| Tween 20                      | Sigma-Aldrich; Cat # P7949       |
| MiSeq disposable wash tubes   | Illumina; Cat# MS-102-9999       |
| Whatman™ Lens Cleaning Tissue | Fisher Scientific; Cat# 11360654 |

## MiSeq™ i100 Series maintenance consumables (User Supplied)

| Consumable                     | Supplier |
|--------------------------------|----------|
| Illumina MiSeq i100 Air Filter | 20116201 |

## Required reagent consumables (User Supplied)

| Consumable                                                       | Supplier                                       |
|------------------------------------------------------------------|------------------------------------------------|
| SPRIselect, 60 mL                                                | Beckman Coulter; Cat# B23318                   |
| <i>One of the following quantification solutions:</i>            |                                                |
| Qubit™ dsDNA HS Assay Kit; and                                   | ThermoFisher Scientific; Cat# Q32851 or Q33230 |
| Qubit™ Assay Tubes (for Qubit™ Fluorometer); or                  | Cat# Q32856                                    |
| Qubit™ Flex Assay Tube Strips (for Qubit™ Flex Fluorometer)      | Cat# Q33252                                    |
| Quant-iT™ dsDNA Assay Kit, high sensitivity; and                 | ThermoFisher Scientific; Cat# Q33120 or Q33232 |
| 96-well Microplates, F-Bottom (Chimney Well), Black, Non-Binding | Greiner BioOne; Cat# 655900                    |

## Equipment (User Supplied)

| Equipment                                                                                                                                                                                       | Supplier                                                                                                        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| General lab personal protective equipment including, safety glasses, lab coats, powder-free protective gloves, stopwatch or timer, cold-rack                                                    | General Lab supplier                                                                                            |
| Microcentrifuge                                                                                                                                                                                 | General Lab supplier                                                                                            |
| Microplate centrifuge                                                                                                                                                                           | General Lab supplier                                                                                            |
| Vortexer, with speed and time control.                                                                                                                                                          | General Lab supplier                                                                                            |
| Thermal cyclers; dedicated for Pre-PCR and Post-PCR applications with the ramp rate set at 3.3°C/sec.                                                                                           | General Lab supplier                                                                                            |
| High-Speed Microplate Shaker (BioShake IQ) or High-Speed Microplate Shaker (BioShake XP) or Advanced High Speed Microplate Shaker (110/120V) or Advanced High Speed Microplate Shaker (230V) or | Qinstruments, Cat# 1808-0506 or Qinstruments, Cat# 1808-0505 or VWR, Cat# 13500-890 or VWR, Cat# 14216-214      |
| Magnetic stand-96                                                                                                                                                                               | ThermoFisher Scientific, Cat# AM10027                                                                           |
| Microplate reader, 96-well plate fluorometer (or equivalent) or Qubit 4 Fluorometer or Qubit Flex Fluorometer                                                                                   | BMG LabTech Cat# FLUOstar Omega or ThermoFisher Scientific, Cat# Q33238 or ThermoFisher Scientific, Cat# Q33327 |
| MiSeq System or MiSeq Dx System (RUO Mode)                                                                                                                                                      | Illumina, Cat# SY-410-1003 or Illumina, Cat# DX-410-1001                                                        |
| MiSeq i100 System or MiSeq i100 Plus System                                                                                                                                                     | Illumina, Cat# 20115694<br>Illumina, Cat# 20115695                                                              |

# 4 TECHNICAL SUPPORT

For technical assistance, contact Vitrolife Genomics Support:

Email                support.genomics@vitrolife.com

Website            www.vitrolife.com

## Safety Data Sheets

Safety data sheets (SDSs) are available Online at

<https://www.vitrolife.com/support/support-material/support-documents?type=safetydatasheet>

# TOGETHER. ALL THE WAY™

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